East West Rail
Construction Assessments for Cambridge and Core Sections May 2023
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2. Workstream Strategy

2.1. Summary

This workstream looked at CS3 section of EWR from the northern interface with Bedford Station to Cambridge Station, from the west end of Paula Radcliffe Way, excluding connection to the MML.

It looked at both the Southern and Northern approaches to Cambridge (online and offline). Given the volume of works, varying stages of design maturity, complexities, and interfaces of the interventions across these routes it has been necessary to employ differing approaches when producing the programme output.

This section will describe the high-level strategies uses to interpret the information available and integrate them into the scheme wide programmes.

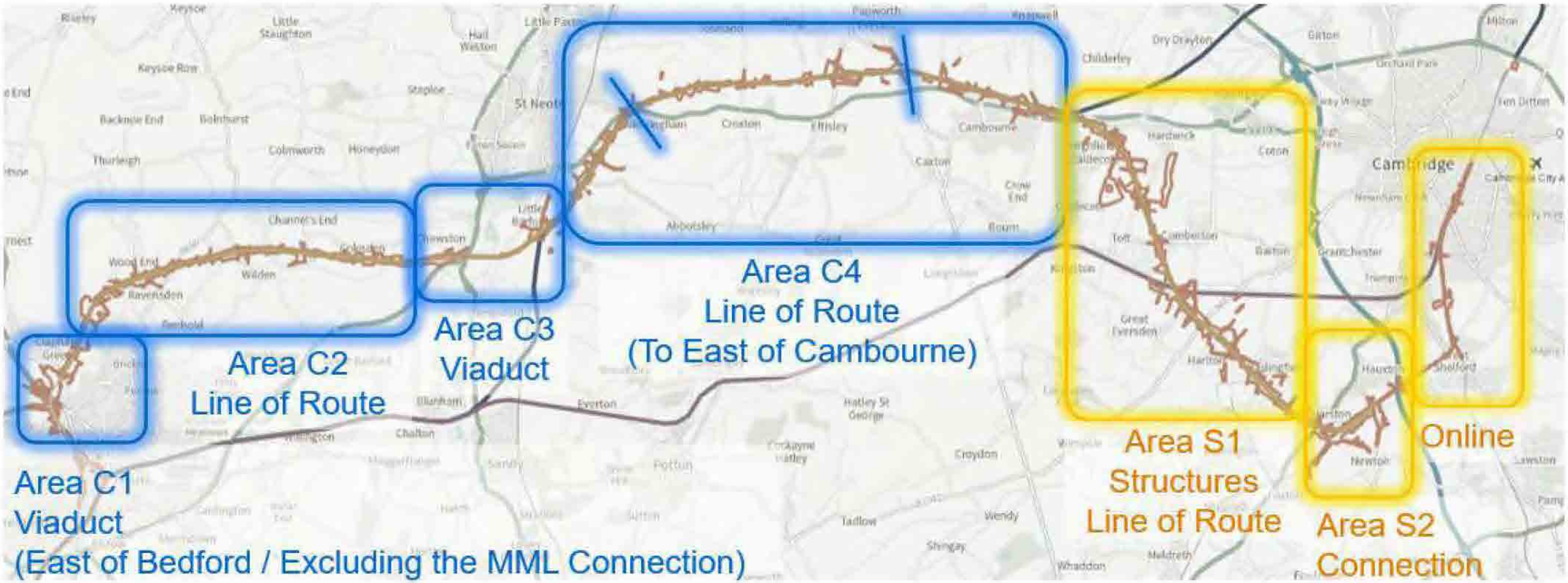


Figure 1 - Core and South Route Areas

Area	Core & SACT Online	Start Chainage	End Chainage	Area Length (m)
Area C1	MML to Clapham Road Ch 2080 to 3200 (Arup Section C)	2080	3200	1120
Area C2	Brickhill to Chawston Ch 3200 to 17000 (Arup Section D)	3200	17000	13800
Area C3	Chawston to ECML Ch 17000 to 20000 (Arup Section D)	17000	20000	3000
Area C4	ECML to A428 Tunnel & Retained Cut under St Neots Road Ch 20000 to 38000 (Arup Section D)	20000	38000	18000
Area S1	A428 Tunnel & Retained Cut under St Neots Road to A10 Harston Ch 38000 to 50800 (Arup Section D)	38000	50800	12800
Area S2	A10 Harston to Shepreth Junction / M11 Ch 50800 to 55040 (Arup Section E)	50800	55040	4240
South Online	West of Shepreth Junction to Cambridge Approach (Arup Section F) Ch 55040 to 60940	55040	60940	5900

Figure 2 – Core and South Route Area Start and End Chainages.

2.2. Bedford Interface

The 'Bedford Area' of the programme has been amended from our programme submission in April 2022. The decision was taken to update this section of the programme due to the initial assumption that the logistics strategy for Core C1 to C4 was reliant on the Midland Main Line connection at Bedford North Junction. Further to this, the SoS decision had been pushed back by 21 months (July 2026 from October 24) and CS3 cannot be commissioned without the completion of Bedford Station. For these reasons, it was thought that 'Bedford Area' would remain crucial for an accurate CS3 programme and should be updated to reflect any new information and assumptions.

2.3. Core

For the purposes of this study, the Core section has been defined as the section between the northern interface with Bedford Station to Cambourne at the point where the Southern and Northern routes diverge. The study used the Design Freeze 2 (DF2) design which follows the route Alignment 1.

The DF2 information used during this study include:

- EWR DF2 GIS
- Arup Structures Schedules
- Arup Drawings
- Arup Earthworks volumes
- Arup Construction and Logistics report

Due the length of the Core and varying sizes and types of interventions across that length, the Core has then been broken down in to four sub-sections. These sections split the major complex structures out from the more generic line of structures allowing greater levels of construction sequencing to be focused on those sections that required closer scrutiny.

The subsections are as follows:

- Core 1 (C1) – Paula Radcliffe Way Viaduct (complex structure).
- Core 2 (C2) – Line of Route between Paula Radcliff Way Viaduct and the A1 to ECML Viaduct.
- Core 3 (C3) – A1 to ECML Viaduct (complex structure).
- Core 4 (C4) – Line of Route between A1 to ECML Viaduct and Cambourne.

For Complex Structure sections (C1 and C3), more detailed construction staging was considered to understand how the individual worksite compounds would operate to manage work fronts and workload while managing interfaces with key enabling works, adjacent infrastructure, and priorities of the EWR programme. These construction sequences were bult up into bespoke programme activities and logic. The details of the complex structure's construction sequencing will be discussed in Section 3.5.

For Line of Route sections (C2 and C4) a series of more standard packs of programme logic have been applied to the individual structures and their durations adjusted to suit scales as necessary.

2.4. South Approach Offline

The Offline section of the Southern Approach to Cambridge has been defined as the section from where the Southern and Northern routes diverge at Cambourne and the point at which the EWR route joins the Shepreth Branch Line at Hauxton Junction. This section of the route is based on the same design information as the Core section and again, has been sub divided down into sections as follows:

- South 1 (S1) – Line of Route between Cambourne and Chapel Hill
- South 2 (S2) – Hauxton Junction Area (complex structures)

In Section S1 there are some structures that were deemed to be complex enough to warrant the more detailed construction sequencing so in Section 3.5 there will be more detail on the following complex structures:

- A428 Tunnel (area S1)
- Chapel Hill Tunnel (area S1)
- Hauxton Junction Area (area S2)

2.5. South Approach Online

The Online section of the Southern Approach to Cambridge has been defined as the section from West of the existing Shepreth Branch Junction to the limits of Track Renewals to the North of Mill Road Bridge to the North of Cambridge Station.

This excludes the Hauxton Junction works on the Shepreth Branch Railway (SBR Lines), these works are included within the Area S2, therefore please refer to Section 2.12 and Section 3.5.5 for further details.

To enable the works to be referenced using the same chainage conventions throughout, the P6 Programme and Tilos have been developed using the CSA Chainage for the Core Section, and therefore, this Chainage has been chosen to be used throughout. To enable this, there are 3nr. Chainages to be considered as follows:

1. CSA Chainage – **CSA**
2. Shepreth Branch Railway Lines Chainage – **SBR**
3. WAML lines Chainage – **BGK**

The drawings for the Online works use the BGK Chainages, therefore the BGK chainages have been used in the detail for the South Online Construction Sequence and P6 Programme activity descriptions, and the CSA chainage has been used in the Tilos and Tilos chainage columns within the P6 programme.

To enable the CSA Chainage to be used throughout the South Online section, we have interpolated the chainages across the site using two drawings to provide the datum point information. The two drawings listed below, are the ones used to compare chainages and set the datum points:

1. EWR_PGM-ARU-RA-ZZ-SK-C-000505:

CSA Ch 52944 = SBR Ch 85904.

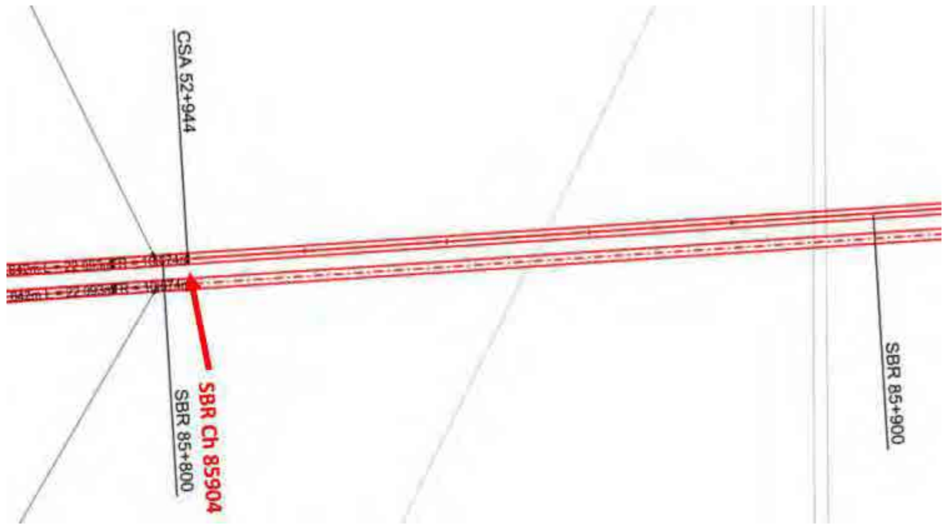


Figure 3 - Extract from drawing EWR_PGM-ARU-RA-ZZ-SK-C-000505.

2. EWR_PGM-ARU-ZZ-XX-SC-C-000511-Sheet 4 of 4:

CSA Ch 55780 = SBR Ch 88640 = BGK Ch 85000

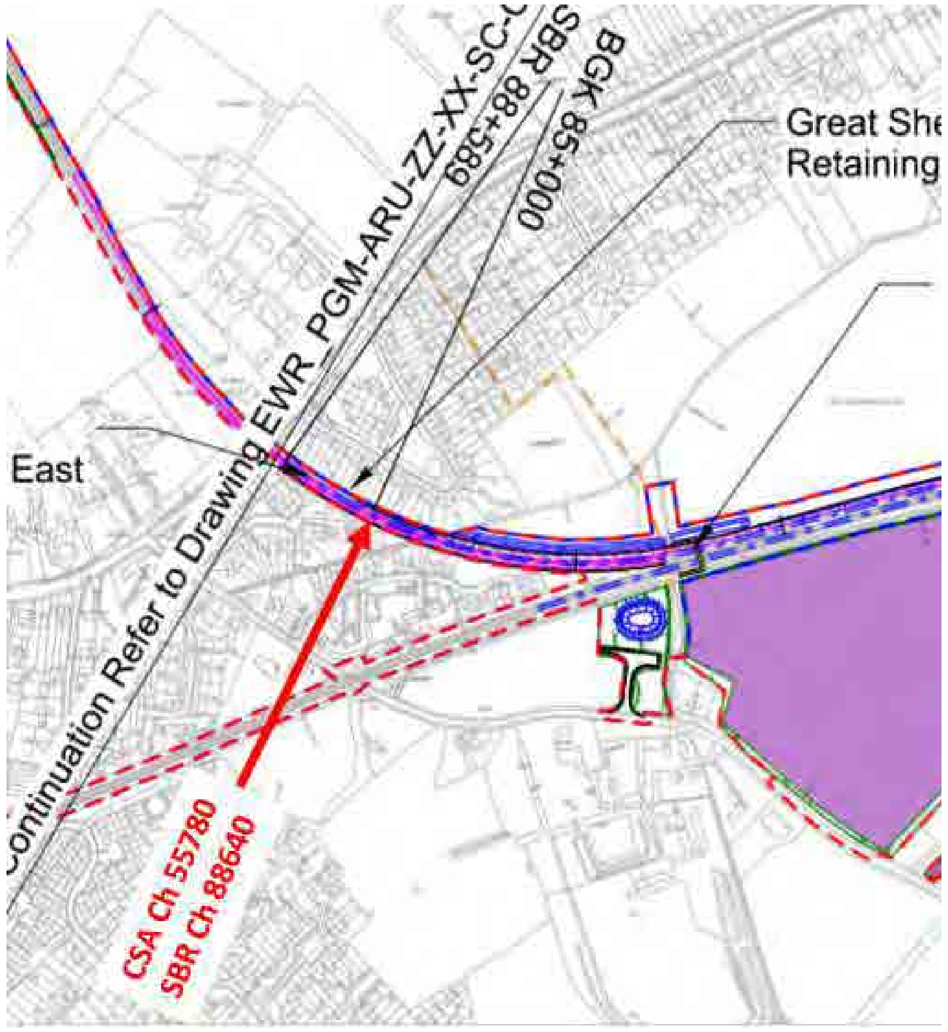


Figure 4 - Extract from drawing EWR_PGM-ARU-ZZ-XX-SC-C-000511-Sheet 4 of 4.

Having established the Datum Points, the chainages were then interpolated throughout to give the Online section of works the following CSA Chainage:

South Online:

Cambridge Approach CSA Chainage: **Ch55040 to Ch60940**

This section of the route is based on the Design Freeze 2 design information, which is the same as the Core section and again, has been sub divided down into 4nr. sections and chainages as follow for the creation of the time chainage in Tilos:

A. South of Shepreth Branch Junction to south of Addenbrook's Road Bridge:
B. Cambridge South Station:
C. South of Long Road Bridge to south of Hill's Road Bridge
D. Cambridge Station:

Please refer to

Figure 5 for the visualisation of these sections on the drawing.

A. South of Shepreth Branch Junction to South of Addenbrook's Road Bridge:

South of Shepreth Branch Junction to South of Addenbrook's Road Bridge	
BGK Chainage:	Ch 84300 to Ch 86500
SBR Chainage:	Ch 88000 to Ch 90100
CSA Chainage:	**Ch 55040 to Ch 57140**
2200m	
84300 BGK Chainage: 86500	

B. Cambridge South Station:

Cambridge South Station	
BGK Chainage:	Ch 86500 to Ch 87800
SBR Chainage:	Ch 90100 to Ch 91400
CSA Chainage:	**Ch 57140 to Ch 58440**
1300m	
86500 BGK Chainage: 87800	

C. South of Long Road Bridge to South of Hill's Road Bridge

South of Long Road Bridge to South of Hill's Road Bridge	
BGK Chainage:	Ch 87800 to Ch 89100
SBR Chainage:	Ch 91400 to Ch 92700
CSA Chainage:	**Ch 58440 to Ch 59740**
1300m	
87800 BGK Chainage: 89100	

D. Cambridge Station:

Cambridge Station	
BGK Chainage:	Ch 89100 to Ch 90300
SBR Chainage:	Ch 92700 to Ch 93900
CSA Chainage:	**Ch 59740 to Ch 60940**
1200m	
89100 BGK Chainage: 90300	

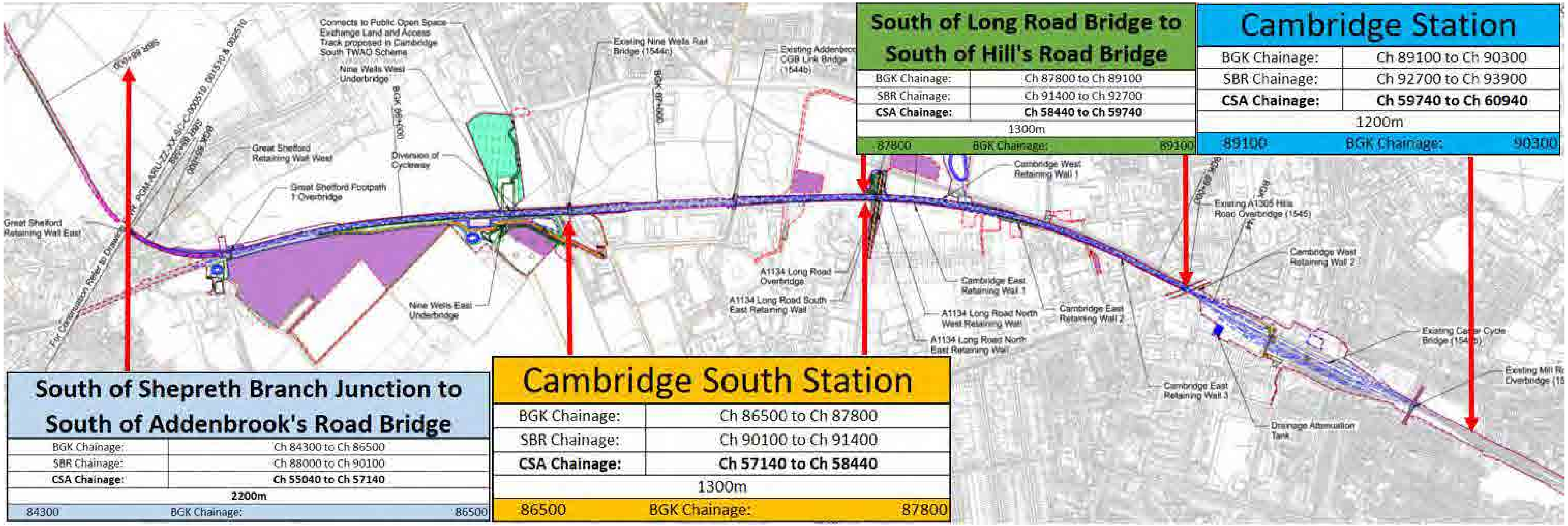


Figure 5 - Extract from drawing EWR_PGM-ARU-ZZ-XX-SC-C-000511-Sheet 4 of 4.

2.6. Key Access Assumptions

Railway access assumptions are key for the production of the construction sequence and programme of works, as they drive the programme logic and scope that can be delivered in each access. This then feeds into the signalling staging requirements (and other disciplines) which inform the signalling data design requirements.

During the February 2022 Costain commission, the construction sequence and programme were delivered based on best access availability for the contractor to deliver the scope of works, with minimal constraints applied.

Therefore, the strategy was based on extended blockade durations being available with high number of weekend accesses being available for works, before, in-between and after the blockades (But over a relatively short period of time) i.e., deliver the scope as quickly and efficiently as practicable.

