BIM + Technology in Large Construction Project Application

October 2017
Contents

(1) Business Introduction

(2) BIM Advancement in Construction Management

(3) BIM+ Application
(1) Business Introduction

China Construction Bureau (Group) Co., Ltd. was established in 1953, is the new China's first building "national team", is China's construction shares of the company's core sub-enterprises. To "housing construction + infrastructure, overseas, investment," 1+3 for the industry positioning.

- The one and only in the Chinese construction field who won the highest prize in the Chinese government quality field - China Quality Award

<table>
<thead>
<tr>
<th>Award</th>
<th>Number</th>
<th>Award</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luban Award</td>
<td>46 Project</td>
<td>Zhan Tianyou Award</td>
<td>11 Project</td>
</tr>
<tr>
<td>National Quality Engineering Award</td>
<td>41 Project</td>
<td>China Steel Gold Award</td>
<td>19 Project</td>
</tr>
</tbody>
</table>

The industry's first national scientific and technological progress won the first prize of the unit, 19 national science and technology award
Global and China’s highly creators:
• The world's first highest (2008) - Shanghai World Financial Center
• China's first highest (2010) - Shenzhen Ping An Financial Center
• The world's tallest steel-concrete structure, the first highest in Europe - the Russian Federation building

The Founder of Global and the Chinese:
• The world's largest swimming pool, the world's largest membrane structure engineering, the world's first polyhedral space steel frame structure - the National Swimming Center (Water Cube)
• The world's first 10.5 on behalf of the line, the largest volume of high-tech electronics factory - Hefei BOE 10.5 on behalf of the line plant
• China's largest ultra-clean electronics factory - Chongqing BOE 8.5 on behalf of the line plant
• China's largest single project - CCTV new site main building
Development Path:

2003
- Bently MEP Monitoring
- Galaxy SOHO
- Glodon Information Headquarters

2005
- Owners lead BIM implementation
- Start exploring BIM5D management

2009
- Complex node deepening design
- Program simulation
- Finite element calculation

2012
- Shenzhen Ping An Financial Center
- Consultant company CCDI led
- The process of the total package unit took over

2013
- Li Xingxing project
- The total package unit dominates BIM implementation
- Changyang West Station Industrialization Project
- Explore BIM and the development and application of industrialization

2014
- Lenovo headquarters two
- Project type BIM team
- Beijing Cultural Center
- Discussion on Special Application of BIM Medical in Beijing Tiantan Hospital
- Discussion on Special Application of BIM Medical in Beijing Tiantan Hospital
- The Application of Tencent Binhai Building Electromechanical Specialty Project

2015
- Changyang West Station Industrialization Project
- Explore BIM and the development and application of industrialization

2016
- The total package unit dominates BIM implementation
- Shenzhen Pingan Financial Center South Tower
- Project full floor, the depth of application

2017年：全员参与，落地应用。
BIM system construction: (A) organizational structure and management system

1. Organizational structure

The establishment of group-level BIM workstations, set up 14 professional groups, teams located in the Group Technology Center, fully hosted the work of BIM workstations.
2. Management system - implementation plan 2013 to determine the Group's eight major technical research direction, start BIM technology system construction work in 2015 to form the relevant implementation of research programs.

1. super high-rise building comprehensive construction technology
2. green building construction technology
3. foundation and underground construction technology
4. building information model (BIM) technology
5. process installation technology
6. infrastructure construction technology
7. decorative deepening design techniques
8. general contract management technology
2、management System - Issued "In The Construction Of A Group Of Sub-enterprises / Regional Companies BIM Workstation / Group / Center Of The Operational Certification Standards"
2、Management System - Release Group "Engineering Construction BIM Modeling Standards"

Standard Catalogue:
1, general rule
2, the term
3, the basic provisions
4, the basic settings
5, model fineness and information management
6, professional model modeling process
7, model integration
8, model delivery

Schedule A professional model fineness table
Schedule B of the professional model information table
Schedule C Navisworks support file format
Schedule D single professional model transfer orders
Schedule E full professional model transfer orders
2、Management System - Release Group "Construction Project Construction BIM Technology Application Guide"

