Application of openBIM in the Design and Delivery of Guangzhou-Zhanjiang High-speed Railway

Category: Design for Infrastructure using openBIM

Submitting Party: China Railway Design Corporation
Project Overview

Guangzhou-Zhanjiang High-speed Railway

Guangzhou Railway Station

Zhanjiang North Station

Bridges and Tunnels

Guangdong-Hong Kong-Macao Bay Area

Bridges

Tunnels
Strategic Objectives

Through the application of BIM technology in the whole process of design and construction, the construction efficiency, quality and safety of the project will be improved.

Intermediate

Research the technical and management issues of the integrated application of BIM in railway design and construction, and cultivate the ecosystem of BIM application in railway.

Advanced

Realize the "one model the whole life cycle" digital application of "all domains and all phases" in design, optimization, construction, management, operation and maintenance.
Project Stakeholders

**Parties**

- Appointing party
- Appointed parties
- Operator
- General contractor
- Designer
- Construction contractor

**Guangdong Guangzhan Railway Co., Ltd**

**China Railway Design Corporation**
Highlights

A BIM Execution Plan (BEP) plan of the project was developed based on ISO 19650 and openBIM standards which were applied throughout the whole process of design, review and delivery to realize fully digital exchange of design information.

- In the planning phase, the ISO 19650 process was adopted to collect the information requirements of the main stakeholders such as the appointing party, the general contractor and construction contractors. A two-level CDE platform for design and construction was innovatively developed to meet the requirements of collaboration, while ensuring that BIM data can be compatibly transferred to the construction phase and the construction management platform.

- Based on the IFC standard and the MVD theory, we developed a IFC data review tool to visually analyze the IFC types, properties and relationships, and innovatively implemented solutions for automatic semantic completion and correction of the data of IFC4 and IFC2x3.

- Based on the BCF standard, a software to capture and manage design issues was developed to realize collaborative review of BIM models across multiple participants and software platforms.
ISO 19650 used

Information Management Process
Establish information requirements

The contractor shall establish a BIM and information system in accordance with the relevant requirements of the developer or the supervisory parties (including the China National Railway Group (former China Railway Corporation)), actively conduct the scientific and technological innovation of this project. Following the relevant requirements of BIM and information system management, relevant professionals should be well equipped for implementation. Related information should be shared with the developer or supervisor through the CDE, and the information system of the contractor must meet the requirements for connection with the developer and its superior and the supervisor.
## Establish responsibility matrix

<table>
<thead>
<tr>
<th>Content</th>
<th>Appointing Party</th>
<th>Appointed Parties</th>
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<td>Design of GZZQ-10 Section</td>
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R—Responsible  A—Accountable  C—Consulted  I—Informed
ISO 19650 used
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<tr>
<th>ID</th>
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</table>
ISO 19650 used

Establish BIM execution plan

Geology  Subgrade  Bridge  Tunnel  Alignment  Station  Track
Rolling stock  Drainage  Telecommunication  Signal  Energy
ISO 19650 used

Establish the project’s two-level CDE
openBIM used

Software Ecosystem Map

- CDE Server: Two-level common data environment
- Enovia: CDE for collaborative design
- AutoCAD & RDS: Alignment design
- Catia & Revit: BIM design
- IFC Rail Reviewer & Navisworks: IFC file review
- rTwin & UE: BIM integration and optimization
- Delmia & Tekla: Construction application
- 3DPDF & Composer: BIM technical instruction
- RailCDE: CDE for construction management
openBIM used

Process of Modelling

Alignment

AUTOCAD

IFC

Rail SPEC

Alignment-2D

Design CDE

IFC Rail SPEC

Alignment-3D

Collaboration

IFC Rail SPEC

2D Experience Schema

Subgrade

3D Experience Schema

Bridge

Architecture

Revit

IFC2x3

3D Experience

Track

Electromechanical

Tunnel

BuildingSMART International
openBIM used

IFC-Spatial Extension
openBIM used

IFC-Entity Extension
openBIM used

IFC to Metadata

- Create mapping of IFC data to metadata
openBIM used

**IFC-Deployment in software**

- Deployment of 413 IFC entities
- Deployment of 802 IFC Psets
openBIM used

IFC - Information Model

- Create BIM models
- Mount the property sets on the BIM models
openBIM used

Generate information & Information model review (LOD 1~2)

- Terrain
- Bridge
- Tunnel
- Subgrade
openBIM used

Generate information & Information model review (LOD 3)
openBIM used

Generate information & Information model review (LOD 4)
openBIM used

BCF - BIM Collaboration Format

Reviewer  

Designer
The original site is located in the peace ditch.
The new site is located in the circle.
openBIM used

BCF-BIM Collaboration issues - Drainage optimization

- Conflict between original site and drainage.
- New site bypasses drainage.
openBIM used

BCF-BIM Collaboration issues - Interface Optimization

- Optimization of Subgrade and Bridge interface design.
openBIM used

BCF-BIM Collaboration issues - Collision optimization

- Optimization of Subgrade retaining wall.
Information Model Delivery

Information model checking
Information Model Delivery

Submit information model
Information Model Delivery

Information model transfer

- Unreal Engine
- DELMIA
- Tekla Structures
- CATIA / Composer
Composer was used to compile EXE program of "3D Design Instructions for Railway Engineering", which helps users to have a comprehensive understanding of the project without the need for third-party software.
Importing the BIM model into 3DPDF is an innovative attempt. Information model was embedded in the PDF file and realize the interactive experience of the 3D model in the 2D file.
Information Model Delivery

Information model transfer and digital delivery - Virtual construction
Information Model Delivery

Information model transfer and digital delivery - VR
openBIM Use Cases

Comprehensive pipeline collision detection and optimization
OpenBIM Use Cases

Automatic Construction of Station Earthworks Based on LandXML MVD
openBIM Use Cases

Engineering visualization based on virtual reality

IFC File Export

Virtual Reality System

Integration and Optimization

IFC File Parsing and Reconstruction
openBIM Use Cases

Intelligent management in tunnel construction
Thank you!