These works provided one end of the scale / book end, which presented a likely best case for the Contractor to build the EWR Online scope, but caried a highly disruptive access strategy (long duration extended closures) and high levels of disruption to operations, including some reduction in service operability (passenger services, freight services and station operations).

The Costain commission from January to May 2023 has focused on providing the other end of the scale / book end, in terms of disruption to operations.

To enable this, the first step was to agree with EWR what the possession planning rules would be used as a basis. These were drafted by EWR, reviewed on 03/02/2023 and additional modifications added on 06/02/2023 to form the final version of the possession planning rules that would be applied to the programme.

Note – these assumptions are also used to drive the NATC Online Programme access requirements.

2.6.1. EWR Possession Planning Rules – 06-02-2023

These are to be applicable to Cambridge for the CS3 construction assessments by Costain.

1. 1 in 4 weekend possession average per annum (i.e., 13no. disrupted weekends) affecting any single point on rail network is broadly acceptable.
2. Up to 4no. sequential disruptive all lines blocked weekend possessions shall be immediately followed by a 4no. weekend moratorium period for disruptive possessions (i.e., 4-weekends blocked, 4-weekends open).
3. Up to 8no. sequential disruptive all lines blocked weekend possessions shall be immediately followed by a 18no. weekend moratorium period for all lines blocked disruptive possessions (i.e., 8-weekends blocked, 18-weekends open) excluding the months of May, June, July, August.
4. No more than 1no. 9-day blockades is permitted per year.
5. Max. 1no. 16-day blockade shall be broadly acceptable for exceptional circumstances and work content and be limited to months of February and October (half term holidays).
6. 9-day blockades may only occur during Christmas holiday, February half term, October half term
7. Only 1no. Bank holiday weekend possession is permitted in May, August BH 76hrs & Easter BH 104hrs are available.
8. Midweek night possession is limited to 1 in 2 for any given point on the railway.
9. Weekend white periods are limited to 1 in 2 for any given point on the railway.
10. Standard BGK possession limits south of Cambridge is Stansted South Junction (clear of)
11. Standard SBR possession limit south of Cambridge is Royston Station (clear of)
12. Standard BGK possession limits north of Cambridge is Ely Dock Junction (clear of)
13. Where a prep possession is 27hr or more, it is deemed a core possession and included in accumulated possession counts.
14. The ECML and WAML shall not be blocked in parallel unless in exceptional circumstances and work content (e.g., final cross-territory commissioning and testing)
15. The GEML and WAML shall not be blocked in parallel unless in exceptional circumstances and work content (e.g., final cross-territory commissioning and testing) - based on NR interface meeting 03/03/23.
16. Possession and worksite limits shall be minimised where possible.
17. Any passenger service provision is preferred during possessions e.g., large mainline stations (e.g., Cambridge, Cambridge North, Cambridge South, Bedford) shall remain open for services terminating from the North or South whenever possible.
18. No consideration for 3rd party works is required (e.g., NR Capex Delivery, NR Maintenance, TOC station and depot work). Clarified on 06-02-23 and agreed that 1 weekend in 13 allowances to be made for maintenance possessions.

2.7. P6 Programme Calendars – Based on the EWR Possession Planning Rules

To enable these rules to be applied to the P6 Programme and Construction Sequence, we have rationalised the 18nr. Rules (in Section 2.6.1), below to enable the calendars to be built within the P6 software:

A. Rule 1, 2, 3, 7 & 18 – Rule 1 trumps rule 2 & 3, therefore rule 2 & 3 are subservient to rule 1. Refer to Section 2.7.1.

- Assume that Rule 1 includes the Late May BH's, but Easter and Christmas are separate and assumed in addition to the 13no possessions in Rule 1.

B. Rule 4. Refer to Section 2.7.2.

C. Rule 5. Refer to Section 2.7.3.

D. Rule 6 10, 11, 12, 16 & 17 – These are all managed in the Construction Sequence & P6.

E. Rule 7. Refer to Section 2.7.4 and 2.7.5.

F. Rule 8 & 9. Section 2.7.6.

G. Rule 13 – We have only allowed for 52-hour possessions (not enough detail to process 27-hour possessions at this stage).

H. Rule 14 & 15 – These are to be manually managed / clash checked in the in the P6 programme. This is partly done, however:

a. We do not have any information for the GEML possessions from NR, therefore these cannot be clash checked at this stage.

b. The Core works that interface with the ECML does not have enough detail currently to fully assess the possession requirements.

c. The possession clash checking across the MML, ECML and WAML has not been undertaken at this stage. As the possession requirements are confirmed, through the detail design and construction programme development, these can be reassessed.

Therefore, these possession clashes will need to be reassessed as the detail design and construction programme develops.

2.7.1. Calendar 1: EWR - 52-hour calendar 2027-2038, Based on Rule 1, 7 & 18:

1 in 4 weekend possession average per annum (i.e., 13no. disrupted weekends) affecting any single point on rail network.

P6 Calendar Assumptions:

13nr. Possessions available: 2nr. in September, 1nr. in October, 2nr. in November, 2nr. in December, 2nr. in January, 1nr. in February, 2nr. in March and 1nr. in April **– whilst avoiding Christmas, Half Terms (Feb & Oct) & Easter.**

Assumed that the Late May BH is available (Early May BH Not available).

2.7.2. Calendar 2: EWR - Easter, BH, Blockades, Based on Rule 4:

No more than 1no. 9-day blockades is permitted per year.

P6 Calendar Assumptions:

This calendar allows 24hr working, during the Christmas periods.

The rule says 9-days; however, each Christmas day falls on a different day and the logical start and end day for the blockade changes every year. Therefore, we have assessed this for each Christmas Blockade and adjusted the duration accordingly. Please refer to Section 2.8 for further details.

2.7.3. Calendar 3: EWR – 16-day blockade, Based on Rule 5:

Max. 1no. 16-day blockade shall be broadly acceptable for exceptional circumstances and work content and be limited to months of February and October (half term holidays).

P6 Calendar Assumptions:

This calendar allows 24hr working, during the Blockade period.

The half term week has been assumed to be the 1st week of the blockade, with the second week being the week after the February 2033 half term week, thus giving the dates from 22:00 on Friday 18th of February 2033 until 06:00 on Monday 07th March 2033.

2.7.4. Calendar 4: EWR – Easter BH calendar 2027 - 2038, Based on Rule 7:

Only 1no. Bank holiday weekend possession is permitted in May, August BH 76hrs & Easter BH 104hrs are available.

P6 Calendar Assumptions:

Easter BH falls on a different week each year, this has been managed in the P6.

2.7.5. Calendar 5: EWR – August BH calendar 2027 - 2038, Based on Rule 7:

Only 1no. Bank holiday weekend possession is permitted in May, August BH 76hrs & Easter BH 104hrs are available.

P6 Calendar Assumptions:

August BH is always available.

2.7.6. Calendar 6: EWR – 1 week on nights 1 week off (Sun 22:00 to Fri 06:00) 2027 - 2038, Based on Rules 8 & 9:

Midweek night possession is limited to 1 in 2 for any given point on the railway.

P6 Calendar Assumptions:

Night shifts are only available in alternating weeks.

2.8. Assumed Blockade Availability

For the SACT Online scope of works, the construction sequence included within Appendix I – South Approach to Cambridge Online– Rail Systems Construction Sequence describe the staging required to deliver the scope if works. There are 5nr. Christmas blockades Identified as being required as part of the staging, these are listed below and visualised in Figure 6, the dashed red lines represent the actual EWR proposed requests.

Figure 6 shows the Christmas blockades assumed as being available for the EWR SACT Online construction sequence and programme. It does not show the 16 day February 2033 blockade, however this is a key blockade for the works and is planned for the February half term period in line with the planning rules applied whilst the sequence was being developed (As described in Section 2.6 and Section 2.7.

The blockade durations have been based on the logical start and end days for each year, as Christmas Day and New Years Day land on different days each year, and therefore their timing with the weekends are different each year, hence the variant in duration from 8 to 12 days for the various Christmas blockades.

1. Stage 2: Christmas 2027 – 10 Day Blockade: Key Stage: Installation, commissioning of the Cambridge South 2-Track Layout into use, Signalling Stage Design required.
2. Stage 19: Christmas 2031 – 12 Day Blockade: Key Stage: Installation, commissioning of the Interim 4-Track Layout @ SBJ into use, Signalling Data Design required.
3. Stage 25: February 2033 – 16 Day Blockade: Key Stage: Installation, commissioning of the New WAML 2-Track Layout & Interim Crossover @ Platform 7 & 8 into use, Signalling Data Design required. Not shown in Figure 6.
4. Stage 28: Christmas 2034 – 10 Day Blockade: Key Stage: Installation, commissioning of the New Cambridge Station Throat (South) Layout into use, Signalling Data Design required.
5. Stage 33: Christmas 2035 – 10 Day Blockade: Key Stage: Installation, commissioning of the New Up & Down Royston Final SBR Layout into use, Signalling Data Design required.
6. Stage 37: Christmas 2036 – 08 Day Blockade: Key Stage: Installation, commissioning of the New Final Layout into use, Signalling Data Design required.

Christmas Working Calendar 2020's / 2030's																							
	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
2026/27	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
2027/28	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
2028/29	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th
2029/30	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th
2030/31	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th
2031/32	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
2032/33	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
2033/34	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th
2034/35	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th
2035/36	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th
2036/37	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
2037/38	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th

Figure 6 - Assumed Christmas Blockades.

The key below seeks to describe the days included within the blockade duration.

	Actual EWR Proposed Request
	New Year Date Line
	Possible Request
	Interim Days
	Weekend / Bank Holiday's

Figure 7 - Assumed Christmas Blockades - KEY.

2.9. Assumed Platform Closures

2.9.1. Cambridge South Station (CSS)

It is assumed that CSS can be reverted back to a 2nr. Platform Station as part of the early works / initial stages of the EWR Project.

To enable this, it is assumed that:

A. The Up Main services would call at the New CSS Project Platform 1.

B. The Down Main services would call at the New CSS Project Platform 2.

a. Assumed that NR would accept the temporary renaming of CSS Platform 2 as Platform 3 during the initial SBJ construction stages – Stage 2 to Stage 18.

On completion of the 4-track layout from Shepreth Branch Junction to CSS in Stage 19, it is assumed that CSS would be reopened as an Interim 4nr. platform station, with 2nr. Main Line (WAML) Platforms and 2nr. SBR Lines terminating platforms, with the platforms being allocated as per below:

- Down Royston (Terminating) – Platform 4 (New CSS Platform 4)
- Up Royston (Terminating)– Platform 3 (New CSS Platform 3)
- Down Main (Through Line) – Platform 2 (New CSS Platform 2)
- Up Main (Through Line) – Platform 1 (New CSS Platform 1)

Opportunity:
This stage (Stage 19 – currently programmed for Christmas 2031) would enable EWR to provisionally run a service to CSS as an interim arrangement. However, this would be dependent on the CS3 Core section being completed and entered into service (EIS) and would need to be suitability integrated into an interim timetable with GTR services to enable the EWR services to run.

On completion of the 4-track layout from CSS to Cambridge Station in Stage 33, it is assumed that CSS would be reopened in its final configuration, with 2nr. Main Line (WAML) platforms and 2nr. EWR / SBR Line platforms, with the platforms being allocated as per below:

- Down Royston (Through Line) – Platform 4 (New CSS Platform 4)
- Up Royston (Through Line) – Platform 3 (New CSS Platform 3)
- Down Main (Through Line) – Platform 2 (New CSS Platform 2)
- Up Main (Through Line) – Platform 1 (New CSS Platform 1)

Opportunity:
This stage (Stage 33 – currently programmed for Christmas 2035 would enable the EWR to run a service to Cambridge Station as an interim / EWR Light arrangement. This would need to be timetabled, as the final layout at Cambridge Station is not completed at this stage, with New Platforms 7 & 8 remaining Out of Use, however, there may be a benefit in running an EWR service as soon as possible, albeit a reduced service until the final layout is installed. Again, this would be dependent on the CS3 Core section being completed and EIS to enable the EWR services to run.

The Shepreth Branch Junction to Cambridge Station final layout is currently planned for substantial completion and EIS in Stage 37 – Christmas 2036, therefore the final and full EWR Service to Cambridge Station is achieved during this stage.

2.9.2. Cambridge Station & Sidings

There are 8nr. existing Platforms at Cambridge Station, the construction sequence has been developed based on retaining as many platforms being operational as possible during the construction of the new Layout.

However, it is assumed that the train service through the Cambridge area and number of Platforms in use at Cambridge Station can be reduced / thinned out during the construction programme as below:

- **Stage 1 to Stage 18 –** 8nr. Platforms in use.
- **Stage 19 to Stage 27 –** 6nr. Platforms in use. See note C below.
- **Stage 28 to Stage 32 –** 6nr. Platforms in use. See note D below.
- **Stage 33 to Stage 36 –** 8nr. Platforms in use. See note F below.
- **Stage 37 to Stage 38 –** 10nr. Platforms in use. See note G below.

These requirements will change as the construction sequence progresses, and each stage or change in Operational Service and Platform availability will need to be assessed further and Timetable Modelling undertaken to validate the assumptions that we have used. These assumptions are listed below:

A. **Stage 3** – It is assumed that existing Platforms 5 & 6 can be taken Out of Use for a 2-week period (10 working days) directly prior to the Easter 2028 BH Closure.

B. **Stage 7 to Stage 30** – It is assumed that the existing Thameslink Sidings and Light Maintenance Depot (LMD) are taken out of use.

- It is assumed that other facilities will be made available elsewhere for this duration, locations TBC.

C. **Stage 19 to Stage 33** – It is assumed that the existing Down Slow (3rd Line) from 1047pts to Cambridge Station Platform 2 & 3 are taken Out of Use, including Platforms 2 & 3 being taken Out of Use.

- It is assumed that the 2nr. Terminating Platforms provided at CSS at this stage (Stage 19) replace the Platform 2 & 3 functionality / reversing capacity, with the Busway being used for onward journeys from CSS to Cambridge Station during this time / construction phase.

D. **Stage 28** – It is assumed that the existing Down Main (P1 & 4 Track) and Through Road are taken Out of Use at Cambridge Station, including Platforms 1 & 4 being taken Out of Use.

- It is assumed that the New Platforms 9 & 10 at Cambridge Station are commissioned and EIS Into Use at this stage (Stage 28) to effectively replace the Platforms that are being taken Out of Use. The Operational Service and usage of these platforms in terms of routing will be very different to the existing layout, therefore this will need to be validated with a Timetable Model to ensure that it is workable during this time / construction phase.

E. **Stage 30** – It is assumed that the New Sidings Layout is commissioned Into Use during this stage.

F. **Stage 33 –** – It is assumed that the existing Platform 7 & 8 tracks are taken Out of Use at Cambridge Station, including Platforms 7 & 8 being taken Out of Use.

- It is assumed that the New / modified Platforms 1, 2, 3 & 4 at Cambridge Station are commissioned and EIS back Into Use at this stage (Stage 33) to effectively replace the Platforms that are being taken Out of Use. The Operational Service and usage of these platforms in terms of routing will be very different to the existing layout, therefore this will need to be validated with a Timetable Model to ensure that it is workable during this time / construction phase.

G. **Stage 37** – It is assumed that the full final layout is commissioned and EIS Into Use at this stage, including the final layout / all 10nr. Platforms at Cambridge Station. Therefore, the full Operational Service can be implemented at this stage.

In addition to these items, it is assumed that small areas / sections of the platforms at Cambridge Station can be Hoarded off during the various stages as required by the construction sequence to enable the works to be completed, these are items such as but are not limited to:

A. Platform Extensions works.

B. Platform Shortening works.

C. Platform & Canopy Modifications.

D. Existing Footbridge Modifications

E. New Footbridge Installation works.

F. M&E & CRMS Route works.

G. Station and Platform Drainage works.

H. Signal Sighting and Signalling Installation works.

I. OLE Foundations and Installation works.

2.10. North Approach Offline

The Offline Northern Approach to Cambridge was defined as from Cambourne to Milton Junction on the WAML. The design for this route option is less mature than that of the Southern approach, therefore this study is based on the East West Rail AC7 route information available on the EWR GIS.

The Northern Offline section was split down into the following sub sections:

- North 1 (N1) – Line of Route between Cambourne and the A14
- North 2 (N2) – A14 Viaduct
- North 3 (N3) – Line of Route between the A14 and the A10
- North 4 (N4) – A10 and Milton Junction (complex structure)

Initially the A14 viaduct was identified as a complex structure on the Northern route but it was later decided that, in comparison, it is a relatively standard structure. It may require bespoke specialist installation method, but the structure as a whole was not considered to be at risk of driving the programme at this stage.

Therefore, the standard structures programme logic has been applied to all sections of the Northern Offline route apart from area N4.

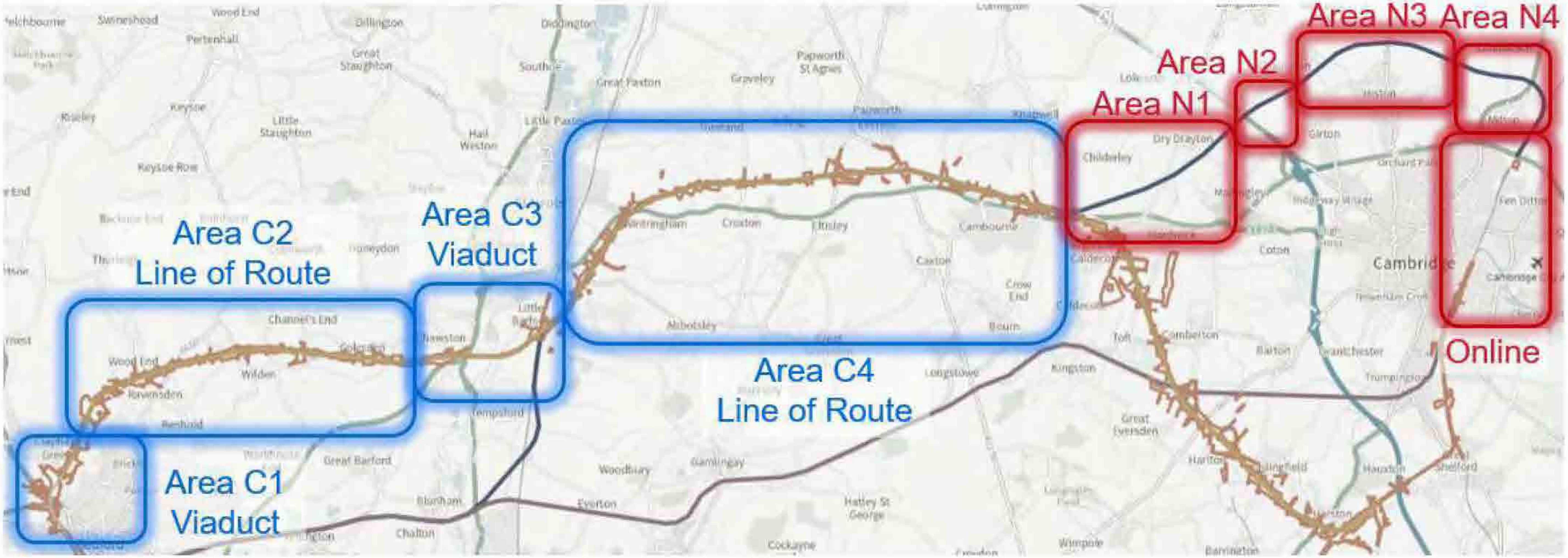


Figure 8 - Core and North Route Areas

Area	Core & SACT Online	Start Chainage	End Chainage	Area Length (m)
Area C1	MML to Clapham Road Ch 2080 to 3200 (Arup Section C)	2080	3200	1120
Area C2	Brickhill to Chawston Ch 3200 to 17000 (Arup Section D)	3200	17000	13800
Area C3	Chawston to ECML Ch 17000 to 20000 (Arup Section D)	17000	20000	3000
Area C4	ECML to Tunnel under St Neots Road Ch 20000 to 38000 (Arup Section D)	20000	38000	18000
Area N1	Knapwell Road to Dry Drayton Ch 38000 to 43000	38000	43000	5000
Area N2	Dry Drayton to Oakington Ch 43000 to 45200	43000	45200	2200
Area N3	Oakington to Milton Ch 45200 to 52000	45200	52000	6800
Area N4	Milton Ch 52000 to 56155	52000	56155	4155
North Online	Milton Junction to Cambridge Approach Ch 56155 to 59000	56155	61605	5450

Figure 9 – Core and North Route Area Start and End Chainages.