Guide Contents:
Preface
Chapter 1 BIM Application Environment
Chapter 2 Project Implementation Standards
Chapter 3 Project Implementation Planning
Chapter 4 BIM Management Mechanisms
Chapter 5 General Contracting Project Management BIM Application
Chapter 6 Application of BIM for Electromechanical Construction
Chapter 7 Steel Application Construction BIM Application
Chapter 8 Decorative Construction BIM Application
Chapter 9 Infrastructure BIM Application
Chapter 10 Completion The BIM model is used for operation and maintenance management
Schedule A: Each professional model information table
Schedule B: Model Change Record Form
Schedule C: Project BIM Technical Application Point Reference Range Table
Schedule D: BIM model information audit record table
Schedule E: Single Professional BIM Model Transfer Order
Schedule F: Full Professional Model Transfer Order
2、Management System - Issued "In The Construction Of A Group Of Science And Technology To Promote Demonstration Project Management Approach"
2、management System - Announcement "Implementation Rules For Assessment And Evaluation Of Technical Research And Application Of Building Information Model (BIM) In China Construction Bureau (Revised Edition)

- Clear and subdivided the type of assessment project, according to the construction of general contracting, professional engineering and design institute design engineering three types of projects were developed assessment criteria.

- Detailed assessment of business types: the group within the construction class business (excluding research institutes), professional companies and design institutes, and the development of assessment standards.
For example: the construction of general contractors (I 18, II 27, III 12)

<table>
<thead>
<tr>
<th>Application Stage</th>
<th>Key Applications</th>
<th>Priority</th>
<th>Evaluation Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tender offer stage</td>
<td>BIM Bidding Standard</td>
<td>I</td>
<td>The BIM model is inserted into the relevant sections of the &quot;BIM Application Plan or Presentation&quot; of the Bidding Documents to compile the technical specifications, project overview, construction deployment, construction progress schedule and guarantee measures, plan layout, BIM implementation plan and so on. Demonstration.</td>
</tr>
<tr>
<td>Tender Interview</td>
<td></td>
<td>I</td>
<td>Production of construction program animation, the tender program demonstration, defense, enhance the technical program performance.</td>
</tr>
<tr>
<td>Tender Cost Planning and Recommendation</td>
<td></td>
<td>II</td>
<td>According to the tender quantity for the tender offer and cost forecasting, extract the amount of work, set the amount of the formation of cost information for the tender to provide data support.</td>
</tr>
<tr>
<td>Project Planning Stage</td>
<td>BIM Actual Project</td>
<td>I</td>
<td>According to the &quot;Construction BIM Model Modeling Standard&quot;, &quot;Construction Project Construction BIM Technology Application Guide&quot; and &quot;in a bureau group project BIM technology implementation of standardized instruction manual&quot;, the preparation of &quot;BIM implementation plan&quot;, including the implementation of planning and implementation standards. Approved by the company in charge of management and filing.</td>
</tr>
<tr>
<td>Project Level BIM Standards</td>
<td></td>
<td>II</td>
<td>Specification of the underlying template file selection, including the axis, elevation, wall, view settings, material, units, visibility settings and so on</td>
</tr>
<tr>
<td>BIM Training</td>
<td></td>
<td>I</td>
<td>Specification of the underlying template file selection, including the axis, elevation, wall, view settings, material, units, visibility settings and so on</td>
</tr>
</tbody>
</table>
For example: the construction of general contractors (Ⅰ 18, Ⅱ 27, Ⅲ 12)-Cont’d

