

# Project Controls Expo 2021

**Subject Category:** 4D Planning

**Primary Author:** Dean Booth, Project Controls Manager – Faithful+Gould, email: [dean.booth@fgould.com](mailto:dean.booth@fgould.com), Tel: 07941 928936, England

**Secondary Author:** Martin Payne, Planning Manager – Volkerlaser (Galicore Services Ltd), email: [galicore@aol.com](mailto:galicore@aol.com), Tel: 07957 693648, England

**Tertiary Author:** Ehsan Ghasemi, BIM Manager – Volkerlaser

## Benefits of 4D Modelling for Major Possession Works

### Abstract

The East West Rail Phase 2 Project is currently constructing and re-establishing a rail line and service between Bicester/Aylesbury and Bedford, and is made up of an Alliance including Atkins (F&G), Volkerrail, Laing O’Rourke and Network Rail. This is part of the wider East West Rail Project designed to connect Oxford and Cambridge. A critical element for the project was the construction of a new flyover at Bletchley (over the existing WCML) in a 74-hour possession in May 2021 to allow access for track laying. The project is a BIM Level 2 and follows BIM standards & protocols for delivering the project. This paper explains how the use of 4D modelling aligned with the P6 Primavera programme facilitated the successful completion of the possession and the installation of 103 ‘Y’ beams across the West Coast Mainline.

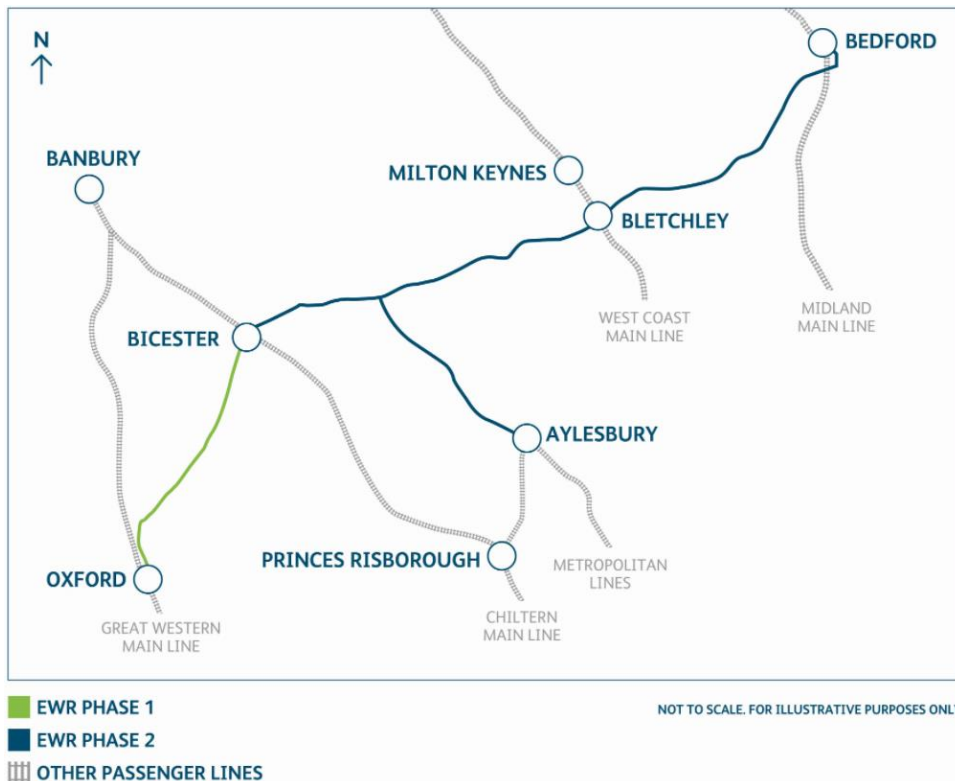
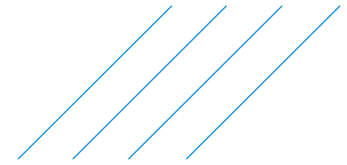


Figure 1 - EWR Phase 2 Overview



## Introduction

The Bletchley Flyover was originally a reinforced concrete railway viaduct that carried the former Varsity line between Oxford and Cambridge over the West Coast Main Line (WCML) just south of Bletchley railway station in Milton Keynes. It was retained but largely unused when the line closed in 1968, until it was dismantled in late 2020 and early 2021.