2.11. North Approach Online

Unlike the Approach from the South layout and scope, the Approach from the North proposed changes have some geographic separation between four key areas:

A. Cambridge Station limits and the north throat

B. Coldhams Lane Junction

C. Cambridge North Station

D. New Milton Junction

This allows certain flexibility in the sequence delivery and reduces the number of programme and operational dependencies between each of the work scopes.

Overall, it was found that Milton Junction itself is related to the Core delivery strategy rather than the online. The detailed online sequence therefore does not consider the interface as a key driver and allows it to operate separately. This provides a wider delivery opportunity for both construction logistics and early service delivery terminating at Cambridge North.

2.11.1. Key Principles

The following flow diagram shows how the strategic programme PERT workflow is envisaged, to deliver these four areas. PERT analysis at this point in the development of a scheme is excellent for identifying strategic interfaces, dependencies, and the overall driving logic of the sequence.

The red bold names identify the critical path activities and the driving key logic through the Cambridge Station scope.

Note that blue boxes surround highlight where significant changes to the layout are anticipated and highlight where signalling change may require staging and/or data design.

Amber boxes and arrows highlight areas where unavoidable impacts to the operational of the railway occur or where logic has been applied to minimise operational disruption.

The possession access assumptions described in Section 2.7 are also used to drive the programme in the NATC works as well as the SATC works.

2.11.2. Common Factors

Station work scope although different in the detail is not fundamentally changed from that of the southern approach. A new platform island with its associated footbridges and vertical circulation, plus various platform extensions to the existing are all still required.

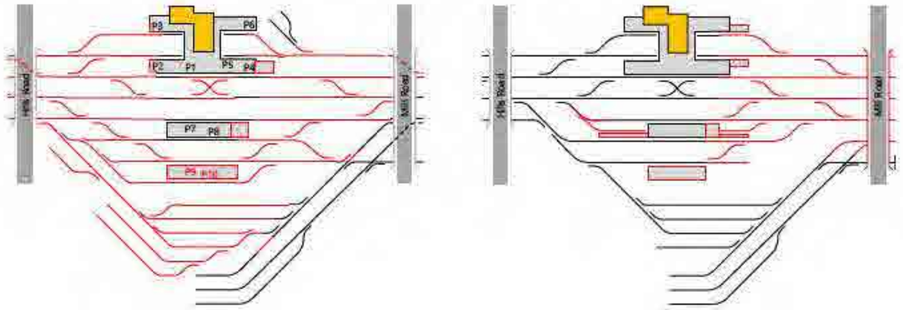


Figure 10 - Similar station scopes in south (left) vs. north (right)

When applied to the sequence this does strategically impact the minimum programme duration more for the northern approach as the station works form a greater overall proportion of the scope.

If the access regime with Network Rail, TOC's and FOC's for works approaching Cambridge can be challenged sufficiently enough, then there is likely to be a stage where durations for both southern and northern approaches become similar due to the similar changes required at Cambridge Station driving the critical path.

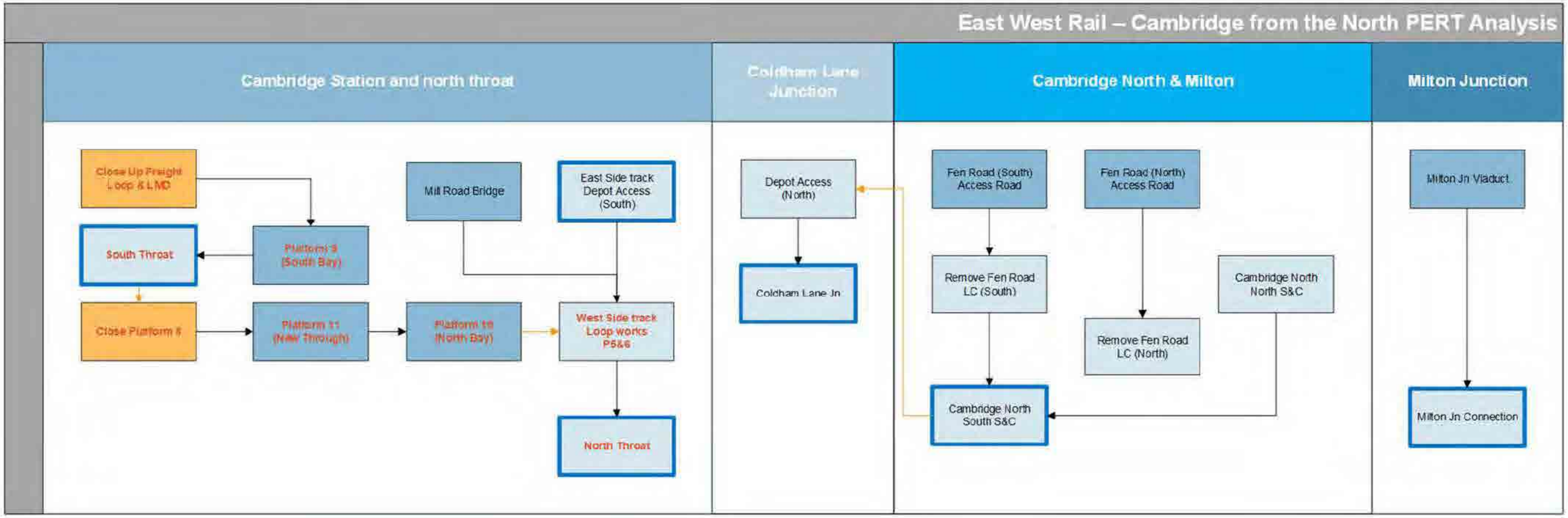


Figure 11 - Strategic scope

2.11.3. Differentiators

There are two main differentiators to how the strategy has been developed in the northern approach compared to the southern approach. These are key factors affecting the programme and the design scoping reduction from a northern to a southern approach are implicitly included in these already.

Physically and operationally discrete scope elements

The ability to split the work scope into geographic packages with minimal physical interfaces helps reduce the complexity of the staging. There are still key operational and systemic drivers, but these can be managed more simply and with less interim stages to suit the physical constraints of the existing layout and construction worksites.

Operational Layout Change Minimised

The volume of railway systems required in a northern approach is clearly significantly less, but another key factor in this is the way that these impact the layout operationally as well as physically. For the northern approach the fundamental principles of a paired by-direction railway do not change, particularly between Cambridge Station and Coldhams Lane Junction.

As a result, the complexity of the sequence is significantly reduced as the systemic changes within the staging are more localised and affect the physical infrastructure changed with more minimal impact on the wider railway.

2.11.4. Operations and Managing Disruption

The following key drivers have been used in the development of the sequence to help minimise the overall disruption to the West Anglia Mainline:

1. Delivery of the new operational layout at Cambridge North, with its turnback from the north functionality, prior to commencing major disruptive works in the Cambridge Station North throat and Coldhams Lane Junction areas. This makes these two elements of work consecutive which extends their combined durations; however, the critical path will still run through the Cambridge Station area.
2. Deliver the new Platform 9 to maintain the number of platforms available at Cambridge Station during the works. This extends the critical path as works to existing Platform 7 must not be concurrent with existing Platform 8 works until Platform 9 is operational.
3. Maintain a terminating platform functionality at the north end of Cambridge Station, both for the terminating Ipswich services plus depot Empty Coaching Stock moves.
4. Maintain access to the Thameslink sidings and Greater Anglia depot through either:
    - Maintaining the current turnback road from 1090A points; or
    - Maintaining the southern access from 1065A/B pts.

   This impacts the programme as certain operational functionality cannot be removed from the layout and increases the volume and complexity of possession access which slows down delivery of the works.

Additionally, the same possession access constraints described in Section 2.6 and Section 2.7 are followed so that the access regime complies.

With the exception of measure 1, these all impact the overall programme duration as they stop various elements of work from becoming concurrent in the programme.

2.11.5. Opportunities

There are five key opportunities identified in the Approach from the North sequence as follows:

1. Negotiation with Network Rail and TOCs to allow existing Platform 8 to be taken out of use earlier and trains re-platformed to suit. This would allow the works to existing Platform 7&8 to become more concurrent and expedite delivery of the overall station works with an approach from the north.
2. Delivery of the Cambridge north throat works in a blockade style approach similar to previous studies on the southern approach would be clearly beneficial. This is due to the overlap of existing layout with the new and the volume of change. The approach applied in this sequence utilises possession access but is clearly inefficient as a result. This will directly reduce the critical path as these works directly drive the completion milestone.
3. Delivery of the Cambridge North station remodelling in a blockade style approach – this will reduce its duration and cost, although there is unlikely to be a benefit to the overall critical path.
4. Delivery of the Coldhams Lane remodelling in a blockade style approach. However, these works should be driven by the approach to the Cambridge Station north throat, its access requirements and maintaining access to the Greater Anglia Depot. There is unlikely to benefit the critical path as a result.
5. Decoupling the delivery of Fen Road new access bridge from the Cambridge North station by not increasing the service over the level crossing and allowing it to remain in situ with a temporary alignment change for the Down Main until the bridge is ready. This would affect operations and timetabling rather than construction.

2.12. Route Wide Rail Systems

2.12.1. Core Overview

The route wide rail systems are dependent on the earth works and structure completion. As a result, the rail systems approach has been disseminated into distinct sections similar to the civils. These are detailed as Core (C1-C4), Southern Approach to Cambridge (S1-S2) and Northern Approach to Cambridge (N1-N4) defined in Section 2.1 Figure 1 and Section 2.10, Figure 8. As the relevant earthworks and structures are completed in the sections, the rail systems can commence. Within the core section C4 is completed first followed by C3, C2 and finally C1.

Although not in the current DF2 scope, a rail construction depot is proposed to be installed where the EWR alignment crosses the East Coast Main Line (ECML) around chainage 198000m in the St Neots area. The ECML rail construction depot will service the Core (C1-4). The total length of the core is circa 38Km. Completing 38km of track end to end in a linear programme removes complexities and interdependencies but is not efficient or realistic.

Figure 12 – ECML Construction Depot

As a result, the construction of the core section delivery has been split at the location of the ECML depot at 20km along EWR alignment. This reduces transit times for engineering haulage in half as it located at the centre of the EWR alignment. It also provides the rail systems programme with the flexibility to work concurrently with the civils works. There is an opportunity where working from the ECML depot removes any reliance on the Bedford programme.

If operationally viable then there is further opportunity for the construction depot to be developed as permanent scope and replace Cambourne sidings. This would provide EWR with the flexibility to bring rolling stock in from the ECML connection and enable dynamic testing to commence for the core section irrespective of the Bedford and Cambridge online programs. Once the ECML depot is installed, a service road will be created by laying down skeleton track along the Eastbound (assumption is that Eastbound is the geographically northern track of the two EWR tracks). The skeleton Eastbound track will then provide a service road for the Westbound (assumption is that Westbound is the geographically Southern track of the two EWR tracks) to be installed using engineering trains. This will form the main strategy to deliver the rail systems route wide.

Once the skeleton track service road has been created there are two areas which are off the critical path which are installed concurrently with the main route works. The two areas are C3 - Loop Lines and C4 - Cambourne Sidings.

2.12.2. Southern Approach to Cambridge Overview

In a similar approach to Core, the Southern approach to Cambridge has been split in two sections S1 and S2. These sections will be serviced from Cambridge North depot Figure 13. There is an existing Network Rail depot that will need to be acquired and repurposed for EWR. One of the key structures to be delivered along the EWR route is Chapel Hill tunnel located in S1. Installing the route from Cambridge North (East to West) removes reliance on this structure thus removing the rail systems works off the critical path for Chapel Hill. Within S2, the rail systems works are phased with civils works around Harston where there is an interface with the Shepreth Branch Line (SBR).

1. The earth works and tunnel for the new SBR line are required to be competed first.
2. Once completed, the rail systems are installed in an offline environment.
3. Possession of SBR to complete formation renewals and diversion / commission of SBR line onto new alignment
4. Completion of earthworks on redundant SBR line for new EWR alignment
5. Commencement of EWR S2 rail systems works.

There is an interface with the possession required for the SBR line works with the Cambridge online works. The possession works for the SBR diversion are completed prior to the four-track layout to Cambridge South station (currently Christmas 2031) which do not have adverse impact on the possession arrangements. For the main works along S1 and S2, there is an interface where the three engineering trains will need to be routed to and from the connection at SBR on a daily basis. It is assumed that a train path between SBR and Cambridge North Depot is available and Rules of the Route possession availability are available to access/egress trains into the EWR trace. The completion of the S1-S2 is the final element of the rail systems works and is independent of the core works. It is recognised that Chapel Hill is one of the complex structures along the route. Having S1 and S2 delivered from Cambridge North deport provides contingency for the completion of Chapel Hill by providing flexibility to commission a railway from Oxford to Cambourne.

3.7. Online Approach

The online works for both the SATC and NATC route options are defined as follows:

- SACT – Route section from west of Shepreth Branch Junction to north of Cambridge Station / Mill Road Bridge.
- NACT – Route section from north / west of Milton Junction to south of Cambridge Station / Hills Road Bridge.

3.7.1. Online Approach from the South Summary

The construction sequence for the Online section for the South Approach to Cambridge route is driven primarily by the operational constraints for both rail and station operations. Please refer to Section 2.9 for more information / details of these constraints.

The diagrams within the construction sequence in Appendix I – South Approach to Cambridge Online– Rail Systems Construction Sequence, seek to visually demonstrate which lines and platforms remain operational during each Phase and Stage of the works, whilst also showing the lines and platforms that are not operational.

The Key in Figure 31 seeks to describe what each line colour and style are representing in the diagrams within the construction sequence.

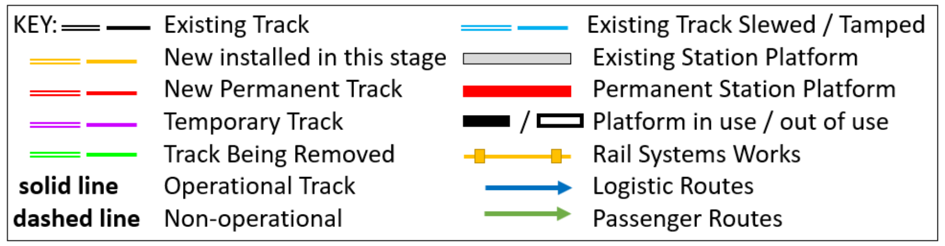


Figure 31 **- Track Diagram Key.**

3.7.2. Online South Construction Sequence Phasing

The works undertaken to date has resulted in a six-phase sequence with preceding enabling works for the EWR CS3 Core, Online and Rail Systems works being detailed in the Construction Programme (P6) and supported by this construction sequence pack. These 6 phases are:

1. **Phase 1:** Enabling works, Cambridge South Station 2-track layout implemented, and the Platforms 5 & 6 works at Cambridge Station commenced. Refer to Appendix I Section 2.
2. **Phase 2:** Platforms 5 & 6 works at Cambridge Station completed, including the Installation of a Temporary Scissor S&C Layout north of Mill Road Bridge. This Temporary Scissor S&C Layout is critical for the sequence to enable the required layout functionality to be maintained throughout the sequence. This is not part of the Design Freeze 2 design; therefore, this will need to be designed and validated during the next design stage. Shepreth Branch Junction to Cambridge South Station 4-track layout implemented (including the temporary reversing facilities from CSS), CSS to Cambridge Station 2-track Layout implemented and the existing Sidings at Cambridge Station Taken Out of Use, enabling the installation of the new layout to the east of the station to be commenced. Refer to Appendix I Section 3
3. **Phase 3**: Continue installation of the new layout to the east of the station and installation of the New WAML 2-track layout from CSS to Cambridge Station, enabling the New EWR / SBR lines / 2-track layout to be installed to the west of the WAML lines. Refer to Appendix I Section 4.
4. **Phase 4:** Continue installation of the new layout to the east of the station, installation of the New Cambridge Station South Throat layout for the WAML lines, including the installation of the New Platforms 9 & 10 and associated track layout at Cambridge Station, and installation of the New EWR / SBR lines / 2-track layout to the west of the WAML lines within the construction work area / compound. Refer to Appendix I Section 5.
5. **Phase 5:** Commission the new layout to the east of the station (New Sidings) into use, commence installation of the New Cambridge Station North Throat layout, including existing Platforms 7 & 8 being taken out of use and extension / shortening works being undertaken, and commissioning of the New EWR / SBR lines / 2-track layout to the west of the WAML lines into use (The new 4-track layout to Cambridge Station is implemented at this phase). Refer to Appendix I Section 6.
6. **Phase 6:** Complete the installation of the New Cambridge Station North Throat layout, including the New Platforms 7 & 8 platforms and track layout, and commissioning of the New EWR Final Track Layout into Use. Refer to Appendix I Section 7.

3.7.3. Online South Construction Sequence Staging

During each phase of works, there are several stages required to deliver the scope and outcome required at the end of each phase. The construction sequence has 38nr. Stages identified, the construction sequence shows each stage as the works progresses and key works are described within each stage with risks, assumptions and opportunities noted with each stage.

It should be noted that these risks, assumptions, and opportunities for each stage are primarily linked to this sequence, therefore if the construction sequence changes as the project develops (due to scope change, possession access changes both in duration and number available and / or any other reason) then these would need to be reassessed and validated in line with the revised strategy / sequence.

It is likely that prep and follow-up possessions for the various areas can be shared where there is a reasonable case for the access regime to accommodate. This should be developed further once the scope is better defined.

