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Midlands Highway Alliance Plus

Digital and Environment

Wednesday 17 September 2025

Annual Event 2025

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Visualising Infrastructure Delivery: 4D Planning in Action

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What is 4D planning

What is 4D Planning

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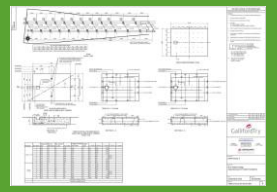
Design and Modelling

2D Drawings

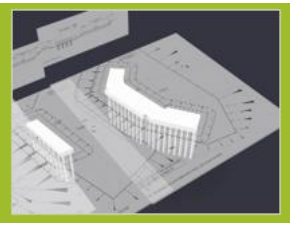
General site information, topography, temporary works, constrains, logistics



.dwg

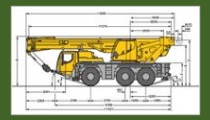
3D Models

3D models of different elements of permanent and temporary works with their attributes



3D Modelling

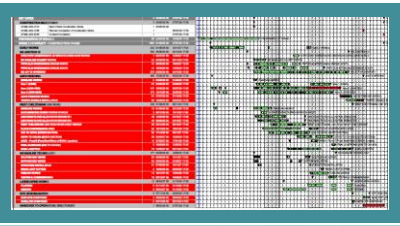
Objects not part of the 3D models (e.g. plant and equipment)



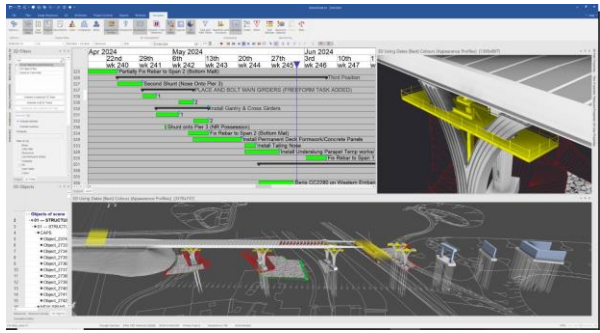
Programme

Schedule

Time information



- 4D is where time, as the 4th Dimension, is assigned to 3D models.
- 4D is where the 3D models are brought together with the programme to create a visual approach to planning.
- Plant and equipment can be imported when working in 4D to assist with logistics.



The 4D planning software acts as the glue of the different disciplines involved

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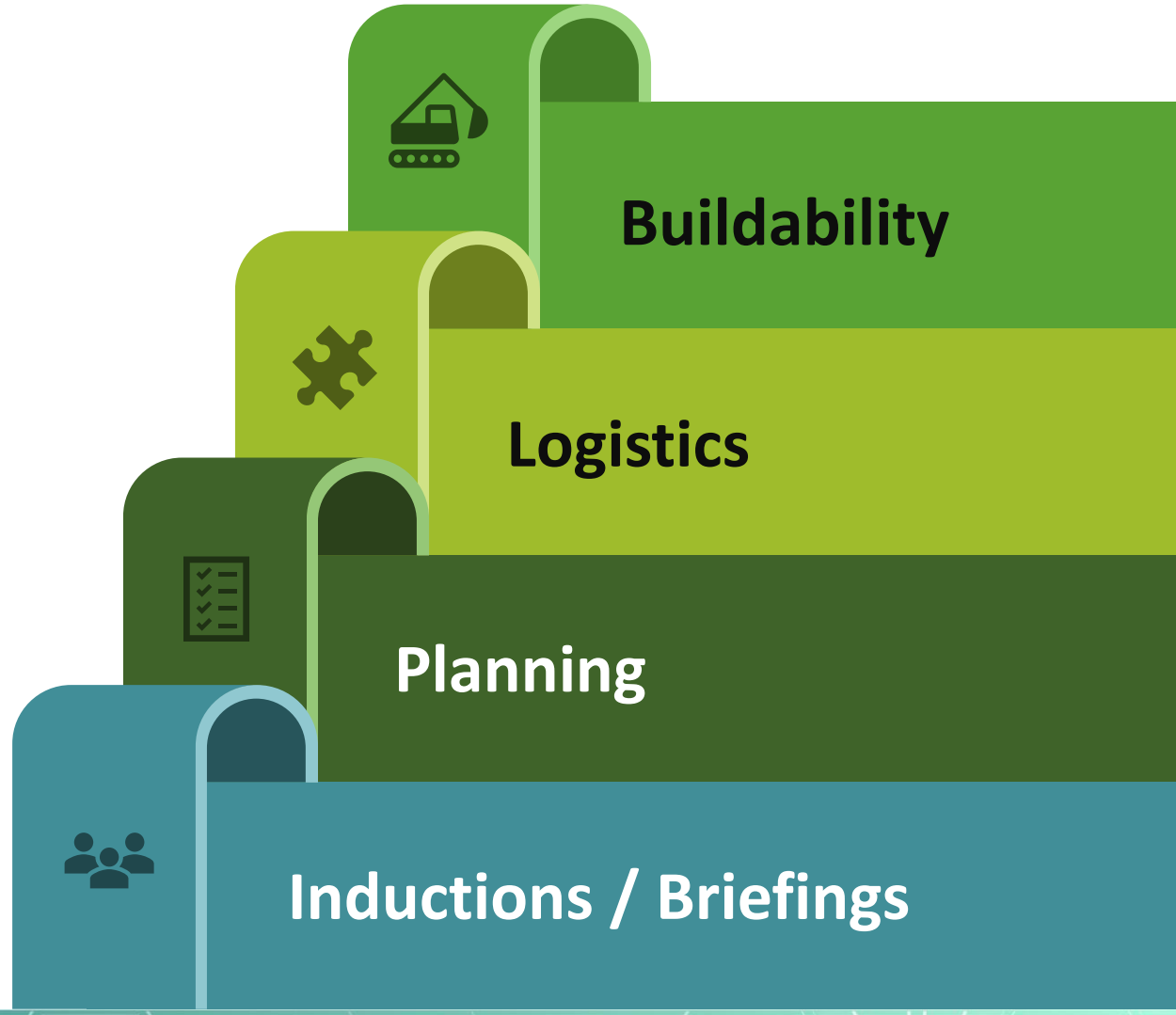
4D Applications