As part of the East West Rail project that will reopen the Oxford – Cambridge route, work to replace 14 of the spans began in April 2020. Sections beside and over the WCML were removed in April and May. The arches crossing Buckingham Road (on the east side of WCML) started being removed in July 2020. The final span was lifted out by crane in October and the last of the supporting piers and pillars were removed in January 2021.

A new structure being built is in the form of a box tunnel around/over the WCML. During the early May 2021 holiday, 103 concrete beams were planned to be lifted into place to provide the bridge deck over the WCML.

## Overview

The re-construction of the flyover over the WCML was focused on using the 2021 May bank holiday disruptive possession (74 hours) to complete the following works:

- Installation of 103 'Y' beams (The between 61-31 tonnes and averaging 26 metres in length)
- Removal of 6no Overhead Line Electrification (OLE) structures
- Re-registration of OLE for both slow and fast lines onto the newly installed 'Y' beams

To undertake these works, 2no 600t cranes were used in tandem along with a number of rail mounted mobile elevated working platforms (MEWP's).

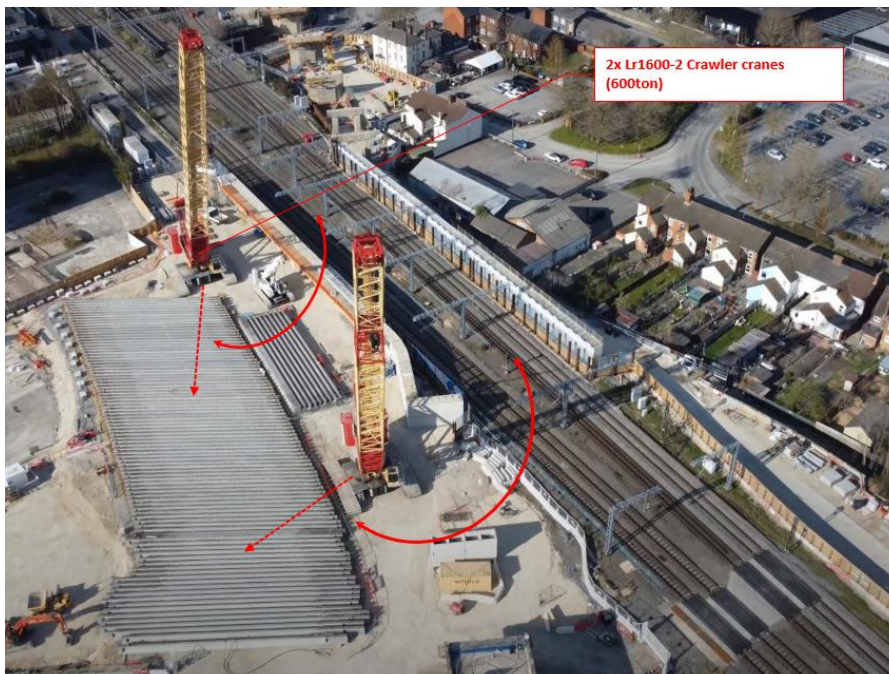
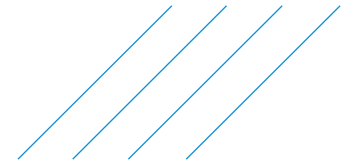


Figure 2 - View of site

These works could only be undertaken during a disruptive possession (all lines blocked) due to the extensive OLE works required, the only available possessions available were either May or



December 2021. If the works were not achieved during the May possession, the project would have been delayed by up to 7 months.