<table>
<thead>
<tr>
<th>Application Stage</th>
<th>Key Applications</th>
<th>Priority</th>
<th>Evaluation Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Stage</strong></td>
<td>Clash Detection</td>
<td>Ⅰ</td>
<td>The professional collision inspection, pipeline synthesis, net high inspection, large equipment, such as lifting routes.</td>
</tr>
<tr>
<td></td>
<td>Construction Method</td>
<td>Ⅰ</td>
<td>With the construction needs of more than three BIM-based technology / process simulation. Simulation to material, process parameters, processes and other information with words or voice to express clear.</td>
</tr>
<tr>
<td></td>
<td>Visual Communication</td>
<td>Ⅰ</td>
<td>Using BIM technology for more than three three-dimensional visualization technology. Cross the screenshot to be clear, accurate information in place.</td>
</tr>
<tr>
<td></td>
<td>Construction Schedule</td>
<td>Ⅰ</td>
<td>Using BIM technology with two or more programming in the node analysis, calculation, checking and so on. Requirements in the temporary construction, foundation pit, mold, steel applications BIM technology.</td>
</tr>
<tr>
<td></td>
<td>Construction schedule control</td>
<td>Ⅱ</td>
<td>Through the actual time entry, the planned duration and actual duration comparison, tracking the actual completion of the scene, a clear schedule ahead or lagging process, to facilitate the construction process of good control and feedback; real-time through the BIM model to show the construction status of the scene, and through the model dynamics Show the completion of the previous month and next month plans and assurance measures.</td>
</tr>
<tr>
<td><strong>Detail Design</strong></td>
<td></td>
<td>Ⅰ</td>
<td>The use of BIM technology to deepen the decoration design, plans and so on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ⅰ</td>
<td>Using BIM technology to deepen the design of the structure, such as plans.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ⅰ</td>
<td>Using BIM technology to deepen the design of drainage, such as plans.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ⅰ</td>
<td>Using BIM technology for HVAC deep design, plans and so on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ⅰ</td>
<td>The use of BIM technology for electrical deepening design, plans and so on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ⅰ</td>
<td>Using BIM technology to deepen the design, plans and so on.</td>
</tr>
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<td>Key Applications</td>
<td>Priority</td>
<td>Evaluation Standard</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------</td>
<td>----------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Quality, Safety, Management</td>
<td>I</td>
<td>Collection of field data, the establishment of quality defects, security risks, civilized construction and other data, the formation of traceable records.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Through the model to assist the management staff on-site quality acceptance, security management, the formation of acceptance information, information and visual records.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>Able to dynamically identify the scene of dangerous sources and timely warning.</td>
<td></td>
</tr>
<tr>
<td>Construction Method Comparison</td>
<td>II</td>
<td>Using BIM technology for more than three construction programs for program selection, select the optimal construction program.</td>
<td></td>
</tr>
<tr>
<td>Rebar Bending Guidelines</td>
<td>II</td>
<td>To optimize the arrangement, the construction of lofting, bargaining statistics and other fine management.</td>
<td></td>
</tr>
<tr>
<td>Construction Model Document Management</td>
<td>II</td>
<td>The use of local area network, cloud space, such as the construction version of the map management, the professional construction plans, deepening the design and other real-time dynamic update management, and timely reflect the design changes to negotiate the contents of the drawings updated.</td>
<td></td>
</tr>
<tr>
<td>Steel Procurement &amp; Installation</td>
<td>II</td>
<td>Proposed steel structure procurement plan, the components of the logistics tracking, the steel structure installation, progress and other management.</td>
<td></td>
</tr>
<tr>
<td>Cladding Installations</td>
<td>II</td>
<td>The development of curtain wall installation program, the curtain wall installation, progress and other management.</td>
<td></td>
</tr>
<tr>
<td>Finishing and Installations</td>
<td>II</td>
<td>The development of decoration programs, decorative installation, progress and other management.</td>
<td></td>
</tr>
<tr>
<td>Material Resources Management</td>
<td>II</td>
<td>According to the requirements of the preparation of the material requirements of the project, the submission of the material plan, through the model of the exact amount of work to do comparative analysis, after the audit, the limit picking control to achieve fine material management.</td>
<td></td>
</tr>
<tr>
<td>Application Stage</td>
<td>Key Applications</td>
<td>Priority</td>
<td>Priority</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Construction Stage</td>
<td>Material Tracking</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vertical Transport Mngt</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subcon Mngt</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engineering Data Mngt</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile Terminal</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internet of Things</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3D Scanning</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visualization Collaborative Management</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prefabrication processing and installation</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final Account</td>
<td>III</td>
<td></td>
</tr>
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<tr>
<td>Handing Over</td>
<td>BIM model maintenance</td>
<td>Ⅲ</td>
<td>Stage integration of the various stages of the model, receive, enter and generate relevant information, update and maintain the BIM completion model</td>
</tr>
<tr>
<td></td>
<td>Completion Acceptance</td>
<td>Ⅲ</td>
<td>Production site to complete the map, with the completion of acceptance.</td>
</tr>
<tr>
<td>Facility Management</td>
<td>BIM Model Mngt</td>
<td>Ⅲ</td>
<td>The completion of the completion of delivery BIM model, the maintenance of the model update.</td>
</tr>
<tr>
<td></td>
<td>FM Mngt</td>
<td>Ⅲ</td>
<td>Can cooperate with the owners to model space, equipment maintenance, maintenance time and other information management.</td>
</tr>
<tr>
<td></td>
<td>Software Redevelopment</td>
<td>Ⅲ</td>
<td>According to the project characteristics and needs, revit software for secondary development and application</td>
</tr>
</tbody>
</table>
2、管理信息系统 - 宣布《标准化手册》发布，