2 main types of 4D planning applications:

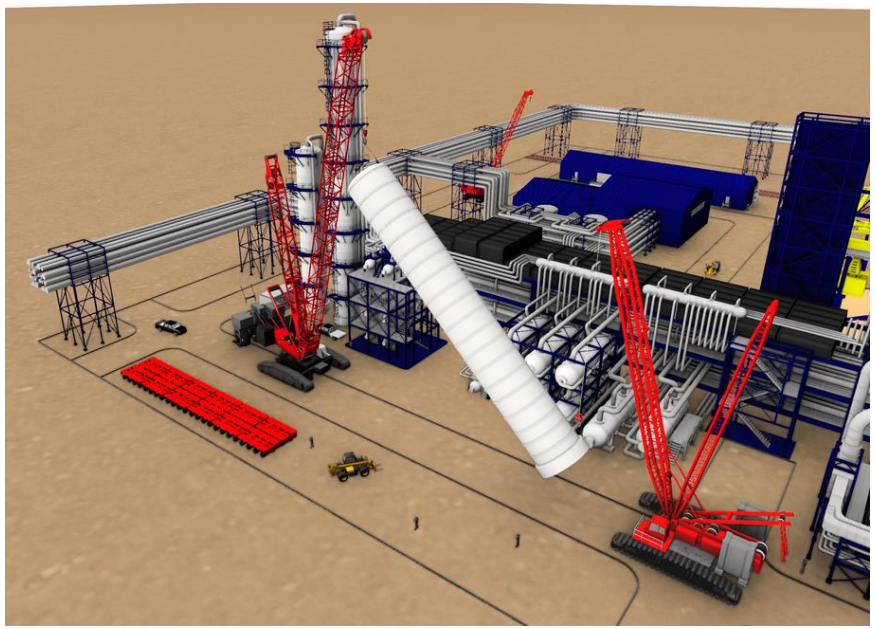
- **Passive** - Using the software to import a completed programme and assigning it to the 3D models to then visualise the programme in the 4D environment.
- **Active** - Using the software to import the 3D models and then create the programme from scratch using the 3D models as resources.

- 4D is collaboration in the production and development of construction programmes.
- 4D is a communication tool for site management teams, site operatives, stakeholders, etc.



What 4D is not

- 4D isn't just about producing a fancy Hollywood style animation to post online.
- We are keen to promote the benefits for planning and collaboration, not just the final outcomes.



4D History timeline

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Traditional Planning

- Tools: Paper drawings, blueprints, Gantt charts
- Limitations: No visual link between schedule and physical space; hard to detect clashes or delays early.