Please refer to for the full sequence in Appendix I – South Approach to Cambridge Online– Rail Systems Construction Sequence for further details.

There are 10nr. key track stages where there are significant changes in railway operational configurations, these are as follows on the next pages.

1. **Stage 2:** Christmas 2027 – 10 Day Blockade: Key Stage: Installation, commissioning of the Cambridge South 2-Track Layout into use, Signalling Stage Design required.

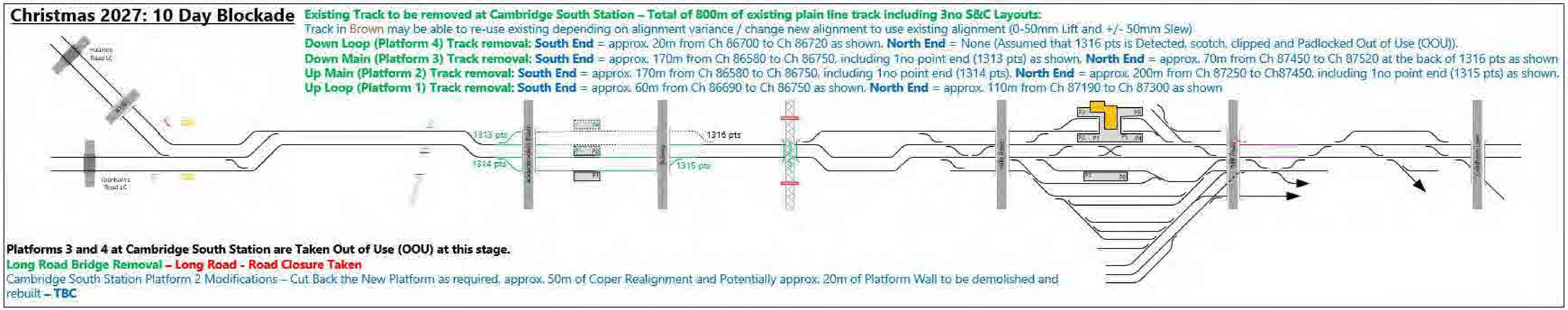


Figure 32 – Stage 2 staging diagram – Start of Christmas 2027 Blockade.

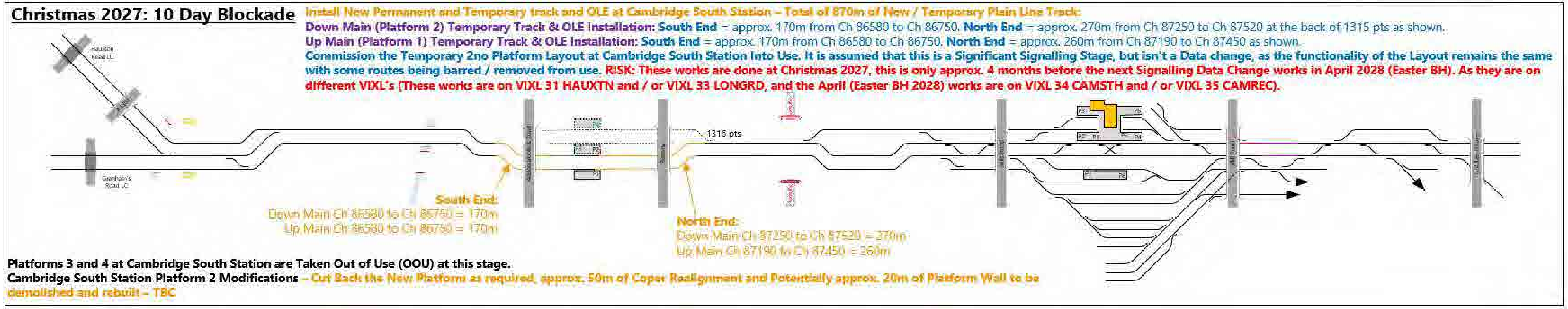


Figure 33 **–** Stage 2 staging diagram – End of Christmas 2027 Blockade.

2. **Stage 4:** Easter 2028 BH: Key Stage: Installation, commissioning of the New Platform 5 & 6 Throat Layout into use, Signalling Data Design required.

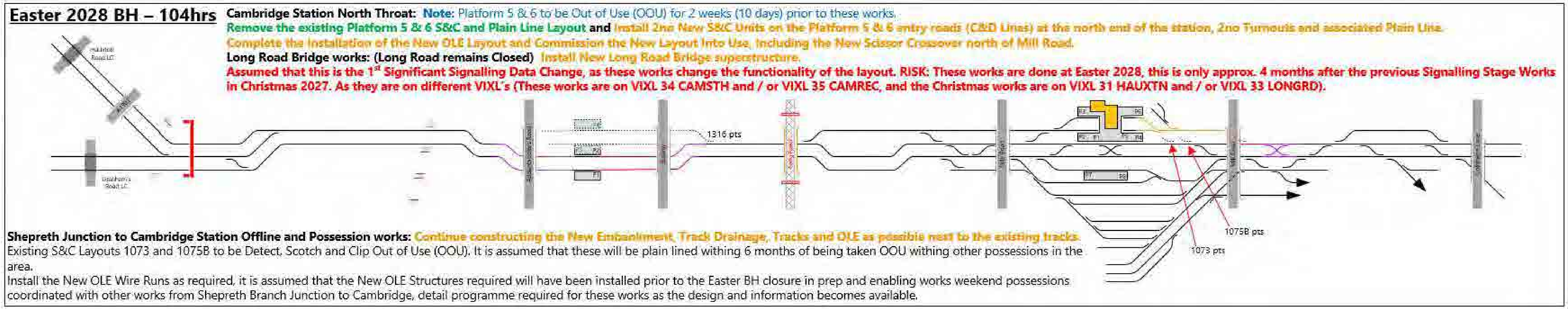


Figure 34 **– Stage 4 staging diagram – Easter 2028.**

3. **Stage 9:** Easter 2029 BH: Key Stage: Installation, commissioning of the Cambridge Station New Scissor Layout into use, Signalling Stage Design required.

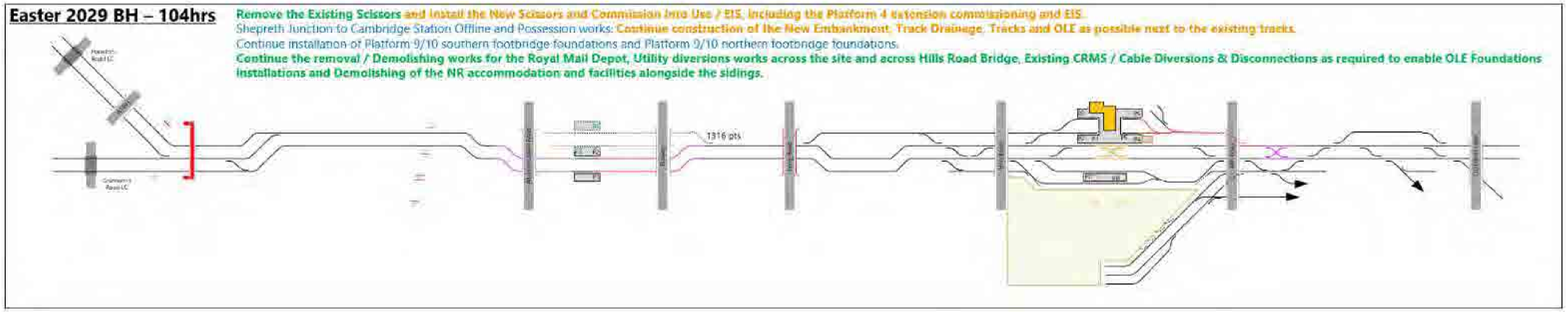


Figure 35 **– Stage 9 staging diagram – E**aster 2029.

4. **Stage 13:** Jan 2030 – 52hrs Possession: Key Stage: Installation, commissioning of the Interim Up WAML SBJ Layout into use, Signalling Data Design required.

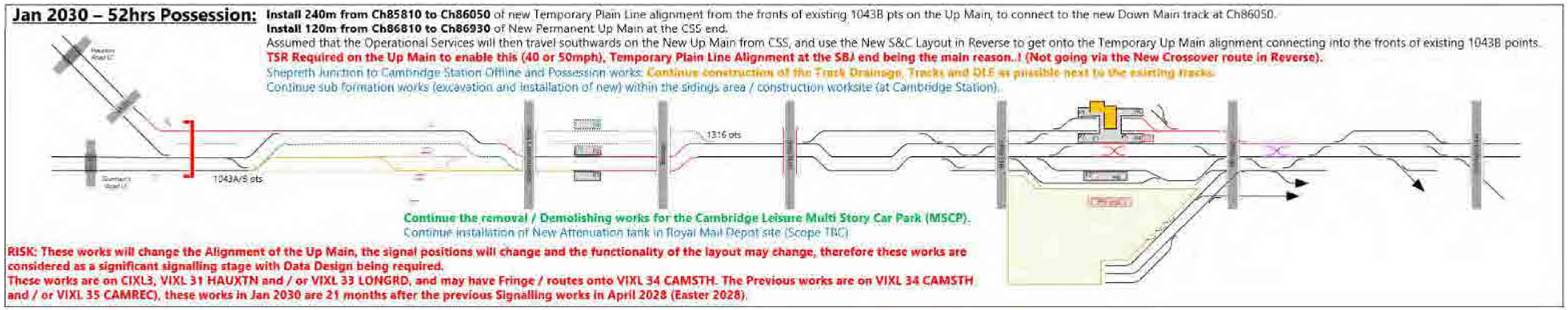


Figure 36 **–** Stage 13 staging diagram – Up Main Interim Alignment.

5. **Stage 16:** Dec 2030 – 52hrs Possession: Key Stage: Installation, commissioning of Interim Down WAML SBJ Layout into use, Signalling Data Design required.

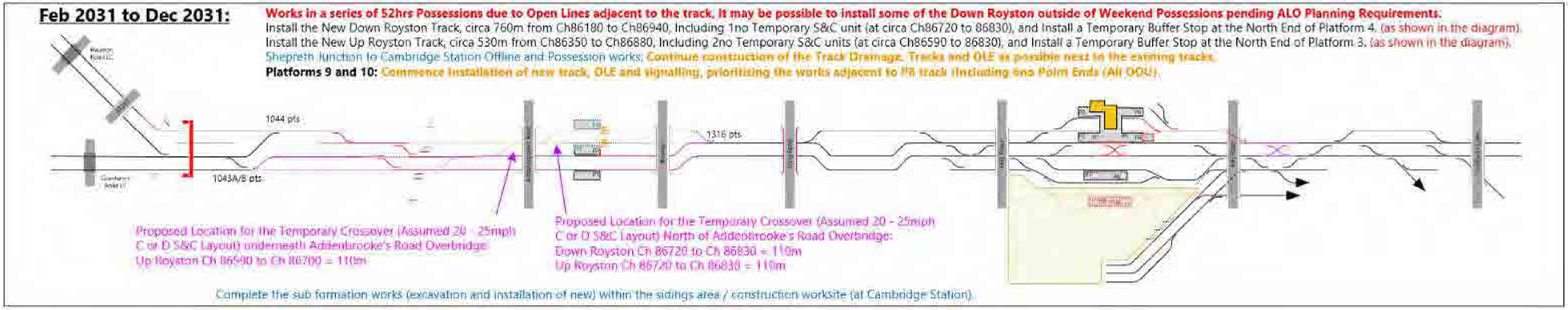


Figure 37 **–** Stage 16 staging diagram – Down Main Interim Alignment.

6. Stage 19: Christmas 2031 – 12 Day Blockade: Key Stage: Installation, commissioning of the Interim 4-Track Layout @ SBJ into use, Signalling Data Design required.

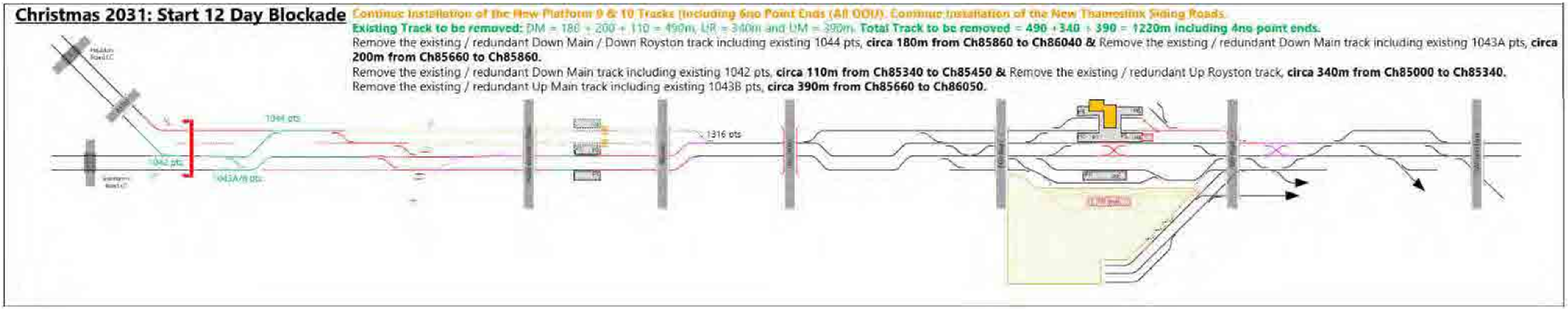


Figure 38 **– Stage 19 staging diagram – Start of Christmas 2031** Blockade.

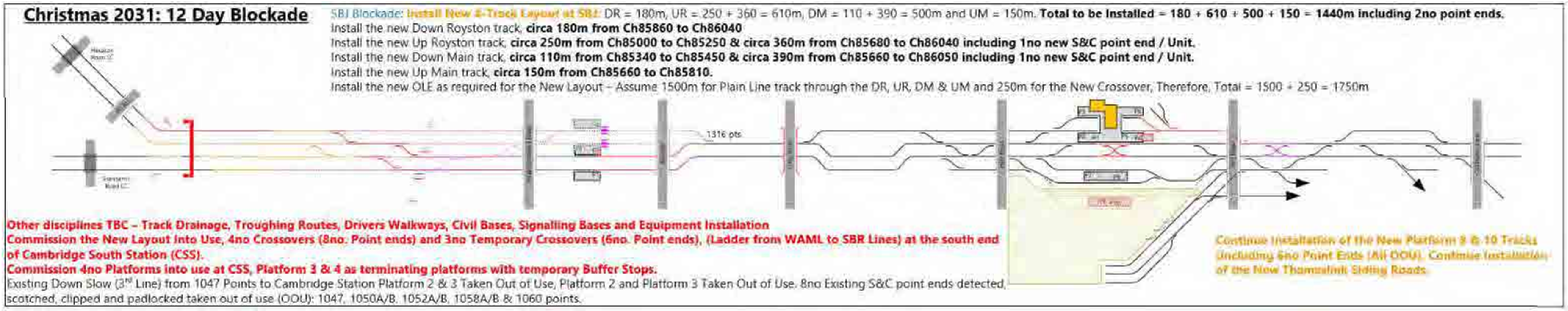


Figure 39 **– Stage 19 staging diagram –Christmas 2031 Blockade.**

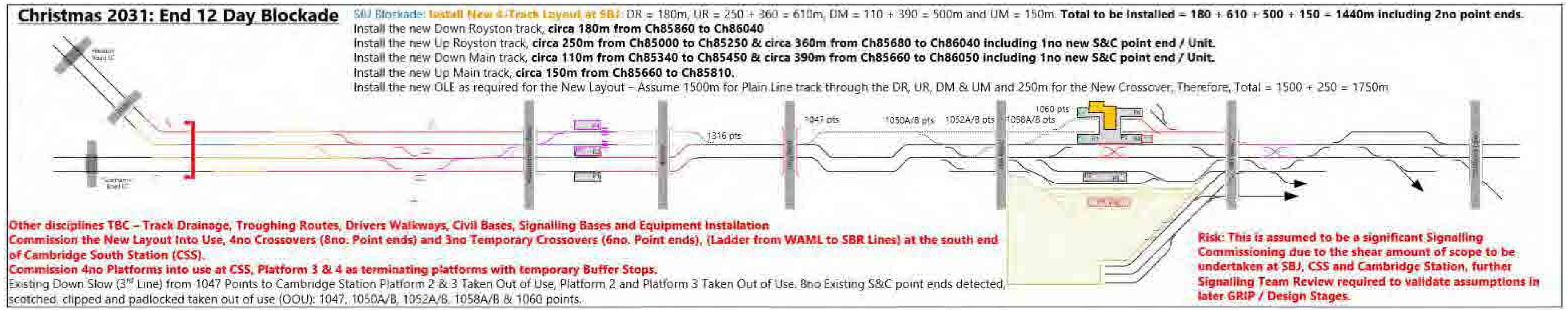


Figure 40 **– Stage 19 staging diagram – End of Christmas 2031 Blockade**.

7. **Stage 25:** February 2033 – 16 Day Blockade: Key Stage: Installation, commissioning of the New WAML 2-Track Layout & Interim Crossover @ Platform 7 & 8 into use, Signalling Data Design required.

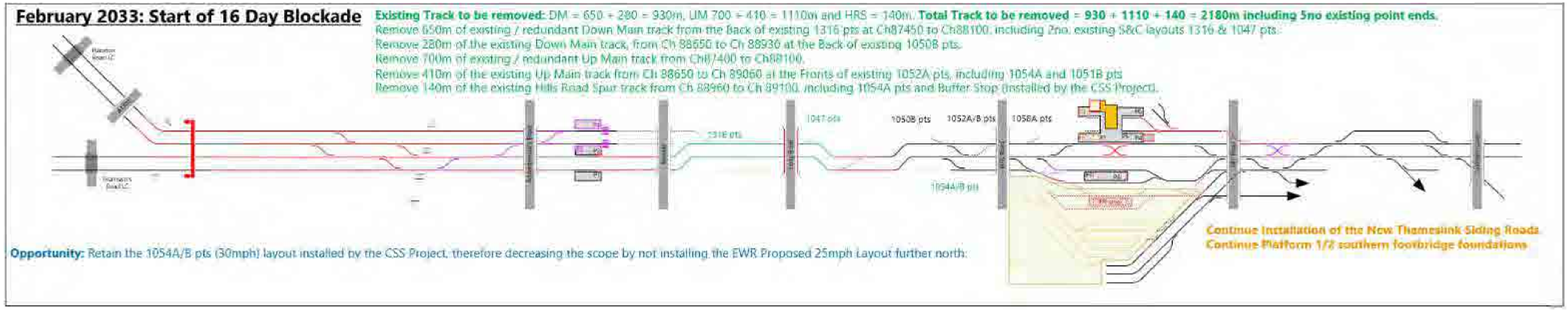


Figure 41 **–** Stage 25 staging diagram – Start of February 2033 Blockade.

