Information Management builds on BIM

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Siemens Mobility has undertaken a proof of concept trial based on a light rail project in Denmark to showcase how advanced information management techniques can complement BIM, potentially opening the door to more transparent management of major infrastructure schemes.

Image: Hovedstadens Letbane / Gottlieb Paludan Architects

Siemens' project to develop the Glostrup stop has approximately 380 identified interfaces.

In the transition to low-carbon mobility, the drive is on to construct new and expand or renew existing rail infrastructure. But such projects are becoming ever more complex, involving a growing array of disciplines and stakeholders. This complexity needs to be managed within tightening fiscal demands and often prescriptive timelines. Those responsible for managing, planning and implementing major projects also face increasingly multi-lateral communication requirements from global teams working on the same project at the same time but in different time zones.

It is no surprise then that the infrastructure supply chain is looking to digital tools. Building Information Modelling is emerging as a key method for the management of major rail projects; it is already widely used in the construction industry where it originated.

BIM allows for full virtual planning of a project, encompassing all of the relevant interfaces and tracking the information flows. This is intended to improve the quality of planning as well as managing the construction phase, and can also feed into subsequent maintenance and renewals, adding value over the whole life of a project.

Siemens Mobility has defined a railway-specific method to implement BIM, in order to take advantage of all the benefits in our rail domain. This provides design-development workflows and modelling guidelines tailor-made for rail infrastructure projects. The standard ensures an aligned set of regulations, definitions and processes for all BIM work undertaken by the company. Such a strong foundation allows Siemens Mobility to create the basis for a 'digital twin' — a virtual model of the project incorporating all the subsystems and interfaces.

One important benefit in the development of a digital twin is the ability to trial all aspects of the project

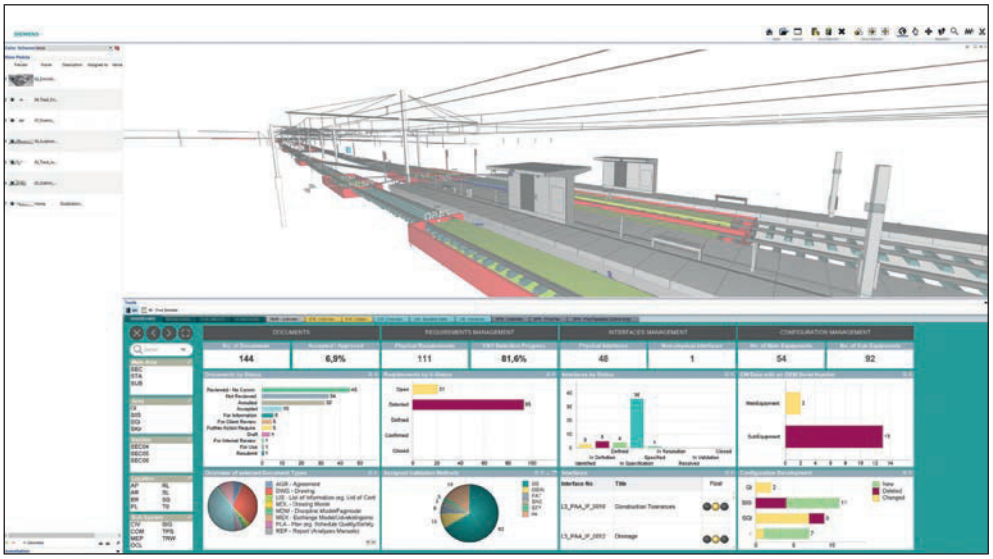
in a virtual environment prior to the start of physical construction, once the model has been fully developed to meet all the specifications — a process that is usually done in co-operation with the client. Virtual testing enables all parties to get an idea at the outset of how the roll-out is likely to proceed, and of the productivity gains that BIM can be expected to deliver through the asset life-cycle. The client has the advantage of an iterative co-creation process and full transparency from the start of their project. They also get access to all of the data over the whole life of the asset.

Easy access to information

Siemens Mobility is seeking to move a step beyond the conventional deployment of BIM, which is commonly used for design development and co-ordination, to deliver interlinked information beyond process boundaries and authoring software. We call this process Information Management.

In most rail infrastructure programmes, project management requires numerous distinct processes to be undertaken in parallel, and typically there are interdependencies between all of them. Managing the links and interfaces at the programme level is usually done manually, but this requires substantial effort, which adds complexity when multiple changes are needed at the same time. Automating these linking tasks and putting data analysis on top to create additional insights is usually not within the scope of BIM for rail projects. However, we believe that such an evolution can reveal novel insights and unlock greater productivity.

Accessing and structuring the data and ensuring consistent quality are crucial to achieving this vision, but that can be quite a challenge. The key is to identify and quickly flag up the implications of any process changes against a 'single source of truth'.



Overview of the Project Insight Board with 3D BIM model and dashboard view at a glance, using the example of Glostrup stop on København's orbital light rail line.