Due to the complexity of the works, the logistics involved and the critical nature of the works, the project decided to use 4D modelling aligned with the traditional P6 primavera programme to provide:

- Logistics analysis
- Sequencing scenarios
- Separation analysis for cranes and track works
- Assurance of the timings

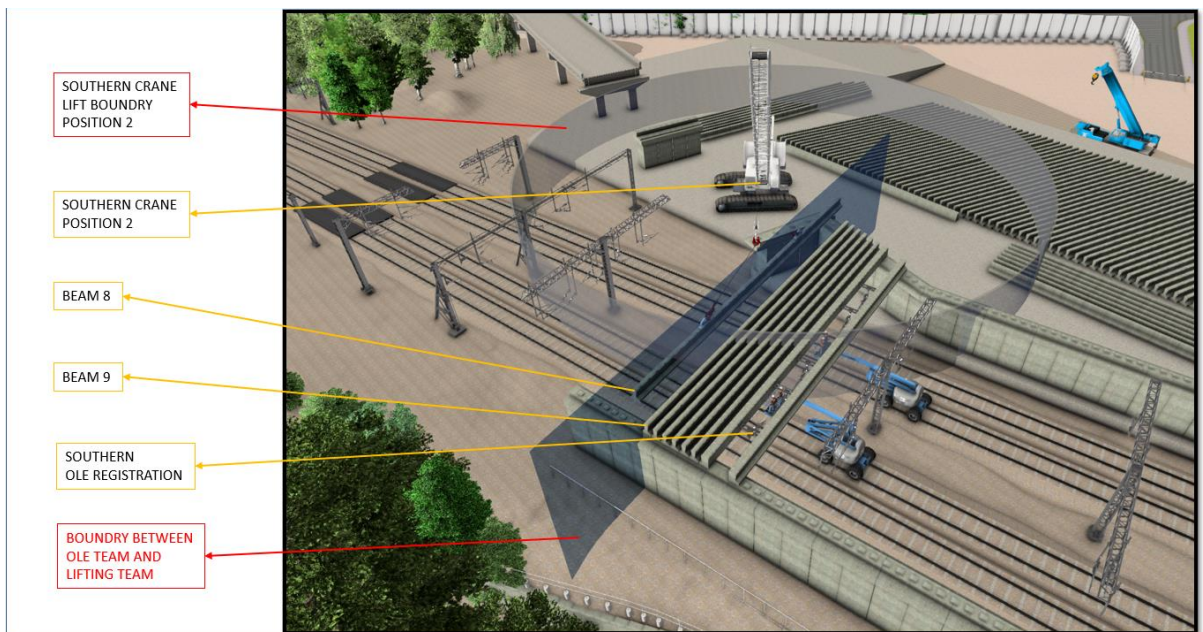


Figure 3 - Example of clash analysis

### Planning & Preparation

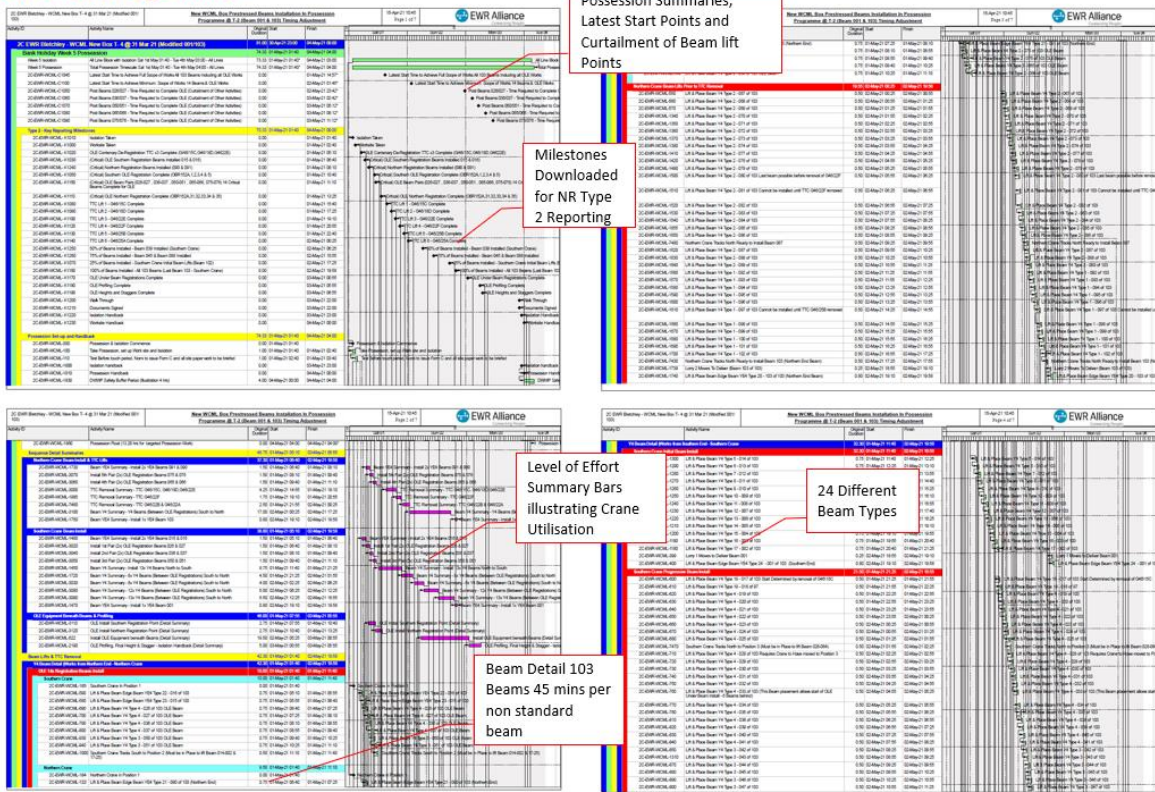
The process commenced with a study of the relevant Civil & OLE design drawings and an establishment of a simplified beam numbering system. The beams were numbered 1-103 from South to North and the 14 beams that support the OLE were identified. A series of meetings was undertaken to identify key constraints with regard to OLE twin Track Cantilever removals (TTC's) and the sequence required for removals in relation to reinstatement of the OLE under the new beams.

An initial programme was developed looking at the use of one crane to lift all 103 beams and remove 6 OLE TTC structures. The programme quickly proved that there was insufficient time in the possession to use only one crane. A two crane option was then developed which confirmed that the beam installation could be achieved, however the sequence of integration with OLE then had to be incorporated. It was determined that there were two OLE registration points (4 beams in total) that had to be in place before the existing OLE TTC's could be removed and that to de-risk the programme the remaining 10 OLE support beams should be installed early in the sequence.

Safety constraints were also considered early in the programme development process, an example being that the OLE team working under the installed beams could not be any closer than 6 beams behind the point where beams were being installed/lifted into place. The programme allied to the 4D allowed visual proof that the co-ordination worked.

Working closely with the 4D Modeller the programme activities could be quickly downloaded via an XML file into Fuzor the 4D software and once the activities had been assigned to the model elements, different programme scenarios/options could be quickly modelled and reviewed by the team to see where issues/potential clashes needed to be resolved.

**Possession Programme**



**Possession Programme**

- All Activities in Primavera driving 4D Animation
- 390 Activities in Total
- Directly downloaded via XML file to 4D Animation software - Fuzor 2021