Start of BIM

- Focus: Digital 3D models of buildings with geometry and spatial data
- Impact: Set the foundation for integrating time and other dimensions

Emergence of 4D

- Concept: Link models with schedules (time dimension)
- Use Case: Visualizing construction sequences to improve coordination and reduce risk

Wider Adoption

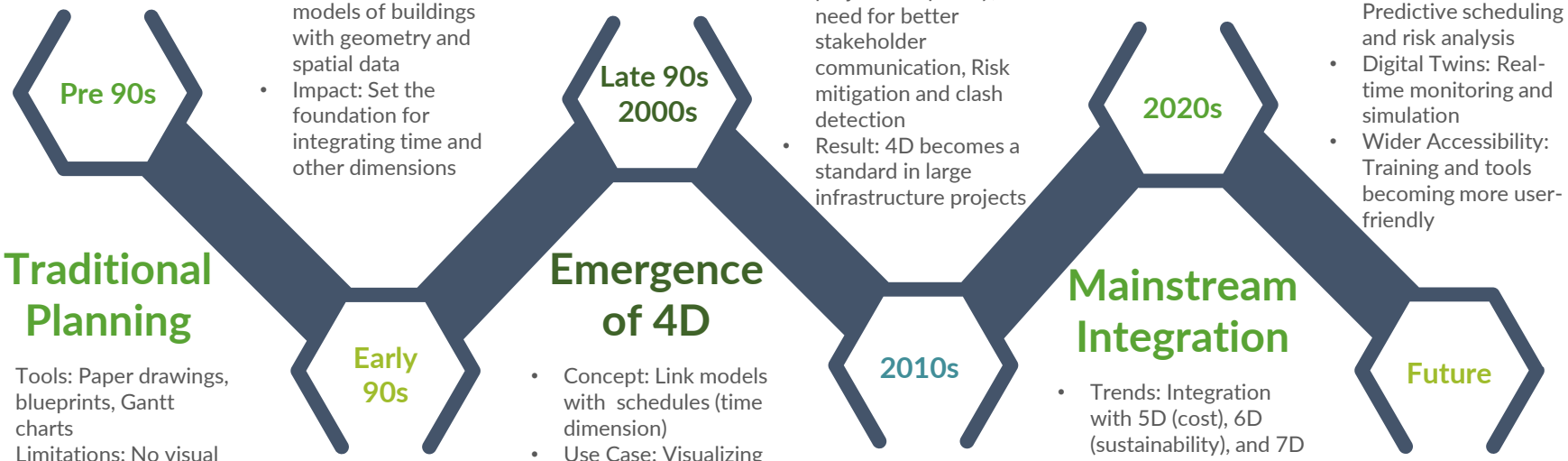
- Drivers: Increasing project complexity, need for better stakeholder communication, Risk mitigation and clash detection
- Result: 4D becomes a standard in large infrastructure projects

Mainstream Integration

- Trends: Integration with 5D (cost), 6D (sustainability), and 7D (facility management); Use in tendering, logistics, and safety planning and loud-based collaboration and real-time updates

Outlook

- AI & Automation: Predictive scheduling and risk analysis
- Digital Twins: Real-time monitoring and simulation
- Wider Accessibility: Training and tools becoming more user-friendly



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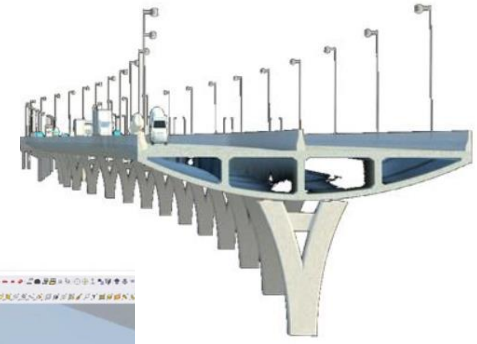
Generating 4D rehearsals

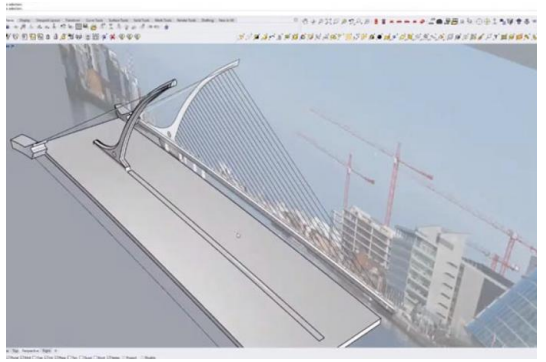
4D Specific Software

- There are a number of software for 4D planning
- The main ones used are
  - Synchro –GT choice
  - Navisworks
  - Other platforms like Fuzor, Revizto, Visilean…

- Synchro 4D Pro is a desktop standalone product which creates a local sp file.
- Synchro Control is a cloud-based platform which creates an iModel.
- Synchro Modeler is a desktop product which is used alongside the iModel, to splice 3D models and carry out quantity take-offs.
- Synchro Field is a mobile application.
- There are other applications for use with the wider team:
  - Viewer allows users to view the 4D with no editing allowed.
  - Scheduler allows users to view and edit the schedule with no animation included.

