Project Value Delivery

Large, Complex Project Leadership
White Paper Series

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How to Overcome 3D Model Issues and Limits for Industrial Projects

3D models are increasingly used during the design of industrial facilities. However, their implementation in that field is much less advanced than in other industries such as aerospace or automotive where this tool has proven to deliver significant value, most of it linked to increased collaboration with the entire supply chain. Industrial facility design 3D models are often incomplete and as-build model data is not comprehensively gathered. In this White Paper we explore the current situation, its causes, and what can be done to improve and release the value of modern 3D modelling in the field of industrial projects.

Introduction

3D models have become mainstream engineering design tools, often coupled with codes to perform calculations necessary to justify the dimensioning and workability of the infrastructure. Today they are becoming the reference data set from which drawings are produced for actual manufacturing and construction. The models can be enriched with multiple layers of data and act as a single source of truth for multiple usage.

Enriched and shared 3D models have been used for years in industries such as automotive and aerospace as a conduit for increased collaboration across the value chain during design and in-service support activities. However, such a usage is often still in its infancy for large industrial infrastructure projects.

We believe the main reason for this belatedness is due to the difficulty to bridge the digital gap across the project value chain including suppliers and contractors. Owners and main contractors seek to protect their intellectual property, and fabricators or suppliers may not be sufficiently equipped to support 3D model management and updating during their activities.

A vast reservoir of value thus appears to be available that could be tapped into, and substantial benefits can be expected for those owners and main contractors that will be able to overcome the current issues and limitations for an enlarged usage of 3D models.

Usage of 3D models in industrial infrastructure projects appears to be in its infancy leading to the inability to exploit the potential value of such integrated collaborative platforms

Current limitations of industrial facility design 3D models

Due to the lack of collaboration around a single source of truth for design, the following observations can be made when considering actual 3D models of industrial facilities:

- 3D models are often incomplete. A typical example is small-bore piping, which is often delegated to fabrication yards to design and install. This data is often not included in the reference 3D model. Other examples include details of supports, which detailed design and fabrication is also often delegated,
- Detailed design data and possible design adaptations may not be included because those design activities are delegated to fabricators and suppliers,
- Detailed 3D models of major equipment may not be included beyond their geometrical envelope and supports, often to protect intellectual property,
- There may be several incomplete 3D models being worked upon by various contributors at different levels possibly at the same time, which are then extremely difficult to reconcile in a single consistent model,
- Material and quality data enrichment is not included such as material and sourcing detailed data, quality control for welds or painting, etc because this information is captured elsewhere (and not always digitally) by fabrication and construction contractors. This prevents effective future usage of the model to support maintenance and operations
- Actual as-built data (geometry, changes made during fabrication and construction, etc.) may not be systematically included in the 3D model. In addition, there may be measurement issues such as reference coordinates and measurement units used. This may lead to a gap between the design model and the as-built model, which may require at the end of the project a significant effort to check and rectify to ensure a model is delivered that reflects the actual facility.

How to overcome current issues

The digital discontinuity across the project value chain appears to be the main issue to be addressed. This needs to be driven by the owner or the main contractor imposing a common way of working across the value chain. The main investment in terms of tools and platform must thus be driven at this level and imposed contractually across the entire value chain.

As examples from the aerospace or automotive industry show, it has taken significant effort and time (several years) to ensure that a common 3D model can be setup with clear conditions for access, user rights, responsibility and expected contribution from each contributor, in a way that satisfies all participants. Spreading the usage of 3D models will potentially also induce significant changes to the ways of working of contractors and suppliers that need to be accompanied and incentivised. Therefore, it is an ongoing effort that must be anticipated overall several years prior to the start of a project to ensure that the final setup is robust and practical, and also to ensure that all participants understand the associated level of effort that will be

required so that their contribution can be priced accordingly.

Access rights must be devised in a way that preserves each contributor intellectual property and clarifies responsibilities for changes and filling in certain categories of information. An architecture effort must be undertaken from the beginning based on a value analysis to ensure that use cases of the 3D model during project execution and future operation phases are clearly defined, by specifying which parameters need to be included and by keeping the parameters to the minimum required.

The digital discontinuity across the project value chain appears to be the main issue to be addressed

What prevents progress in 3D model development?

Current hurdles include:

- Difficulties to set up standards at owner level when contractors are different for each project, and the lack of progress on a standard architecture in each industry due to competition aspects,
- The need to invest in the tool architecture development for several years before achieving a fully workable model and process,
- The level of sophistication of suppliers and fabricators which may not always support the usage of such advanced tools, or which require significant investment to bridge with their design and production management software. Extreme examples include adaptations carried out manually in the field by experienced fabricators on some design details (based on discipline practice and experience) and which may not be fully reported even under current systems.

However, examples in other industries have shown that substantial benefits can be derived from increased collaboration across the value chain around a fully functional 3D model and an effort needs to be made by industrial project owners to promote more advanced and integrated ways of working.

Summary

Usage of 3D models in industrial infrastructure projects appears to be rather in its infancy leading to the inability to exploit the potential value of such integrated collaborative platforms that can digitally gather valuable data. The main issue is the digital gaps across the value chain. Only a decisive investment by owners and main contractors will allow to develop workable approaches. A substantial change management and incentivisation will also need to be deployed across the value chain (suppliers and subcontractors) to ensure they adopt new ways of working using a common platform. We expect this to be a major issue in the next few years possibly leading to differentiation in terms of competition across the industrial infrastructure project value chains.