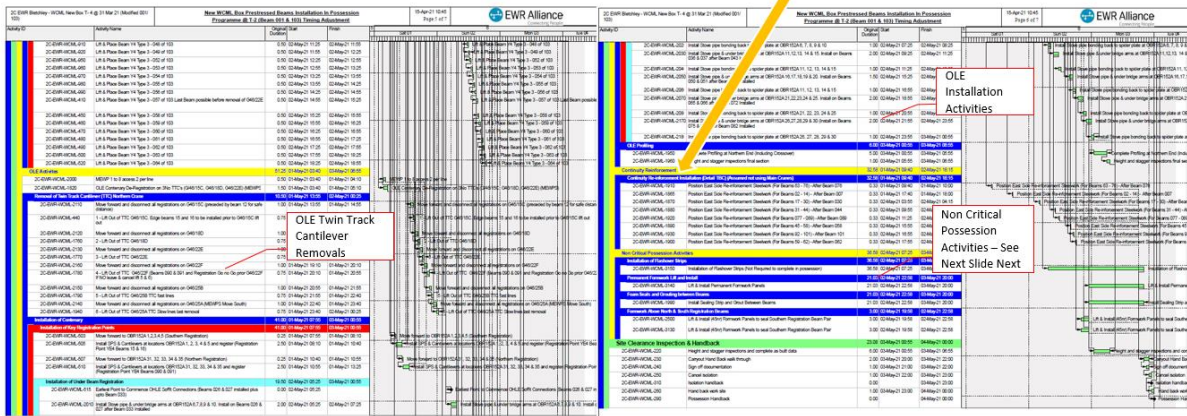
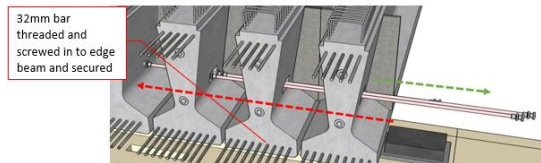


Figure 4 – Illustrations from the P6 Primavera Programme

Once the sequencing was confirmed the it also enabled the confirmation of the sequence in which the 103 beams needed to be delivered into the laydown area in the weeks prior to the possession to support the installation and the optimised crane movements. The programme clearly illustrated the critical path through the possession and milestones where included to be directly downloaded to the Network Rail type 2 reporting structure. Latest start points and curtailment cut-off times were also included.

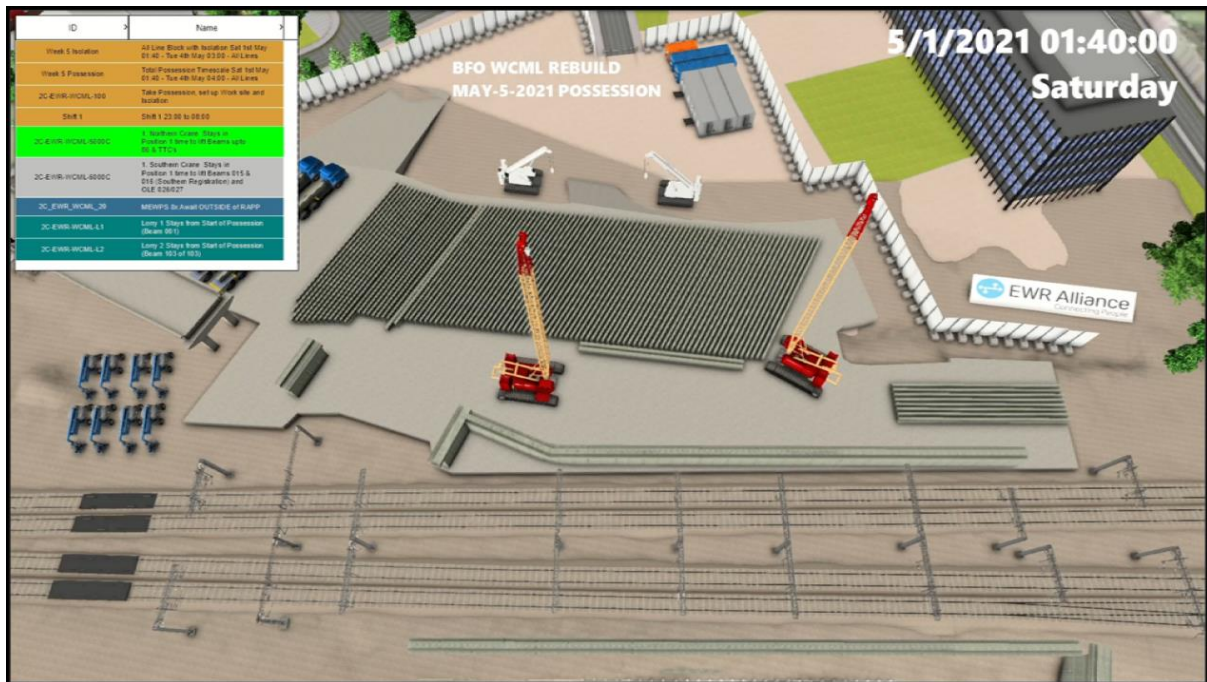
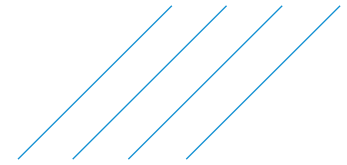