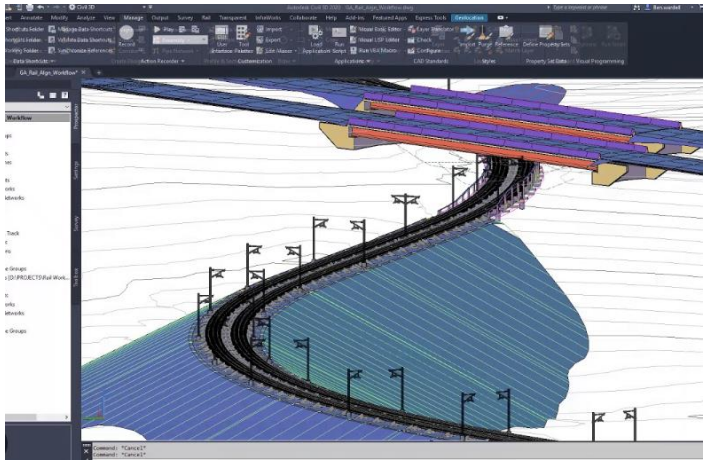
Modelling Software





- Design 3D models are required, such as:
  - Topo survey
  - Design models (Highways Alignment, Structures, etc)
- The platforms typically used are Autocad Civil 3D, Navisworks, Revit and Microstation.
- Other supporting platforms are Blender and Rhinoceros.

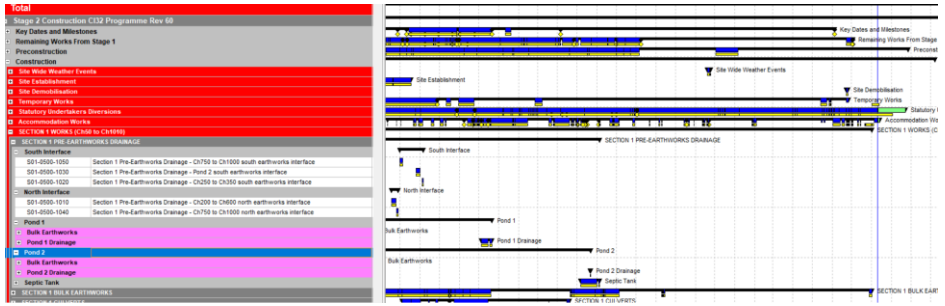
- If working in Synchro 4D standalone, then it has to be a Navisworks import through a plug-in. If working online in Synchro Control it can be any format of 3D model.