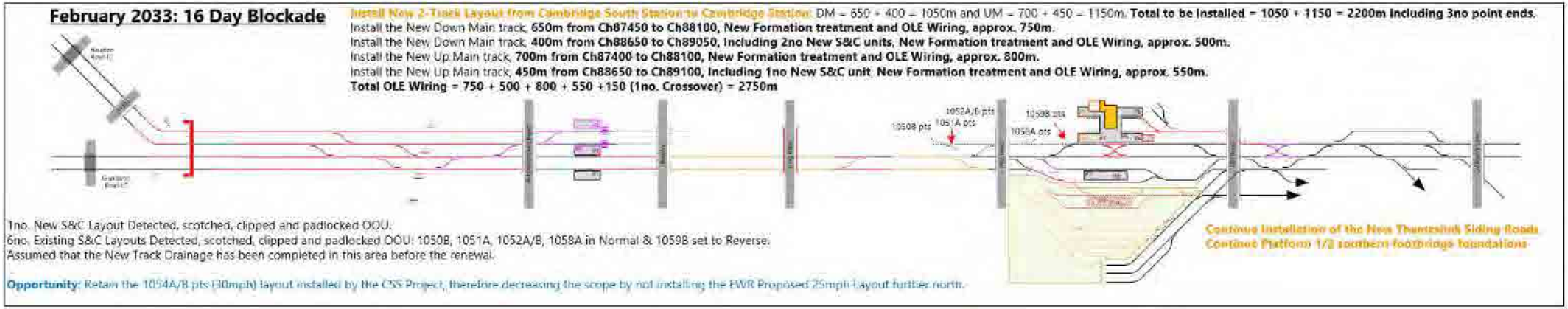


Figure 42 **–** Stage 25 staging diagram – February 2033 Blockade.

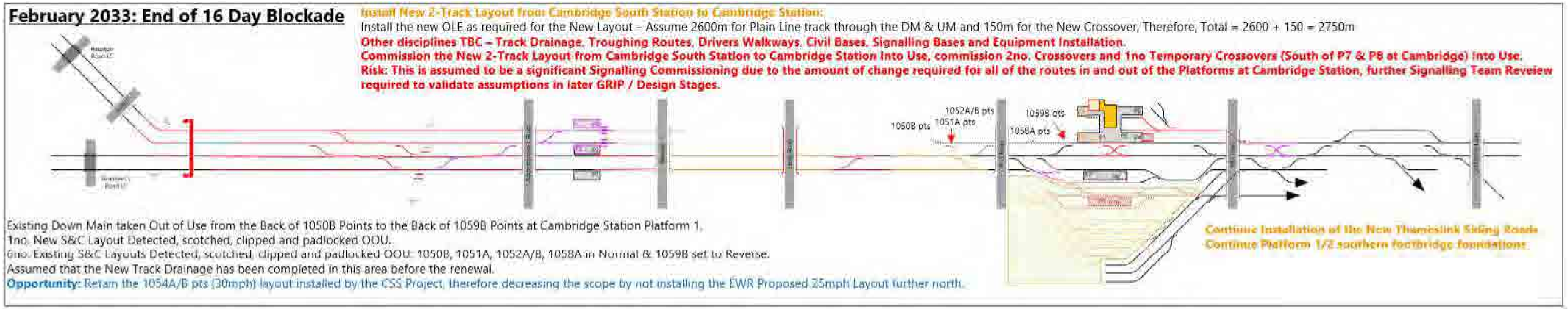


Figure 43 **– Stage 25 staging diagram – End of February 2033 Blockade**.

8. **Stage 28:** Christmas 2034 – 10 Day Blockade: Key Stage: Installation, commissioning of the New Cambridge Station Throat (South) Layout into use, Signalling Data Design required.

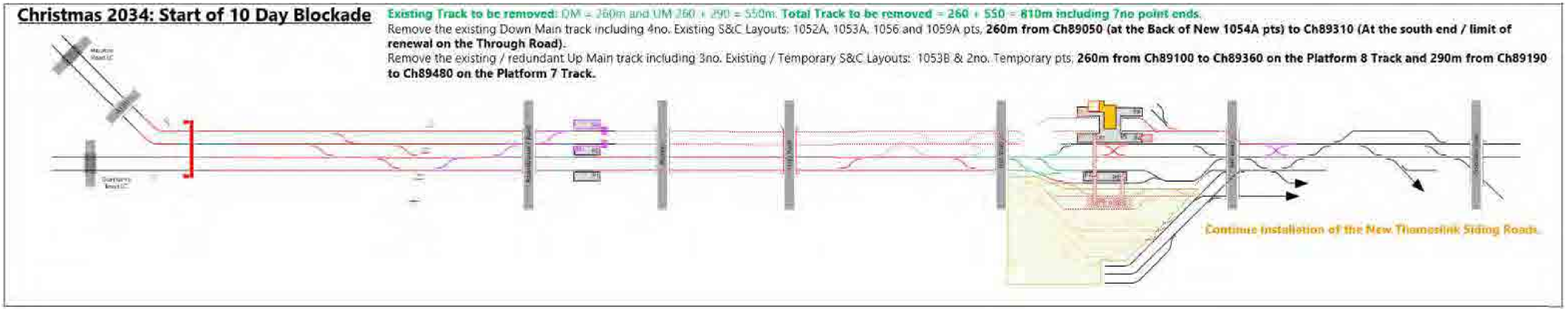


Figure 44 **–** Stage 28 staging diagram – Start of Christmas 2034 Blockade.

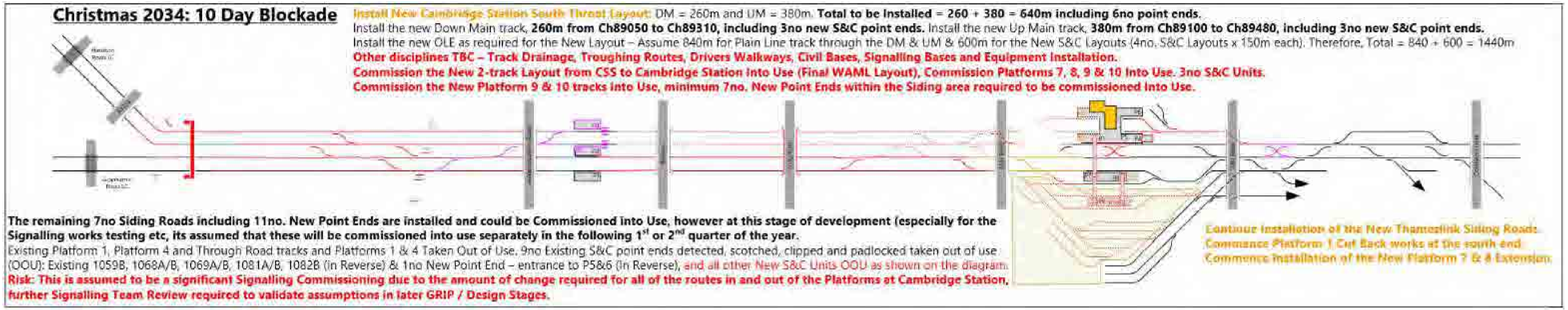


Figure 45 **–** Stage 28 staging diagram – Christmas 2034 Blockade.

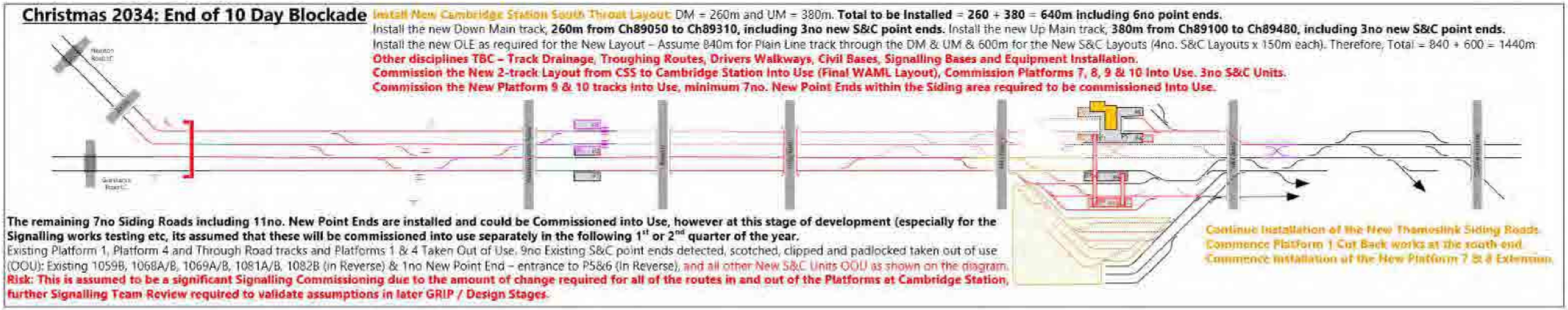


Figure 46 **– Stage 28 staging diagram – End of Christmas 2034** Blockade.

9. **Stage 33:** Christmas 2035 – 10 Day Blockade: Key Stage: Installation, commissioning of the New Up & Down Royston Final SBR Layout into use, Signalling Data Design required.

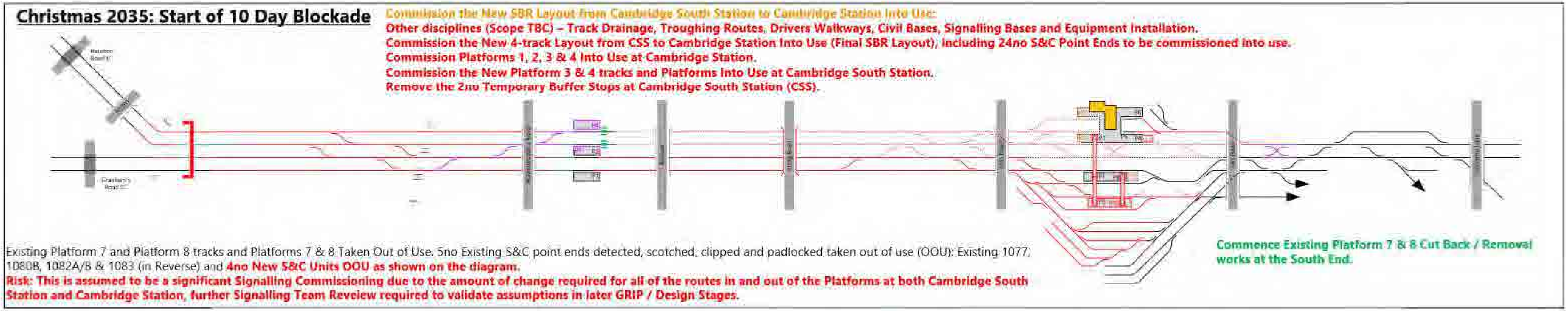


Figure 47 **– Stage 33 staging diagram – Start of Christmas 2035 Blo**ckade.

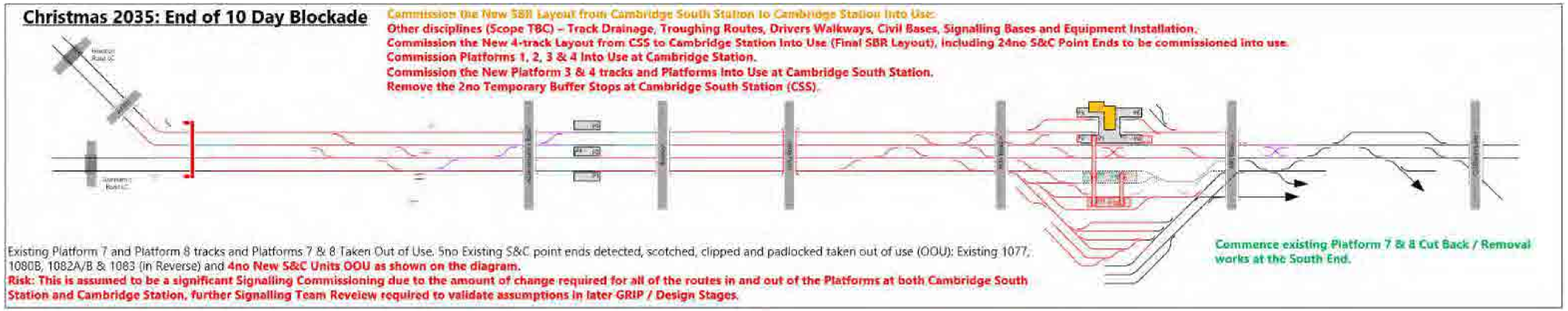


Figure 48 **– Stage 33 staging diagram – End of Christmas 2035 Blockade.**

10. Stage 37: Christmas 2036 – 08 Day Blockade: Key Stage: Installation, commissioning of the New Final Layout into use, Signalling Data Design required.

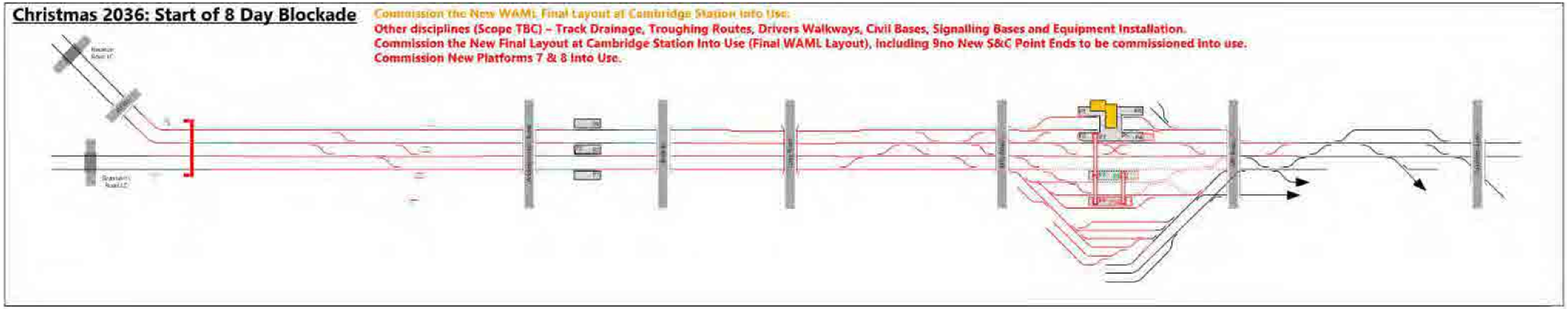


Figure 49 **–** Stage 37 staging diagram – Start of Christmas 2036 Blockade.

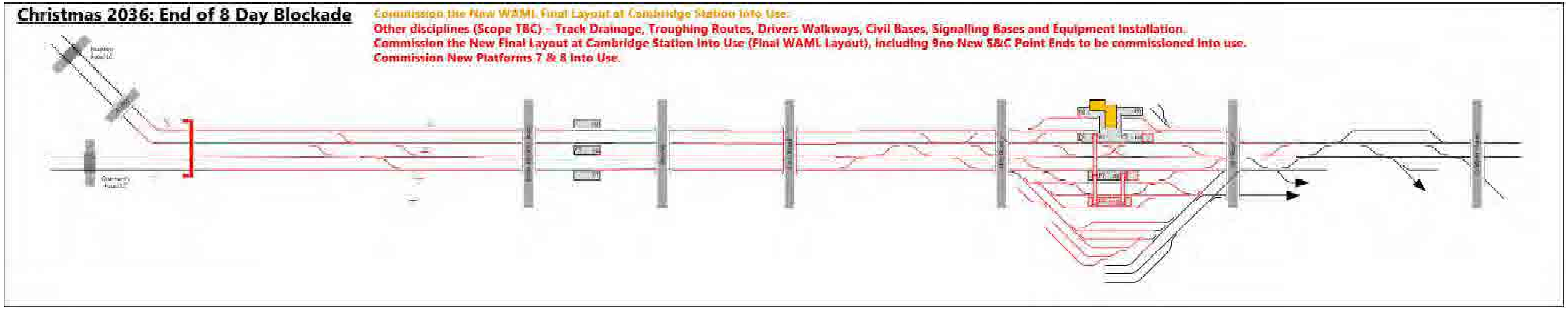


Figure 50 **– Stage 37 staging diagram – End of Christmas 2036 Blockade.**

3.9. Core Rail Systems Installation

3.9.1. Overview and Principals

The railway systems installation is delivered from two rail construction depots. A new depot located at EWR chainage 198000m which is connected to the East Coast Main Line (ECML) and the repurpose of an existing depot at Cambridge North along West Anglia Mainline. The depots would be managed by EWR which would remove reliance on Network Rail Supply Chain Operations that would otherwise import resource risk for materials from Network Rail by stockpiling prior to the work commencing. The depots would be designed to enable the turnaround of three engineering trains a day to cater for dayshift working only. The construction rail depot along the ECML has an opportunity to be the permanent sidings for EWR in place of Cambourne Sidings subject to operational acceptance. With the two construction rail depots, the core railway systems have been planned so that transit times for engineering haulage are less than 2.5hr (assumed 5mph travel speeds in a worksite). This was the main opportunity captured in the programme when compared with the Arup base line programme which had engineering haulage transiting from one end (Bedford) to service the whole site. As detailed in section 2.12, the location of the rail depots will mean sections C1-C4 will be serviced from the ECML depot and section S1-S2 or N1-N4 will be serviced from Cambridge North depot. Generally, the core railway systems have been broken down into the following constituent areas.

1. Rail delivery.
2. Skeleton Track Install.
3. Bottom Ballast Install.
4. Sleeper installation.
5. S&C Track Install.
6. Rail Installation.
7. Top Ballast.
8. Tamping.
9. Ballast and track reinstall.
10. OLE install.

Traditional track installation would require the installation of bottom ballast prior to the installation of sleepers and rail. This would normally be serviced from an adjacent track or would require single line methodologies such as using site dumpers to deliver the ballast to site. Through the core section, the mass haul for circa 38Km of bottom ballast through the trace damages formation and would have constraints with passing significant size dumpers along trace. Additionally, the quantum of distance from the rail yard is not efficient using dumpers to deliver ballast. The locations of the haul roads at the bottom of embankments/ top of crests are not viable to deliver the ballast. As such the method of construction is to lay a skeleton track on the formation which will provide a service road for engineering trains to provide the logistics for track construction. The sequence would entail building the Eastbound (EB) as a skeleton track first which would be used as a service road to build the Westbound (WB) track. The EB has been selected as the skeleton track as this is the track closest to the ECML depot. This was favoured over the WB as a service road on the WB would require crossover moves for haulage to access/egress the depot.

3.9.2. Installation of Skeleton Track

The use of the New Track Construction (NTC) Train has been opted as the preferred method to install the skeleton track on the EB. As shown in Figure 51, the NTC train is designed for installation of single tracks in large volumes compared with conventional track installation techniques. At present there are only two NTC trains in operation Nationally. The NTC train and supporting sleeper wagons (type KRA) will need to be secured to remove critical resource risk (circa 15 KRA wagons included with the NTC and further 15 required from NR SCO). Although capable up to 1500m per shift, NTC train has been planned to work 914m per 8hr shift with a day turnaround reloading back at the construction depot. There is an opportunity to reduce the programme time of the NTC by enabling 24hr working in the depot. Prior to the NTC operation, rail will need to be in place on site for the NTC to operate. Long Welded Rail (LWR) will be delivered to site using Rail Delivery Trains (RDT). Rails of 216m will be delivered as close as possible to site and Trac Rail Transposer (TRT) McCullochs or similar plant will deliver the rail where required. The rail delivery has been staggered throughout the duration of the project to reduce pressure of the Rail Delivery Train (RDT) resource profile and has assumed that the RDT will be made available.