Siemens' aspiration has been to ensure that anyone involved in a project who wants to access information such as schedules, resourcing or equipment, can do so via a dashboard without needing specialist software knowledge. This would ensure that information can be disseminated in a structured and consistent way.

> 'BIM allows for full virtual planning of a project, encompassing all of the relevant interfaces and tracking the information flows'

The solution that has been developed is known as the Project Insight Board, a kind of 'BIM plus' intended to consolidate information project-wide. The benefits are threefold: firstly, it makes the impact of changes transparent across all workstreams; secondly, it reduces the effort required to gather project information; and thirdly, it provides a sound basis for discussions among all the stakeholders, from frontline engineers to senior management.

Unifying disparate data

One of the main hurdles to BIM adoption is the different formats used by proprietary systems. To overcome this, Siemens has applied its own 'project data structure', designed to enable traceability. Taking catenary as an example, each mast has an identifier, so the system knows at what location and to which OLE assembly it belongs. This approach is already applied to 3D models, but our structure expands the record keeping to apply to every aspect of the programme, all of which can be accessed via the PIB.

The ultimate objective is to 'flip the coin' in terms of how the project workflow is addressed. Consider the case of an OLE mast being delayed in production for a given period of time. How does the project team assess the likely impact of this delay? Currently, they would interrogate multiple sources requiring hours of staff time — data fields to be analysed would typically include BIM Design, Document Management, Requirements Management, Configuration Management, Interface Management, Scheduling and Strategic Procurement, and all the connections between them. The team has to find out where the masts are located, how many there are, and when they are scheduled to be installed. Only after gathering this information can the project team analyse the situation and come up with countermeasures.

The objective of the project data structure is to ensure that this task can be completed in minutes rather than hours or days, freeing up staff to respond in a more agile way to problems and unforeseen changes.

The Project Insight Board makes the impact of changes transparent throughout all processes in a single source of truth.

København ring trial

To validate the proposition, Siemens decided to create a proof of concept based on the orbital light rail line now

being developed in København, for which Siemens Mobility is providing project management and supervision as part of its railway systems package.

Being co-ordinated by Hovedstadens Letbane, this 28 km light rail line serving 29 stops is now under construction between Ishøj and Lundtofte through the western suburbs of the Danish capital. It is forecast to carry between 13 and 14 million passengers per year. As well as undertaking overall project management and system integration, Siemens Mobility is supplying 29 four-section Avenio LRVs, the electrification equipment, signalling, communication and workshop equipment, under a contract which includes 15 years of maintenance. Siemens is working in a consortium with Aarsleff Rail, a subsidiary of civil company Per Aarsleff, on the rail systems package.

For the data case study, we focused on the stop at Glostrup, as this was one of the locations where many subsystems come together. The project has approximately 380 identified interfaces and well-established interface management. Nevertheless, we felt that deploying Information Management techniques could lead to further automation of the processes and bring greater transparency.

> ‘The aim of [the Project Insight Board] is to tear down [the] walls between process tools and data, to deliver transparency, quality control and collaboration in a couple of clicks’

The proof of concept team evaluated several case studies originating from this project, one of which was a change to the signalling equipment arising from the results of testing and commissioning a final design. The alteration involved modifying some specific aspects of the signalling cabinets, and this was tracked and recorded in the PIB to make it more transparent. The system identified the changes very quickly, and alerts were sent out instantaneously to all parties affected by the work.

A ‘deep dive’ into the affected components was undertaken, but full control of the changes was maintained thanks to the connection between the design model and the configuration management process. This also allowed all the data associated with the 3D model to be analysed in minute detail. Throughout the process, the PIB continued to serve as a ‘single source of truth’. The PIB also facilitated collaboration between the various disciplines involved in the project by providing structured data and visual cues.

After viewing the modifications in detail, the Glostrup project team could quickly analyse the implications of the changes for the entire light rail scheme. The links between the 3D model and the relevant project documents provided a common view of configuration management information. This ensured that any potential inconsistencies could be investigated thoroughly, and any knock-on effects for other elements such as the power supply could be rapidly taken into account.

29

stops will be served by København’s 28 km orbital light rail line

Data from individual sub-systems has typically been stored in independent databases that require bespoke access tools and specific knowledge. The aim of PIB is to tear down these walls between process tools and data, to deliver transparency, quality control and collaboration in a couple of clicks, even for those who do not have specialist knowledge of the systems involved.

We are confident that this proof of concept has validated the potential for PIB to become the next step towards managing complex supply chains and multi-lateral rail projects. Establishing BIM with Information Management as a top layer ensures that scheduling and costs can be managed more efficiently. It enhances efficient change management during remote meetings across all workstreams and with every partner, which should prove a lasting benefit beyond the duration of the current Covid-19 pandemic.

Siemens Mobility is supplying 29 four-section Avenio LRVs for København’s orbital light rail line.

Images: Hovedstadens Letbane / Gottlieb Paludan Architects