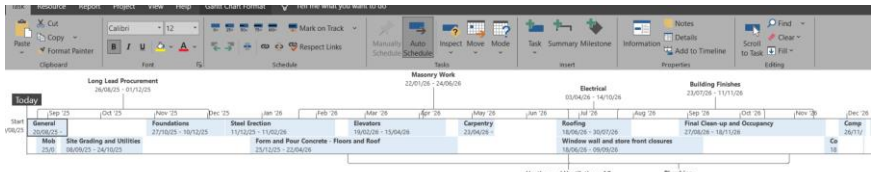


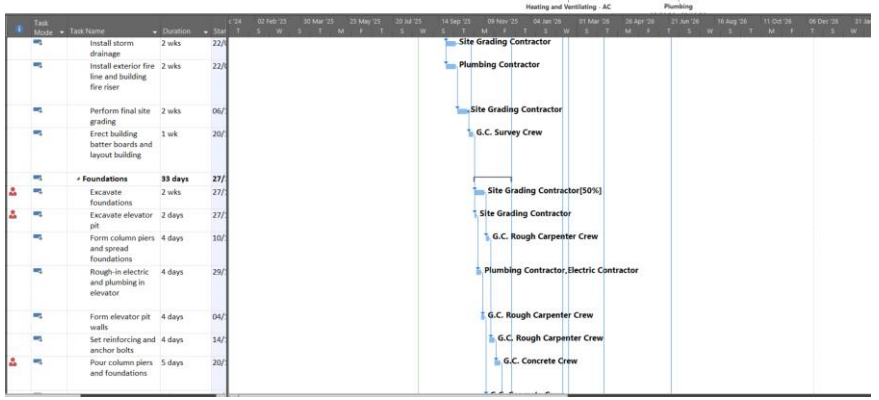
Planning Software

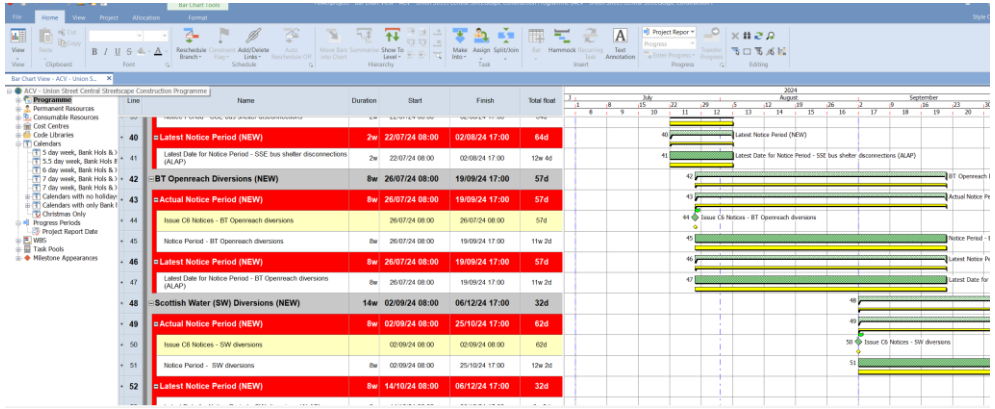
- Asta
- Microsoft Project XML
- Primavera P6 XML

- This will be either the importing of a completed programme into Synchro 4D, or be the exporting of programme created in Synchro 4D.









Blending everything together

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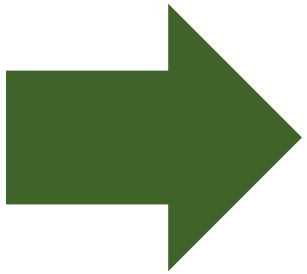
MicroStation CONNECT Edition

IFC

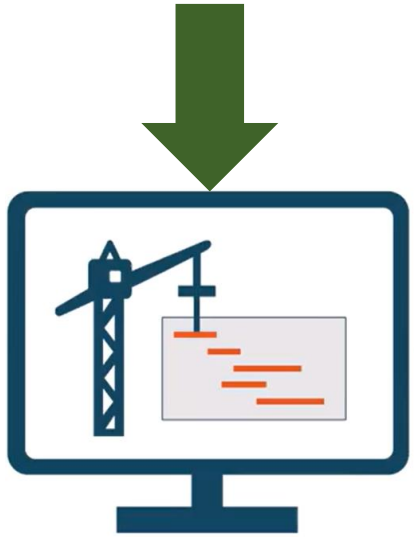
AUTODESK REVIT

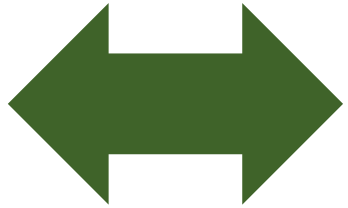
NAVISWORKS

+ Others



SYNCHRO™





MS Project XML and Excel

ORACLE PRIMAVERA P6

Asta Powerproject

Passive 4D Planning

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Models to Synchro

Review of contents, level of detail and attrbutes

3D break down

Splice, and break down 3D models to adjust sequence

Create Resources

3D objects created and named from the model

Import Programme

Import full programme to Synchro

Linking

Link resources to tasks

Review

Carry out reviews of programme sequences

Active 4D Planning

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Models to Synchro

Review of contents, level of detail and attrbutes

3D break down

Splice, and break down 3D models to adjust sequence

Create Resources

3D objects created and named from the model

Create Tasks

Create tasks from resources

Use scripts

Automatize the process (calculate quantities, durations…)

Linking

Link tasks

Review

Carry out reviews of programme sequences

What does the system look like?

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WINDOWS

ALL WINDOWS CAN BE HIDDEN, MADE FULL SCREEN, REMOVED OF DOCKED. TO DOCK/UNDOCK, CLICK AND HOLD THE TOP BAR OF THE WINDOW OR CLICK AND HOLD THE TAB.