Figure 51 – NTC Train

3.9.3. Installation of Bottom Ballast

Once the EB skeleton track has been laid, the rails will be temporarily clamped with an inspection regime in place. The track geometry will be checked with an inspection regime in place to ensure derailment risks are minimised. The skeleton EB track will be used as a service road to build the WB track. Bottom Ballast (500m per shift) will be delivered to site using open wagons such as Falcons (Circa 400m Engineering trains) and offloaded in a day shift with a day turnaround reloading at the construction depot. The ballast will be compacted conventionally using triple plate compaction plate. It is recommended that EWR secure Falcon type wagons for the project duration to remove resource risk from other rail projects.

3.9.4. Installation of Sleepers

Sleeper installation (400m per shift) from salmon wagons would follow the ballast installation offloaded in a day shift with a day turnaround reloading at the construction depot. It is recommended that EWR secure salmon type wagons for the project duration to remove resource risk from other rail projects. The programme has assumed three concurrent activities (NTC/Ballast and Sleepers) would require reloading at the construction depot on a daily (day shift) basis. The construction depot must therefore be able to cater for reloading of three trains and be able to accept delivery of materials from SCO to replenish stock. There is an opportunity to reduce the programme time by carrying out the reloading activities at night, so the trains are ready for the following shift.

3.9.5. Installation of Rail

As sleepers are installed, rail will be installed using conventional methods and an S&C team will install the S&C (in panels) using a Kirow train. The S&C installations are localised and do not form part of the critical path. There is opportunity to use the S&C along the route to increase concurrent working subject to capability at the construction depot.

3.9.6. Installation of Top Ballast and Tamping

Top ballast and tamping will follow once all the rail and S&C has been installed. Top ballast activities happen concurrently with ballast, sleeper installation/ NTC activities. It is assumed that EWR will acquire an S&C tamper for the duration of the project. There is an opportunity to increase tamping rates from 250m/hr to 500m/hr with the use of dynamic triple bank tamper pending availability.

3.9.7. Ballast and Track Reinstallation

Once the adjacent WB track has been constructed the skeleton track is then removed in 216/108m track panels using Trac Rail Transposer (TRT) McCullochs/PEM&LEMS or Track Relaying Machine (TRM). The bottom ballast is then installed conventionally using the newly installed EB as a service road. Once the ballast is installed the track reinstated (shown as Reinstall and Ballast EB circa 432m per shift). This method has been selected over Bottom-up construction for track quality purposes.

3.9.8. Overhead Line Equipment (OLE) Installation

OLE Main Part Steel (MPS) with the Small Part Steel (SPS) attached will be installed onto foundations using conventional method along the route once the track has been installed. The OLE MPS and SPS installation is off the critical path and can happen concurrently to ensure programme efficiency. The foundations on which the MPS is fixed to will be installed as part of the Civils works package as part of the Mass Haul & earth works (Section 3.3). The installation of the contact and catenary wire and associated panning takes place after the track is tamped and concurrently with other activities such as top ballast and tamping further along the trace. With the volumes of wire runs to install, the High Output Plant System (Figure 52) is capable of 2km of OLE contact and catenary per day shift.

Figure 52 - HOPS Train

3.9.9. Assumptions

1. The construction depots at ECML and Cambridge North would be designed to enable the turnaround of three engineering trains a day to cater for dayshift working only.
2. With the two construction rail depots, the core railway systems have been planned so that transit times for engineering haulage are less than 2.5hr (assumed 5mph travel speeds in a worksite)
3. Although capable up to 1500m per shift, NTC train has been planned to work 914m per 8hr shift with a day turnaround reloading back at the construction depot.
4. The programme has assumed three concurrent activities (NTC/Ballast and Sleepers) would require reloading at the construction depot on a daily (day shift) basis.
5. Conventional installation of ballast and compaction has been assumed for optimum track quality in place of Bottom-up construction (top ballast and tamping in 100mm lifts) for track quality purposes.
6. Concrete foundations (circa 1.2x1.2x3m) as per the Furrer+Frey design catalogue have been assumed.
7. Signalling installation activities are off the critical path and can be carried out concurrently using conventional installation methods without impact to the programme provided.
8. M&E installation activities are off the critical path and can be carried out concurrently using conventional installation methods without impact to the programme provided.
9. Track construction consists of CEN60 rail, concrete sleepers, 300mm ballast compacted with a triple plate compaction plate and a geotextile layer.

3.9.10. Opportunity & Risk

J. There is an opportunity to reduce the programme time by carrying out the reloading activities at night, so the trains are ready for the following shift. There is an opportunity to reduce the programme time of the NTC by enabling 24hr working in the depot.

K. There is an opportunity to increase tamping rates from 250m/hr to 500m/hr with the use of dynamic triple bank tamper. This would require securing the resource.

L. Derailment risk associated with running engineering trains / plant on EB skeleton track that has been laid by NTC on formation. The rails must be temporarily clamped with an inspection regime in place. The track geometry will be checked with an inspection regime in place to ensure derailment risk are minimised.

M. The NTC train and supporting KRA sleeper wagons will need to be secured to remove national critical resource risk (circa 15 KRA wagons included with the NTC and further 15 required from NR SCO).

7. Programme Outputs

7.1. Core with South Programme

7.1.1. Baseline Programme

SATC has a programme duration of 10-years with an EIS date of the 2nd of Jan 2037, not including the TRA. The P6 programme includes a TRA of 300-days, which then gives an alternative programme duration of 11-years and 1.5 months and an EIS date of the 15th of March 2038. The SATC Core is ready for EIS on the 5th of July 2035 which is a 7-year and 5-month duration (including TRA).

The completion dates for each area are summarised in Section 5.2.2.

Table 16 – SATC Section Completion Dates. The finish dates are the Testing, Commissioning, Trial Running & EIS for each area and include the 3-month TRA as previously explained in Section 5.10. The TRA that is included within the key dates area of the programmes are not included in these finish dates. Completion works that follow on from these finish dates include landscaping, earthworks disposal / resoiling and demobilisation are also not included in these finish dates

Core & Online	Start	Finish
Area C1 - MML to Clapham Road Ch 2080 to 3200 (Arup Section C)	01-Jul-24	21-Jul-33
Area C2 - Brickhill to Chawston Ch 3200 to 17000 (Arup Section D)	01-Jul-24	21-Jul-33
Area C3 - Chawston to ECML Ch 17000 to 20000 (Arup Section D)	01-Jul-24	21-Jul-33
Area C4 - ECML to Tunnel under St Neots Road Ch 20000 to 38000 (Arup Section D)	01-Jul-24	21-Jul-33
Area S1 - Tunnel under St Neots Road to A10 Harston (Ch 38000 to 50800 (Arup Section D)	01-Jul-24	30-Sep-33
Area S2 - A10 Harston to Shepreth Junction / M11 Ch 50800 to 53750 (Arup Section E)	01-Jul-24	30-Sep-33
South Online - Cambridge Approach (Arup Section F)	01-Jul-24	11-Dec-37

Table 16 – SATC Section Completion Dates

The South online extends 3-years and 10-months beyond the Core (Southern Online programme is 11-years and 1.5 months long), this is fundamentally due to the possession access regime and the subsequent signalling data designs required for the staging.

The Access regime used to develop the programme is discussed in detail in Section 2.6, therefore please refer to Section 2.6

The Signalling Data Designs which are assumed to be 9-months in duration for each design package, these are assumed to be linear activities in the programme, as these cannot be delivered concurrently due to the existing standards and procedures for signalling design requirements. Furthermore, each activity in the programme is linked to the previous design package and the implementation of that design being completed before the next design package commencing. Refer to Figure 63 – Signalling Data Design Programme

Opportunity:

If the access availability changes following wider stakeholder negotiations, then the construction sequence and signalling staging requirements would change. This would directly impact the number of signalling data design packages required and could reduce the programme duration substantially. e.g., there are 10nr. signalling designs required due to the way the works have been sequenced (based on the deliverable scope in the access available), if longer blockades are available, this could increase the scope that can be delivered in each access, which in turn could reduce the number of signalling data designs required. If this reduced to say 5 or 6 being required, then several years could be saved from the programme.

Figure 63 – Signalling Data Design Programme

The total float in the programme can be seen in Figure 64. Due to the long time it takes to complete Chapel Hill in comparison with the other works the total float in C1 & S2 is relatively high.

Areas C2, C3 and C4 are the nearest to the critical path and have total float of between 50 and 74 days. In Area C2 the completion of the track drainage has total float of 50 days. This has logic driven through earthworks and settlement. The earthworks in this area is affected by a number of SU diversions including BPA Finaline which is the driving activity.

In Area C3, which is the A1 Great Ouse Viaduct, the total float is 65 days. The works near to ECML are affected by numerous diversions and driven by the 132kV overhead diversion.

In Area C4, completion of the structures has the lowest value for total float and nearest to the critical path. The driving structure is completion of Knapwell Wood Road Overbridge. This overbridge is driven by the completion of the earthworks cutting 14 which is also affected by several SU diversions. The driving SU diversion being a 15" Cambridge Water diversion.

Activity ID	Activity Name	Total Float
Core		126
Area C1		439
MILE 1080	A6 EWR bridge constructed	617
MILE 1180	Paula Ratcliffe Viaduct complete along trace in Area C1	439
MILE 1210	Track Drainage complete along trace in Area C1	439
Area C2		66
MILE 1350	Bulk earthworks complete along trace in Area C2	101
MILE 1260	Structures complete along trace in Area C2	84
MILE 1370	Track Drainage complete along trace in Area C2	50
Area C3		65
MILE 1320	A1 Great Ouse Viaduct complete along trace in Area C3	65
Area C4		74
MILE 1240	Bulk earthworks complete along trace in Area C4	302
MILE 1340	Track Drainage complete along trace in Area C4	156
MILE 1330	Structures complete along trace in Area C4	74
Southern Route		0
Area S1		0
MILE 1400	Structures complete along trace in Area S1	29
MILE 1410	A428 St Neots Road Tunnel Complete	29
MILE 1420	Bulk earthworks complete along trace in Area S1	20
MILE 1430	Track Drainage complete along trace in Area S1	0
Area S2		525
MILE 1480	Hauxton Road Level Crossing Closed (Permanent)	670
MILE 1490	Rectory Farm Level Crossing Closed (Permanent)	670
MILE 1170	Structures complete along trace in Area S2	587
MILE 1310	Bulk earthworks complete along trace in Area S2	525
MILE 1360	Track Drainage complete along trace in Area S2	525
South Online - Cambridge Approach		0
MILE 1000	Start South Online - Cambridge Approach	0
MILE 1050	Close Long Road Bridge	8
MILE 1090	Long Road Reopens	255
MILE 1470	SATC Online Construction Complete	0

Figure 64 – SATC Milestones

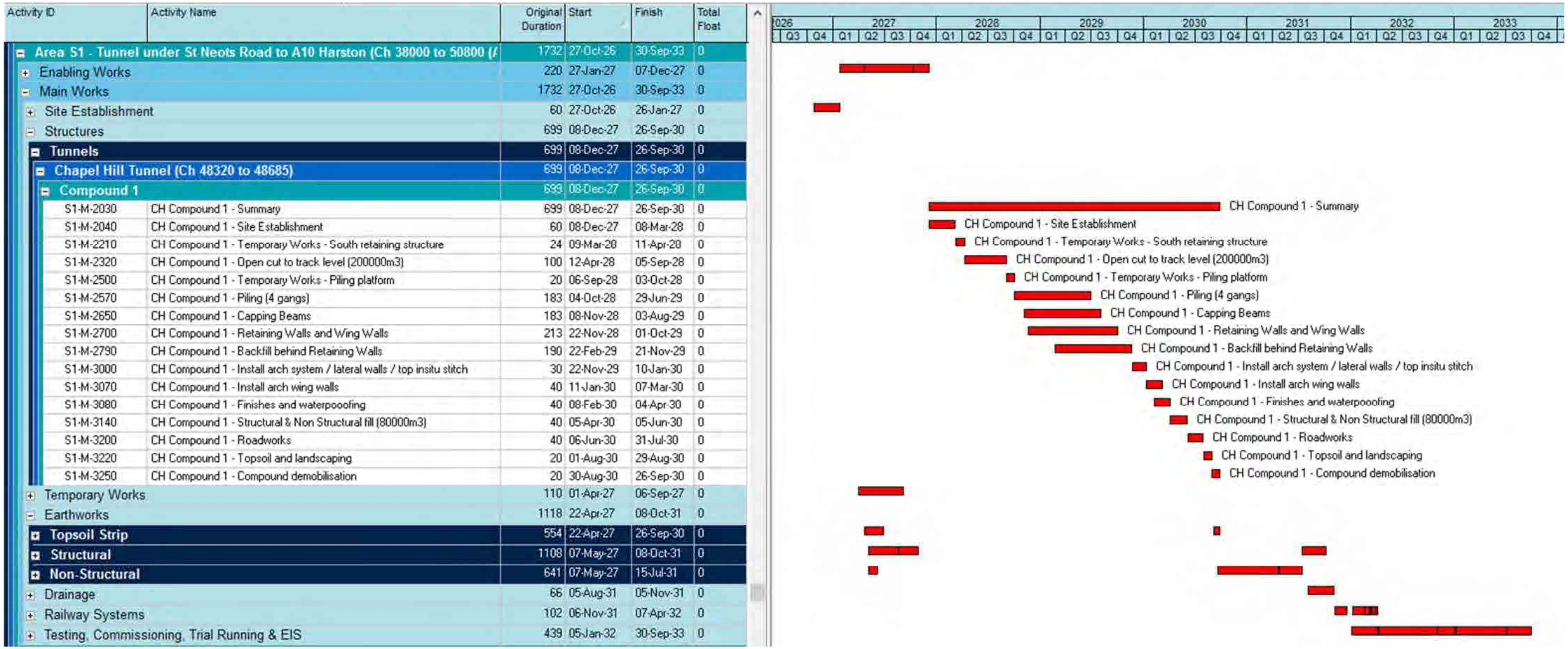
[redacted]

Offline

The critical path is driven around the works for Chapel Hill Tunnel. Initial works are the construction of a haul road to move the excavated bulk earthworks materials including the critical path Cutting 18. The bulk excavation for Cutting 18 takes place during the 1st year of the main works and drives the start of establishing the compound for the 1st section of the works at Chapel Hill during the 2nd year of the main works. Along with the earthworks, a 33kV UKPN overhead power line diversion is critical.

The 1st section, that includes the tunnel, equates to approximately 1/3 of the works at Chapel Hill. The critical path through compound is shown below. This section includes the tunnel piling, constructing the retaining walls and installing and backfilling an arch system. Once all the finishings and remaining earthworks are complete, a switch then takes place to complete the remaining bulk excavation to Cutting 18.

The remaining cutting takes a further 10-months to complete. This work then drives a 3-month period for embankment settlement and then completion of the track drainage. Completion of the drainage drives the start of the installation of the railway systems with the Phase 2 Site Acceptance Testing also taking place at the same time. Once these activities are complete, the remaining Testing, Commissioning, Trial Running & EIS can be completed. A Time Risk Allowance of 160 days then drives completion of the Core on the 25th of May 2034.



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Area S1 - Tunnel under St Neots Road to A10 Harston (Ch 38000 to 50800 (A		1732	27-Oct-26	30-Sep-33	0
Enabling Works		220	27-Jan-27	07-Dec-27	0
Main Works		1732	27-Oct-26	30-Sep-33	0
Site Establishment		60	27-Oct-26	26-Jan-27	0
Structures		699	08-Dec-27	26-Sep-30	0
Tunnels		699	08-Dec-27	26-Sep-30	0
Chapel Hill Tunnel (Ch 48320 to 48685)		699	08-Dec-27	26-Sep-30	0
Compound 1		699	08-Dec-27	26-Sep-30	0
S1-M-2030	CH Compound 1 - Summary	699	08-Dec-27	26-Sep-30	0
S1-M-2040	CH Compound 1 - Site Establishment	60	08-Dec-27	08-Mar-28	0
S1-M-2210	CH Compound 1 - Temporary Works - South retaining structure	24	09-Mar-28	11-Apr-28	0
S1-M-2320	CH Compound 1 - Open cut to track level (200000m3)	100	12-Apr-28	05-Sep-28	0
S1-M-2500	CH Compound 1 - Temporary Works - Piling platform	20	06-Sep-28	03-Oct-28	0
S1-M-2570	CH Compound 1 - Piling (4 gangs)	183	04-Oct-28	29-Jun-29	0
S1-M-2650	CH Compound 1 - Capping Beams	183	08-Nov-28	03-Aug-29	0
S1-M-2700	CH Compound 1 - Retaining Walls and Wing Walls	213	22-Nov-28	01-Oct-29	0
S1-M-2790	CH Compound 1 - Backfill behind Retaining Walls	190	22-Feb-29	21-Nov-29	0
S1-M-3000	CH Compound 1 - Install arch system / lateral walls / top insitu stitch	30	22-Nov-29	10-Jan-30	0
S1-M-3070	CH Compound 1 - Install arch wing walls	40	11-Jan-30	07-Mar-30	0
S1-M-3080	CH Compound 1 - Finishes and waterpooofing	40	08-Feb-30	04-Apr-30	0
S1-M-3140	CH Compound 1 - Structural & Non Structural fill (80000m3)	40	05-Apr-30	05-Jun-30	0
S1-M-3200	CH Compound 1 - Roadworks	40	06-Jun-30	31-Jul-30	0
S1-M-3220	CH Compound 1 - Topsoil and landscaping	20	01-Aug-30	29-Aug-30	0
S1-M-3250	CH Compound 1 - Compound demobilisation	20	30-Aug-30	26-Sep-30	0
Temporary Works		110	01-Apr-27	06-Sep-27	0
Earthworks		1118	22-Apr-27	08-Oct-31	0
Topsoil Strip		554	22-Apr-27	26-Sep-30	0
Structural		1108	07-May-27	08-Oct-31	0
Non-Structural		641	07-May-27	15-Jul-31	0
Drainage		66	05-Aug-31	05-Nov-31	0
Railway Systems		102	06-Nov-31	07-Apr-32	0
Testing, Commissioning, Trial Running & EIS		439	05-Jan-32	30-Sep-33	0

Figure 65 – SATC Offline Critical Path

Online

The critical path is initially through the utility diversions from Shepreth Branch Junction to Addenbrooks Road. Once these are complete, this will enable the construction of a bridge across Nine Wells stream for the new up and down main tracks and then the diversion of the cycleway east of the WAML to be completed. The drainage on the east side of the WAML will follow.