Figure 5 - Laydown area (4D model)

The 4D modelling allowed the project team to:

- Provide specific briefings to the Alliance Management Team allowing them to challenge the plan
- Undertake peer reviews
- Facilitate the readiness review meetings (attended by all parties include Network Rail)
- Obtain Network Rail buy-in to the works, the sequencing, and the timings
- Facilitate the quantitative risk schedule analysis (QSRA) to confirm the works would be completed within the possession timescales
- Brief all management and supervisors on duty during the works

All of the above led to a fully briefed and co-ordinated project team understanding and buying into the sequencing and timings and focused on achieving the works safely.

## **Conclusion**

By providing an integrated and highly visual view of the works, the project was able to successfully complete the works and whilst the P6 primavera programme was instrumental in planning the works, without the 4D modelling we would have been unable to:

- Agree and validate on an optimised sequencing of the works
- Undertake clash analysis and avoid clashes on site during the possession and potential conflicts
- Ensure safety exclusion zones were adequate and briefed
- Fully brief everyone on the sequencing and ensure understanding
- Fully de-risk the programme
- Gain full buy-in from the leadership team and stakeholders

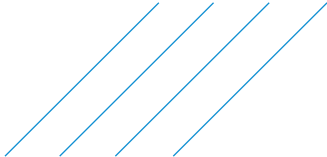
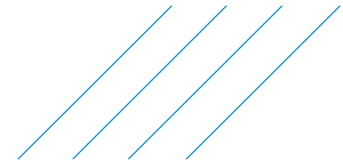


Figure 6 - Pre-possession



Figure 7 - Post Possession



Achieving the works during the possession meant:

- No delays to the re-opening of the WCML (which can result in millions of pounds of charges!)
- Project remains on programme to achieve its completion date thus avoiding EOT costs
- No additional possessions required saving £k's
- No loss of reputation (reputation increased)
- Confidence and motivation for completion of the remaining works

### **Brief Author Profile**

Dean Booth – Project Controls Manager for Bletchley Flyover works.  
Associate Director at Faithful+Gould. Experienced Project Controls/Planning Manager with 30+ years expertise in the rail and construction industry, working on several large multi-disciplined projects within the UK.

Martin Payne – Planning Manager for Bletchley Flyover works.  
30+ years in the rail and construction industry, including several major station and rail infrastructure projects in the UK and abroad.

Ehsan Ghasemi – BIM Manager at Volkerlaser.  
10+ years' experience in the construction industry utilising BIM Information in the project delivery process for BIM level 2 Projects.

### **Acronyms**

**WCML** – West Coast Mainline

**OLE** – Overhead Line Electrification

**EOT** – Extension of time

**Possession** – railway closed for works

**'Y' Beams** – pre-cast beams forming the structural deck of a bridge

**Fuzor** – 4D modelling software

**P6** – Primavera Planning software

**TTC** – Twin Track Cantilever

**MEWP** – Mobile Elevated Working Platform