OPTIONS

TO ACCESS ALL FILE SETTINGS

ANIMATIONS

TO ACCESS ALL PRE-SET ANIMATIONS

FOCUS TIME

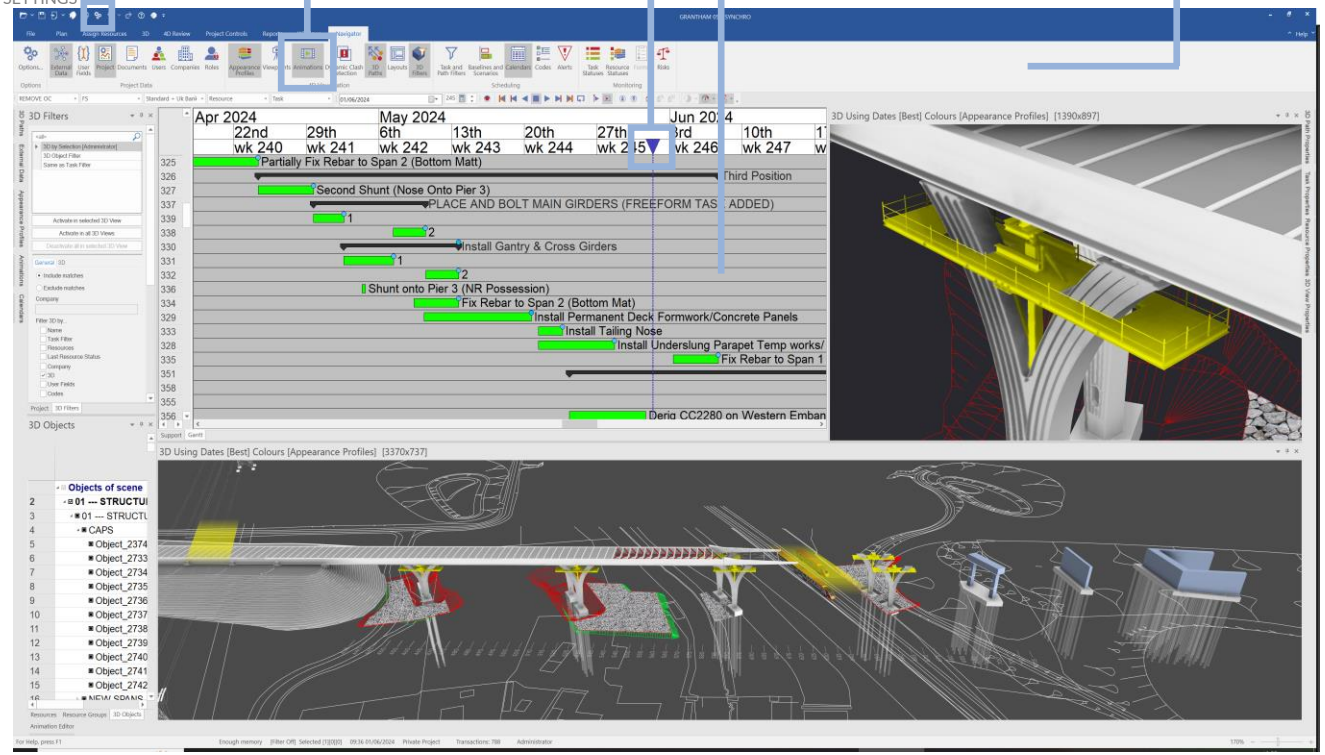
USED TO NAVIGATE THE TIMELINE, LEFT CLICK THE RED TRIANGLE AND DRAG TO MANIPULATE

GANTT CHART

LIVE AND UPDATED EITHER IN SYNCHRO, OR VIA IMPORT/SYNCHRONISE FROM EXTERNAL INFORMATION

TOOL RIBBON

CAN BE MINIMISED TO GAIN SCREEN SIZE. HAS NEARLY ALL NEW WINDOWS AND TOOLS ACCESSIBLE



3D FILTERS

USED TO FILTER THE 3D WINDOW VIEW TO EITHER:

1. MAIN – ALL ITEMS EXCEPT SMALL DETAIL ITEMS
2. SUB + SUPER
3. SUB + SUPER + FACADE
4. FITOUT OPTIONS
5. MEP + SITE WIDE UTILITIES