An 'Available float to possessions' has then been included to create a critical path. The railway systems for the Shepreth Branch Junction to Cambridge South Station then follow on the critical path which includes a 12-day blockade at Christmas 2031. This enables the signalling data design for the new WAML 2-track layout and interim crossover at platforms 7 & 8 to be undertaken.

Another 'Available float' activity ensures a critical path, during this period a new temporary crossover and OLE will be installed in the eastern area of Cambridge Station and S&C between Long Road Bridge and Hills Road Bridge. Following this the railway systems for Long Road Bridge to Hills Road Bridge will be undertaken. This work includes a 16-day blockade during February/March 2033 and a 10-day blockade at Christmas 2034.

The final works on the critical path are completing the railway systems for Cambridge Station and additional systems at Shepreth Branch Junction to South Station. This work includes an 11-day blockade at Christmas 2035 to complete the railway systems for Long Road bridge to Hills Road Bridge. A TRA of 300 days then drives EIS on the 15th of March 2038.

A 1-year follow up period to complete tamping, OLE adjustments, weld inspections, S&C inspection, grinding works etc is included and critical to complete the works. A TRA of 300-days then drives completion of SATC online to the 28th of February 2039.

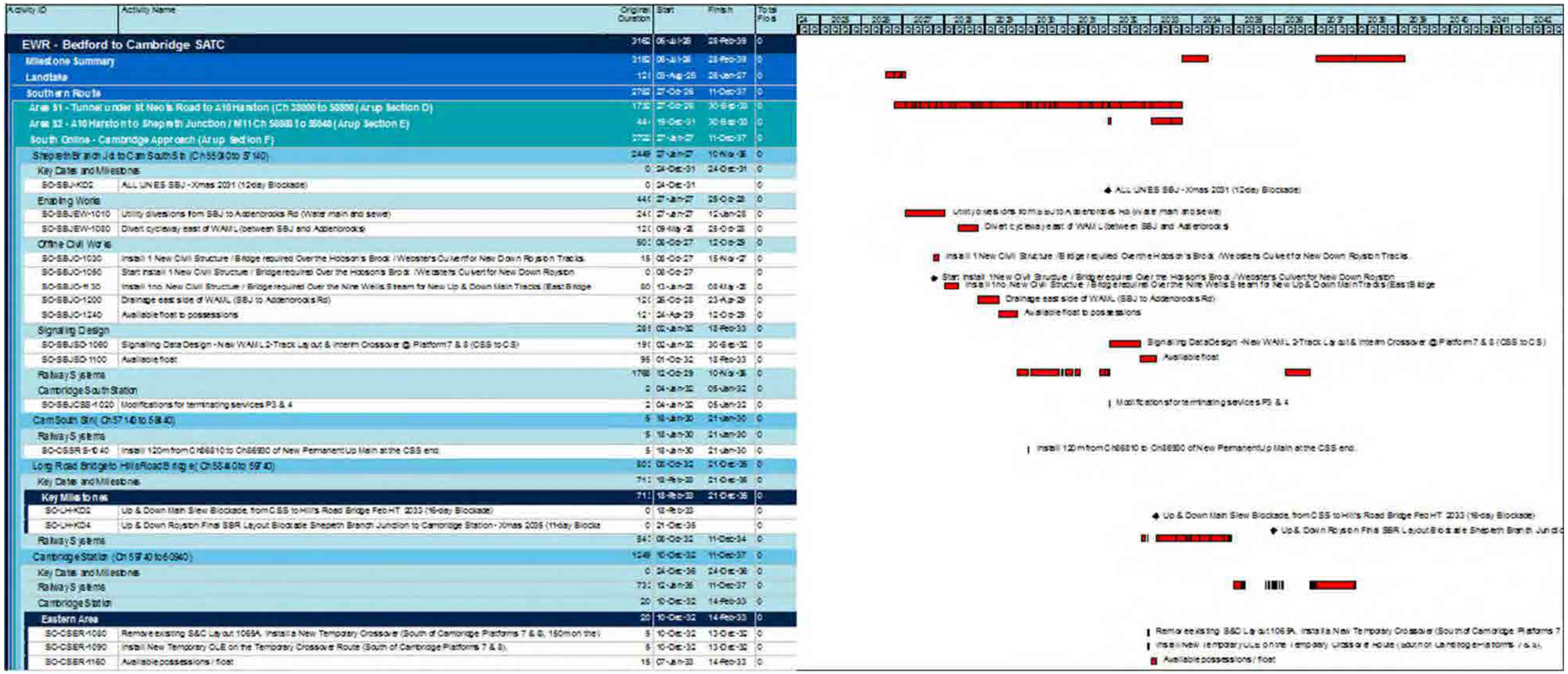


Figure 66 – SATC Online Critical Path

7.2. Core with South Programme Scenarios

The above programme narrative describes the detailed programme that has been produced as part of this study. This P6 programme represents what is considered the most likely construction duration based on the DF2 design and using standard methods of construction with minimal implementation of innovation.

Whilst producing the P6 programme several risks and opportunities have been identified which could impact on the construction programme. The following indicative time chainage charts have been produced to illustrate the likely impacts of the key risks and opportunities. This section will cover the following scenarios:

- SATC Reference Programme (Scenario B)
- SATC Risk Programme (Scenario A)
- SATC Opportunity Programme (Scenario C)
- SATC Opportunity Programme (Scenario D)

These scenarios will then be compared on a single Gantt chart illustration.

7.2.1. SATC Reference Programme (Scenario B)

The indicative time chainage shown in Figure 67 represents the Reference P6 Programme. No risks and opportunities have been applied to this programme. This illustration is included to provide a comparison to the following scenarios.

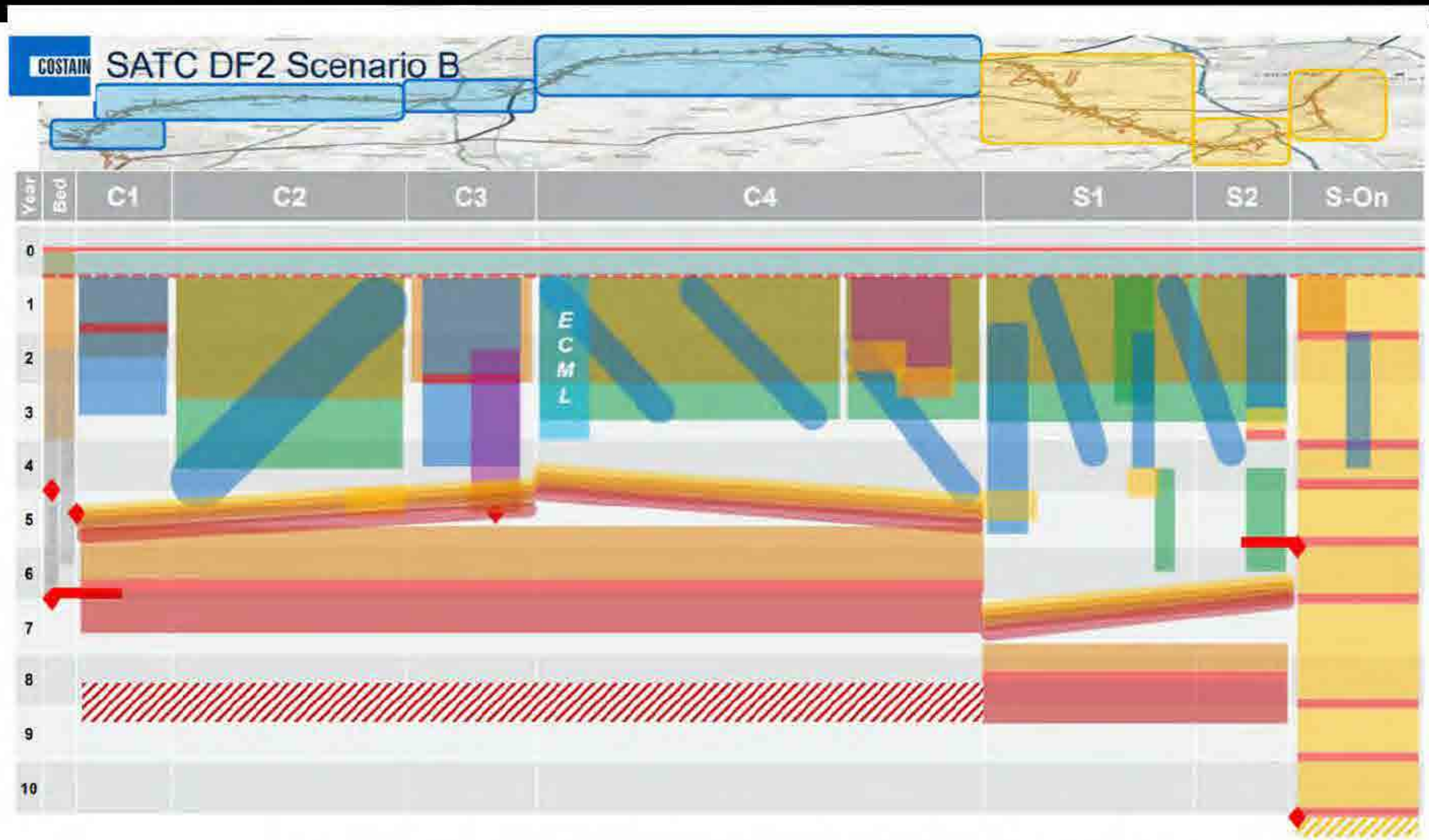


Figure 67 – SATC Scenario B – Reference P6 Programme Indicative Time Chainage

[redacted]

Scenario A (Figure 68) is the illustration of what the programme would look like is several of the key risks are realised and compounded on top of each other. This is representative of very worst case. The purpose of modelling this scenario is to demonstrate why the key risks must be managed and mitigated against to prevent the programme elongating.

The key risks that have been applied to this scenario are:

1. A Judicial review causes 1 year delay to discharging the consents and site setup,
2. The utility diversions are more complicated, or delay is encountered in carrying out the diversions causing a 6-month elongation of the utility diversion durations.
3. Adverse weather or other complications in the earthworks causes delay requiring an additional earthworks season causing a 1-year elongations to the earthworks.
4. Complexities in the structures cause a 1-year elongation to the structure's programmes.
5. In the South Online section of the programme the possessions assumed to be available in the Reference P6 Programme are not available and are replaced with less frequent possessions and blockades.

This is not an exhaustive list of risks; they are only the ones / top 5 risks that have been agreed with EWR during the workshops to be represented on this Scenario A model. There are many more risks that could impact the programme, but too many to list and illustrate here.

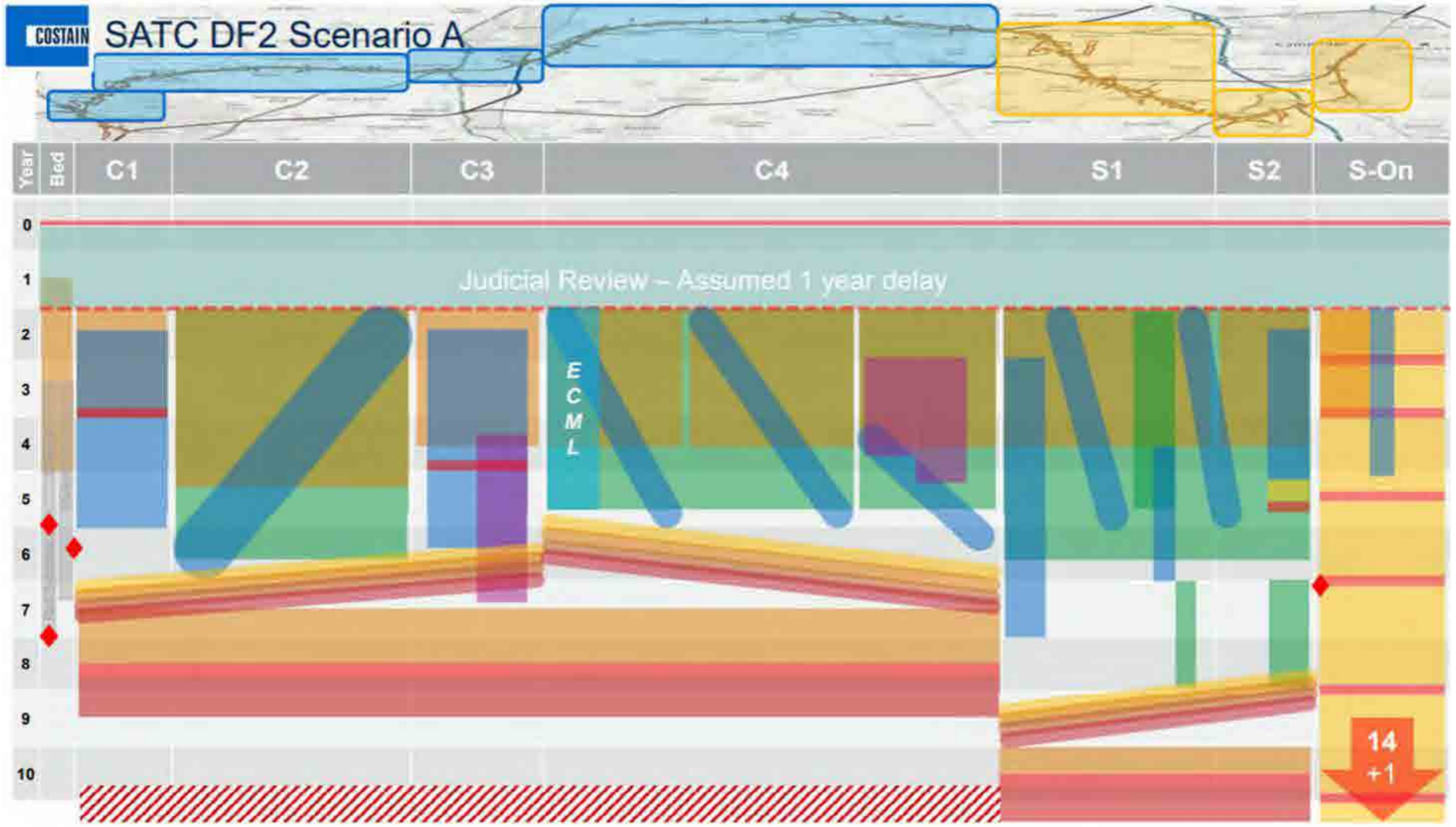


Figure 68 – SATC Scenario A – Risk Programme Indicative Time Chainage

[redacted]

Scenario C (Figure 69) is the illustration of what the programme would look like if certain key opportunities are realised and zero risks materialise. This is representative of a scenario where everything occurs perfectly as planned. The purpose of modelling this scenario is to demonstrate the importance of targeting key opportunities and how the programme could be shortened, it is not indented to be a realistic duration at this stage but more or a target to focus efforts whilst developing opportunities in future design stages.

The key opportunities that have been applied to this scenario are:

1. The three key complex structures which drive the critical path in the South Offline sections have been value engineered to provide 1 year savings on their construction programmes. The three key complex structures are the Tunnel under St Neots Road (Existing A428 Tunnel), Chapel Hill Tunnel and the structures around Hauxton Junction.
2. The new EWR Light Maintenance Depot is relocated to the ECML (from the current DF2 proposed Location at Cambourne), which provides an earlier start to the testing and commissioning.
3. Testing and commissioning durations are assumed as per those planned for CS1 section.

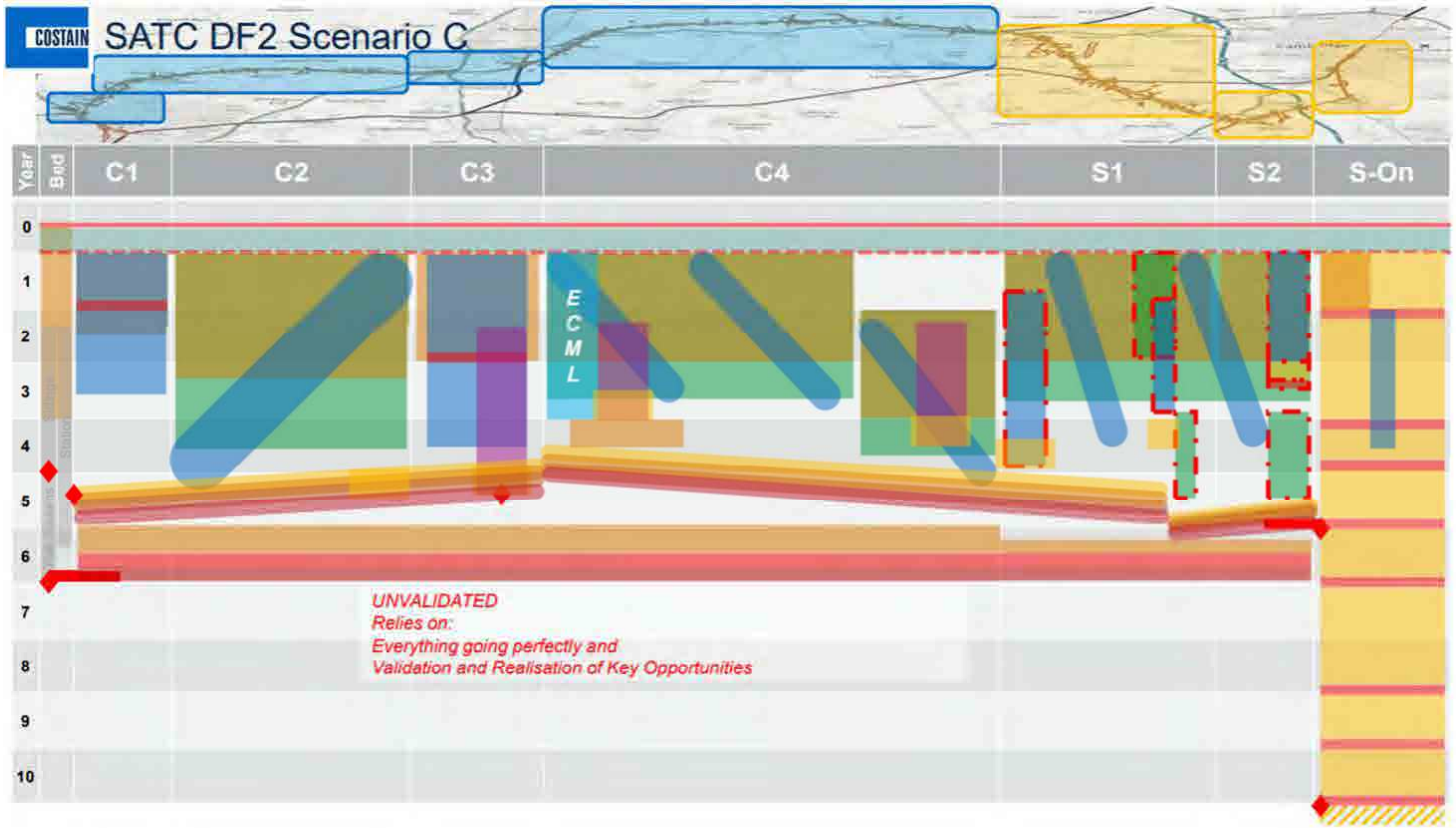


Figure 69 – SATC Scenario C – Opportunity Programme Indicative Time Chainage

7.2.4. SATC Opportunity Programme (Scenario D)

Scenario D (Figure 70) is also an opportunity scenario. In the Offline sections the opportunities are all realised as per Scenario C. The key difference in this scenario is the access availability in the South Online section.