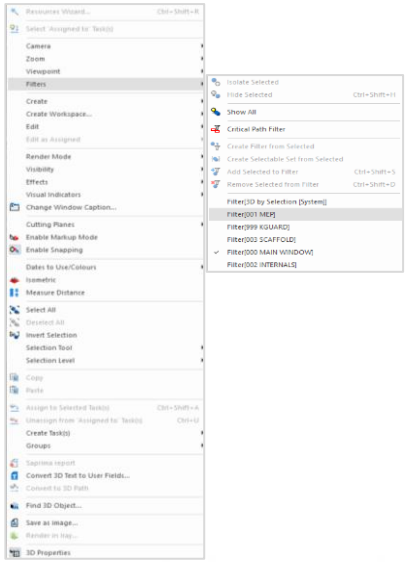
3D OBJECTS

LONG LIST OF ALL 3D OBJECTS USED IN THE MODEL. THESE CAN BE SELECTED ON/OFF AS RADIO BUTTONS IN THIS WINDOW, WHEN OFF, THE OBJECT OR SET OF OBJECTS WILL NOT APPEAR IN ANY OF THE 3D WINDOWS.

SUB 3D WINDOWS

USED TO SHOW DIFFERENT CAMERA POSITIONS, PROGRAMME OPTIONS AND/OR FILTERS

RIGHT CLICK MENU



MAIN 3D WINDOW

NAVIGATE USING LEFT MOUSE CLICK AND HOLD – DRAG. SELECT USING LEFT CLICK, MENU, RIGHT CLICK

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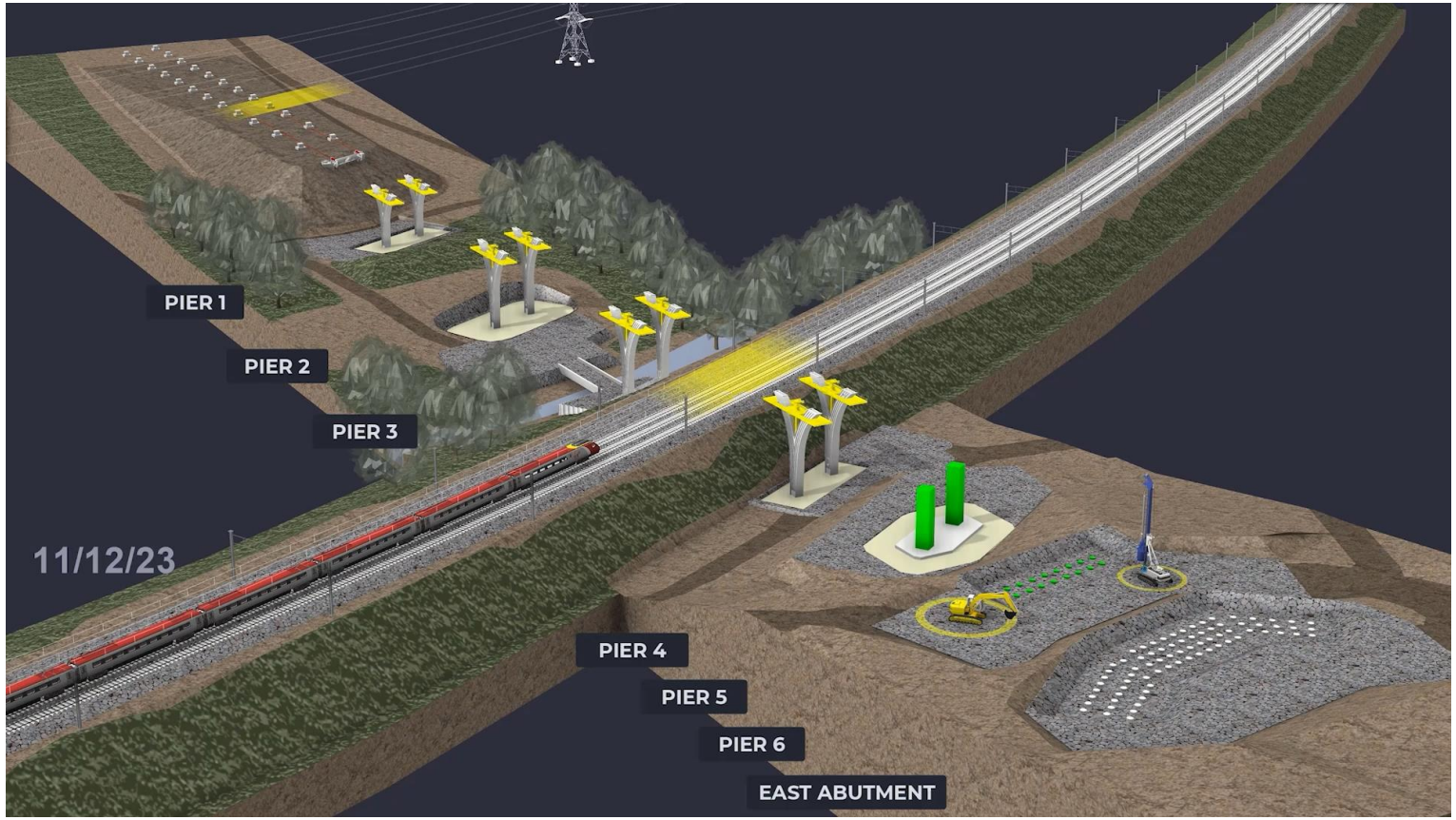
How we use 4D in Construction Projects

Grantham Southern Relief Road Phase 3 – Beam Launch



Sizewell C Major Roads – Active 4D planning of Structures

- Tender Stage:
  - Synchro 4D used to develop structure programmes from scratch using the client's federated Navisworks model.
  - Scope included:
    - 7 Watercourse Culverts (SLR)
    - 6 Flood Relief Culverts (TVB)
    - 2 Farm Access Underpasses (SLR)
    - 1 Railway Bridge (SLR), 1 Road Bridge (SLR)
    - 1 River Bridge (TVB), 1 NMU Bridge (TVB)
  - Synchro Control and Modeler used for construction joint splicing and detailing.
- ECI Stage:
  - Revit models and 3D highway alignment models provided by the client.
  - Tender programme updated to reflect latest design information.
- Planning Automation:
  - Introduced Synchro scripts, auto matching, and user fields to streamline planning.
  - Task durations calculated from 3D model volumes/areas using predefined output rules.
  - All durations automatically rounded to the nearest full day.
- Buildability & Temporary Works:
  - Synchro projects used in workshops to assess site interfaces and construction sequencing.
  - Example: Two Village Bypass includes 4 double portal flood culverts and a 3-span river bridge within a 300m section.

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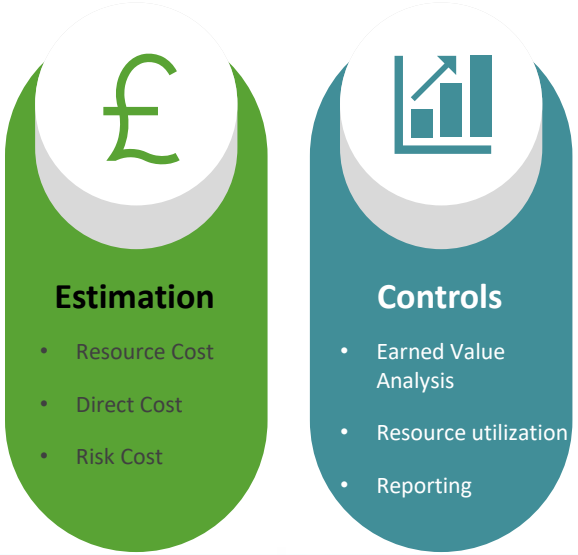
GT and industry initiatives

5D – Integrating Cost, Time and 3D Models

- 5D is where costs, as the 5th Dimension, are added to time, as the 4th Dimension, and the 3D models.
- To achieve 5D, Synchro 4D classes the following steps as 5D cost management:
  - Model based physical quantities – using the model attributes to calculate quantities of resources assigned to tasks.
  - Cost estimation – adding resource cost, direct cost and risk cost
  - Cost control – earned value analysis, resource utilisation and reporting
- This would be developed working alongside the estimators, in the same way a P6 programme would be cost loaded.



Future Applications

"War rooms"
Rooms with interactive equipment to support decision making

Augmented reality
Use of VR headset to navigate a project

Increase interactivity of Communication & Briefings

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Key Takeaways

How can 4D help a project?

01

Clients

- Improved visibility of programme and construction sequencing.
- Enhanced decision-making through visual validation of design and phasing.
- Reduced risk of delays and cost overruns via early clash detection and interface management.

02

Designers

- Better design coordination with real-time feedback on constructability.
- Streamlined revisions by linking design changes directly to programme impacts.
- Improved collaboration with planners and engineers through shared 4D models.

03

Contractors

- Optimised planning using model-based quantities and automated task durations.
- Improved site logistics and sequencing through visual simulations.
- Enhanced communication with teams and subcontractors via clear visual plans.

04

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- Greater transparency into project timelines and impacts.
- Improved stakeholder engagement through accessible visualisations.
- Support for social value by enabling informed discussions around disruption and mitigation.

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Contact us

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THANK YOU!