In this scenario it is assumed that a series of long blockades and numerous 52hrs possessions before, in-between and after the blockades, can be agreed with the relevant stakeholders. These long blockades would be very disruptive and so perhaps have quite a low probability of being successfully negotiated. The scenario also assumes that the blockades are successful met and completed as planned.

The blockades used to model this scenario have been taken from a previous study on the Cambridge Online section covered in the following documentation (all issued to EWR via Aconex):

A. **EWR_CS3/COS/CL/XX/PR/Y/000001_D00:** Construction Strategic Programme (PDF & XER File).

B. **EWR_CS3/COS/CL/XX/ST/Y/000002_D00:** Long Road Bridge Sequence.

C. **EWR_CS3/COS/CL/XX/ST/Y/000003_D00:** Cambridge Throat Sequence.

D. **EWR_CS3/COS/CL/XX/ST/Y/000004_D00:** Overall Approach to Cambridge Sequence.

E. **EWR_CS3/COS/CL/XX/PP/Y/000005_D00:** Workshop 4 - Logistics and Red Line Recommendations

Supporting Information / Presentations:

F. **EWR_CS3/COS/CL/XX/PP/Y/000001_D00:** Initial Review / Ideas Generation - Kick-Off Workshop

G. **EWR_CS3/COS/CL/XX/PP/Y/000002_D00:** Sequences Overview / Workshop 1 - Document Review Workshop

H. **EWR_CS3/COS/CL/XX/PP/Y/000003_D00:** Sequences Overview / Workshop 2 - Constructability Update

I. **EWR_CS3/COS/CL/XX/PP/Y/000004_D00:** Sequences Overview / Workshop 3 - Constructability Update

The key advantage of a scenario such as this is that the Online section now completes in a similar time period as the Offline and hence testing and commissioning can be completed across the entire route at the same time.

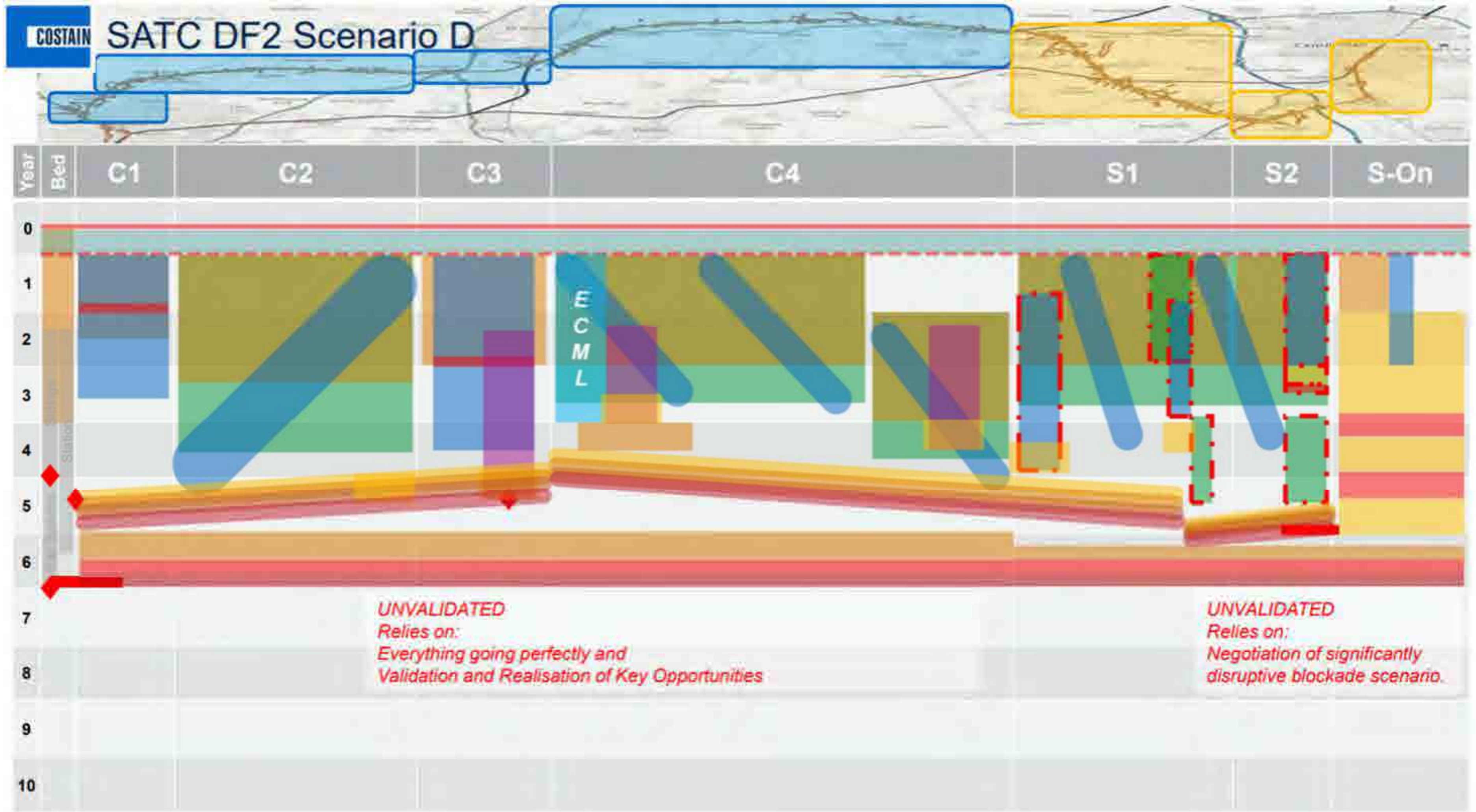


Figure 70 – SATC Scenario D – Opportunity Programme Indicative Time Chainage

7.2.5. SATC Programme Scenario Comparisons

The diagram shown in Figure 71 presents the durations for all Scenarios A to D in Gantt chart layout. The durations for each scenario are easily comparable and demonstrate the range of durations for the Core & South offline and Cambridge Station.

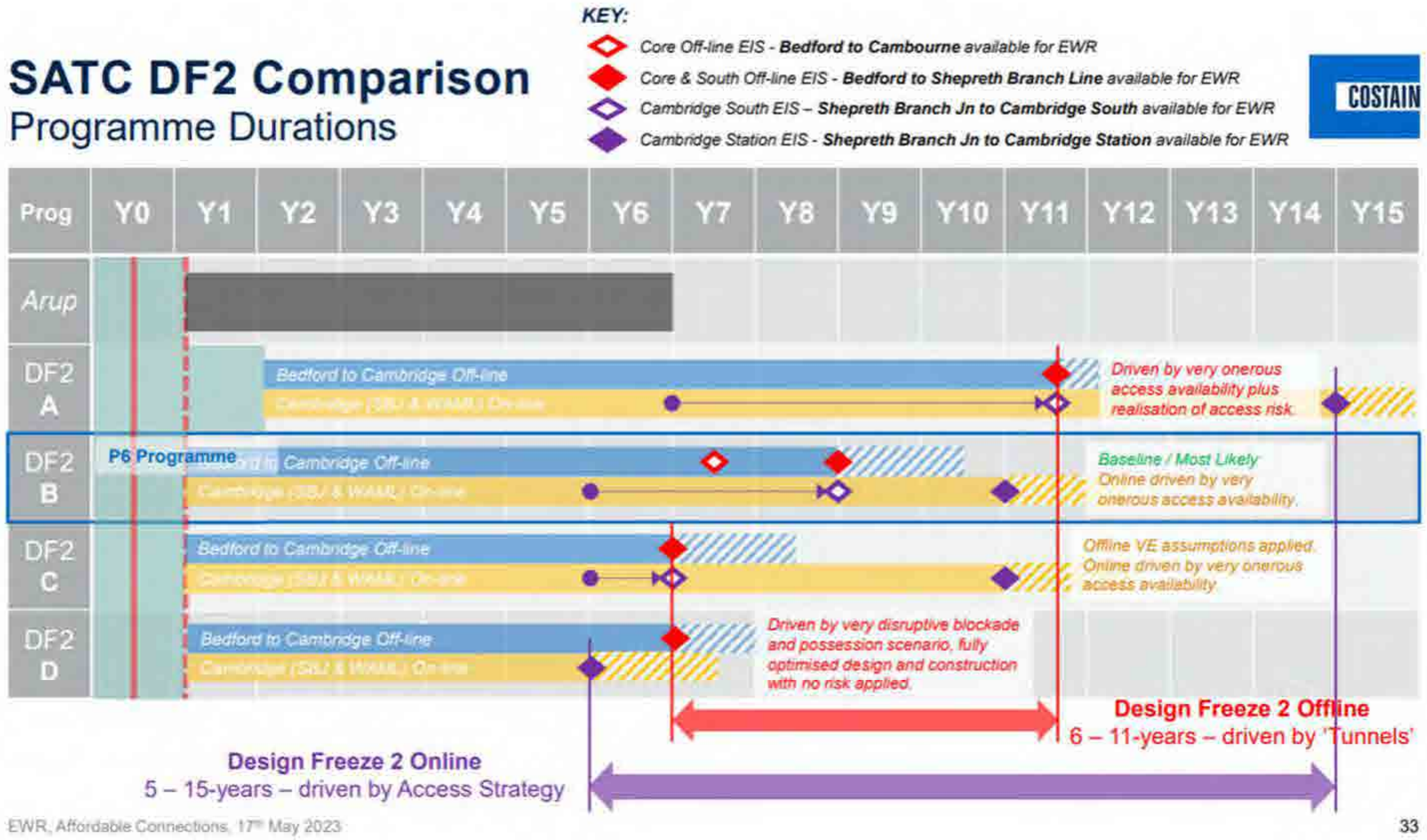


Figure 71 – SATC Programme Scenarios Comparison

11. Programme Interfaces

11.1. Internal Critical Programme Interfaces

Key programme interfaces driving duration – solution development required (not within this study):

1. DCO Date 3-months earlier and/or Early Works packages. Reduce pressure on Start-on-Site in Year 1
2. Access for Design Surveys etc.
3. Chapel Hill / Hauxton Jn earthworks
4. Bat mitigation requirements around Chapel Hill
5. Hauxton Jn Rail Systems / Cambridge Online area, particularly Cambridge South / Shepreth Jn access
6. Cambridge area signalling data design – currently two design teams assumed – can this be made more efficient for such critical resource.
7. Bedford Station area rail systems coordination
8. MML / ECML / WAML access coordination & other UK schemes

11.2. Local Major Project Interfaces

This section discusses some of the key interfaces with local projects that may have a direct relationship to EWR that will need to be fully understood and managed at future design stages:

11.2.1. Cambridge Area Re-Signalling Project (C3R) and Cambridge South Station (CSS) Project.

It is assumed that these projects will both be complete prior to the commencement of the EWR programme, therefore it is not envisaged that there would be a critical resource impact or interface with this project. However, there is a risk that if their implementation dates / programme moves or are delayed, then this could result in critical resources being required at the same time and possession access conflicts.

There are 4nr. Cambridge South Station (CSS) Project Design Drawings that we have reviewed, these are listed below:

1. 158454-JMS-ZZ-ZZZ-DRG-ETR-000001- P07 Shepreth Branch Junction GA
2. 158454-JMS-ZZ-ZZZ-DRG-ETR-000002- P07 Cambridge South Station GA
3. 158454-JMS-ZZ-ZZZ-DRG-ETR-000005- P07 Hill's Road Shunt Spur GA&LS
4. Signalling scheme plan 20-SO-055 – Version 8.0 Sheet 1 of 2. (Cambridge South Station overlay to C3R_Scheme plan)

High Level Interfaces, Issues & Risks have been identified as per below *(This is not an exhaustive list, and it is likely that there will be more when detailed design integration is undertaken):*

The items identified will increase the scope of work for the EWR project, therefore, the aim should be to minimise this by having coordination meetings with these projects to endeavour to make allowances for the future EWR project (Passive provision). However, this may be difficult, as EWR do not have funding or finalised designs to enable the design engagement to occur.

General Comments:

1. There are numerous (too many to list here) new driver's walkways, SPT's & bases, troughing routes, LOC bases and equipment, New Points Heating bases and equipment, new UTX's, New OLE structures, New Signal Structures etc that clash with the proposed new EWR alignments.
2. The Chainages do not align between the designs, it appears that there is an approx. 60 – 65m discrepancy at the Hill's Road end, and at Long Road Bridge end.
3. Based on the information for formation treatment and Bottom Ballast requirements, the existing ground conditions throughout this area are poor, and will affect the rates for installation for EWR in this area due to the additional excavation works that will be required to install the formation treatment (Assuming that similar will be required for EWR works).
   - Where Geogrid and / or Geocell products have been used, and the alignments intersect for the new EWR alignment, the Tie-in of these Sub Formation Treatments will be more difficult to achieve and deliver, which will impact the EWR programmes / access durations required.

158454-JMS-ZZ-ZZZ-DRG-ETR-000001- P07 Shepreth Branch Junction GA

4. 300mm Ballast, Geotextile, 150mm or 200mm Geocell & Geotextile (At the SBJ end) are required.
5. There is a new GSM-R mast being installed at the SBJ end to the west of the railway directly where the new 4th line (Down Royston) for EWR is being planned / designed. This could have been relocated on their design to provide passive provision for the EWR Down Royston alignment. **However, this opportunity has now been lost as the GSM-R has already been moved into its CSS Final Position during the May 2023 Bank Holiday weekend – Item Closed.**

158454-JMS-ZZ-ZZZ-DRG-ETR-000002- P07 Cambridge South Station GA

1. 300mm Ballast, Geogrid, Geotextile and 200mm - 250mm of Type 1 Fill or 200mm Geocell (AT the Cambridge South Station (middle bit)) is required.
2. No Aluminothermic Welds permitted within specified works area (Within 180m of centre of Anne McLaren Building) Restrictions Applies to all 4 Tracks within the Hatched area on the drawing (Ch.86720m - Ch.87060m).
   - EWR will need to monitor the impact that this restriction has on the CSS Project, and utilise lessons learned during the project implementation.
3. The EWR alignment at the north end of CSS will require Platform Modifications on P1 & P2, depending on the quantum of these works, they may clash with the New Footbridge installed at the north end of the platforms by the CSS project, it may need modification works or removal / replace with new footbridge to enable the required EWR track alignments.

158454-JMS-ZZ-ZZZ-DRG-ETR-000005- P07 Hill's Road Shunt Spur GA&LS

4. 300mm Ballast, Geogrid, Geotextile and 200mm of Type 1 Fill (AT the Cambridge Station end) is required.
5. The CSS project location for 1054A/B points is circa 30-40m south of the EWR design for the C13 Transitioned Crossover (25mph) that does the same move. Can the CSS higher speed (30mph DVS15 Transitioned Crossover) layout be maintained, thus reducing the scope for EWR.
   - This could also mean that the existing 1051A/B layout (DV15 – 20mph) could be retained in its existing position, further reducing the scope, as the equivalent EWR C13 TC 25mph layout would not be needed (Reducing Drainage, Formation Treatment and OLE works / changes required).
   - This would require the New S&C layout from the Up Royston to the Down Royston to be moved southwards, further away from Cambridge Station, which may impact the operability of the proposed EWR layout.

11.2.2. A428 Black Cat to Caxton Gibbet

There is a clear and obvious geographic interface with the National Highways A428 enhancement project.

In terms of this exercise, a strategic programme interface has been understood based on a review of their DCO Transport Assessment submission documents that show major disruptive vehicle movement and traffic management completing by Christmas 2026. A year's delay has then been assumed for the currently ongoing judicial review.

This provides a year's overlap in the programmes based on the best-case delivery timescales for East West Rail. This has been shown clearly in the PowerPoint time-chainage breakdown of the works.

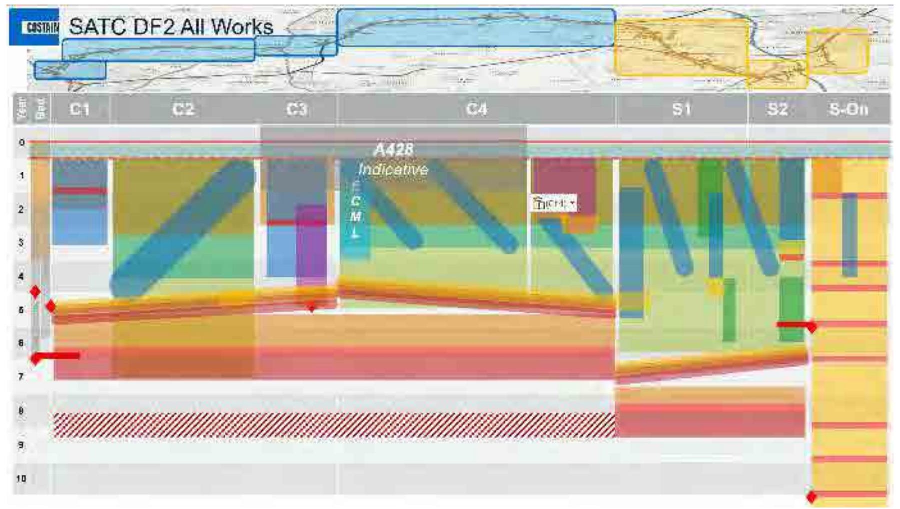


Figure 50: Time Chainage view with A428 interface shown.

A detailed review of both programmes could be undertaken, but at this early development stage the interface is unlikely to be resource driven. The A428 scheme is likely to completed for earthworks and delivering the final highway and systems at the point East West Rail is commencing significant statutory utilities.

The key likely interfaces will be logistical, vehicles on the highways and how worksites are being access where there is close geographic proximity.

However, as both schemes need further planning and funding approvals there is a likelihood of change to the way this interface interacts, and this could both improve or provide further risk to the EWR delivery programme.

Clearly this particular project already has interfaces being manged and that will need to be retained by EWR, including programme schedule interfaces but also present opportunities such as for haul roads, enabling works and compounds.

11.3. UK Major Project Resource Interfaces

The following major projects are potentially going to be concurrent with the EWR programme and may cause resource constraints on the scheme. This list is not exhaustive but illustrates the need to coordinate and plan resources on a wider scale.

The following rail projects are planned to on site in the same timescale as EWR and involve large quantities of rail infrastructure works and testing and commissioning works – all of which might coincide with the same resource needs on EWR.

- HS2
- Northern Powerhouse Rail

The following civils projects are planned to be on-site in the same timescale as EWR and involve large quantities of heavy civils, earthworks, and national grid utility diversions – all of which might coincide with the same resource needs on EWR.

- Lower Thames Crossing
- Thames Water and Anglian Water Reservoirs
- A303 Stonehenge Tunnel