关于发布《中建一局集团项目BIM技术实施标准化指导手册》
（修订版）的通知

建一技字[2017]023号

各有关单位、各企业：

根据《中建一局集团项目BIM技术实施标准化指导手册》的发布和应用情况，本集团于2017年6月对《中建一局集团项目BIM技术实施标准化指导手册》进行了修订，为方便使用者的查阅与查阅使用，集团BIM工作站修订了《中建一局集团项目BIM技术实施标准化指导手册》中的相关内容，现将修订后的手册发布给你们，请遵照执行，实施过程中如有问题请拨打咨询电话。

咨询电话：

姜军：010-63982039 13501230180
何艳辉：010-63982023 13693622995

2017年9月22日

中建一局集团项目BIM技术实施标准化指导手册（修订版）

于2016年12月集团BIM工作站根据《中建一局集团项目BIM技术实施标准化指导手册》进行了修订并发布。为方便使用者的查阅和查阅使用，集团BIM工作站修订了《中建一局集团项目BIM技术实施标准化指导手册》中的相关内容，增加了新的内容并进行了必要的修改。现将修订后的新版手册发布给你们，请遵照执行，实施过程中如有问题请拨打咨询电话。

咨询电话：

姜军：010-63982039 13501230180
何艳辉：010-63982023 13693622995
Construction of Supporting Resources - Construction of Group BIM Resource Data Platform framework contains the professional library, BIM standard specifications, guidelines, programs, models and other large data base module, has been uploaded CI library.
Contents

(1) Business Introduction

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Basic Characteristics Of Large - Scale Construction General Contracting Project

First, the project scale, high cost, large volume
Second, a wide range of engineering disciplines, complex processes
Third, the high quality requirements
Fourth, tight schedule
Tech Control Benefit

Higher product quality
Requirements and sustainable construction.
Building VS lack of effectiveness
The technical means

Project Complexity
Increase VS 2D cannot be done, cannot do well

Strict construction and construction
Cost control VS frequent
Missed out and Design Changes

Globalization Increases
Competition VS
Unsupported Technology and Management Deprive
Tech Control Benefit

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(3) BIM+ Applications
In the full participation of the BIM work mode, the project technology, engineering, business, steel, quality, safety and other departments organized 100 days, more than 30 times BIM training.

The project held BIM skills test, test the mastery of the students, the latter part of the project staff will be divided into A-B-C Level, the implementation of personalized, differentiated training.

To achieve full "high-level can understand, the middle can use, grass-roots can do"
BIM Management Field

- BIM Execution Plan
- BIM Progress Meeting
- BIM Model Check & Control
- BIM Site Brick Layout
- BIM Coordination Meeting
Modeling Standard & Colour Coding

1. 模板的选择
1.1 模板的用途

Revit项目模板为新项目提供了起点，包括Revit视图模板、已定义的Revit族、定义的设置（如单位、填充样式、线形样式、线宽、视图比例等）和几何图形（如视线）、安装后，Revit中提供了若干个板块，用于不同的规程和项目类型。也可以创建自定义模板，以满足特定的要求，例如在办公室日历、项目模板使用文件扩展名.rte。

模板本质上是进入模板界面后进行一系列自动化操作，例如，载入本模板内的族，规划视图，建立视图，处理材质等。

我们通过自建的模板可以方便的处理各类初始化工作。

1.2 常用模板

建筑模板，主要用于建筑模型建立，预先加载了建筑族，设置了视图规程为建筑规程。

结构模板，结构模板与建筑模板他们的默认视图范围是不一样的，他们的可视性也不是一样的，因为他们是用户在Structure中绘制不出来的建筑的图。都需要设置，所以他们区别在于与一个项目的起始状态的设置不一样。

通常我们使用建筑模板，再在项目设置的.rte文件模板或则自己来设定适合自己项目的模板文件夹来绘制模型。

Modeling Standard & Colour Coding
### Detail Specification for Each Stage

#### 2.3.1 Modeling Detail/Description

<table>
<thead>
<tr>
<th>砌体结构构件</th>
<th>1、砌体结构构件应包含：砌筑墙体、系梁、过梁、构造柱等； 2、构件绘制信息应包括墙体厚度、门窗洞口尺寸、管槽尺寸、系梁和过梁的高度及定位信息；</th>
<th>室内装饰</th>
<th>1、室内装饰应包含房间的墙面、地面、踢脚和顶棚的建筑做法，建筑做法应包含垫层、找坡层、防水层、保护层、面层、龙骨等构造； 2、室内装饰构造信息应包含材料种类、厚度等信息；</th>
</tr>
</thead>
</table>

#### Diagram Description

[Diagram showing detailed specification for each stage]
Integration of 3D & 2D Detail Design

Conventional two-dimensional, three-dimensional deepening of the design work mode:

- 2D MEP Cabling/Piping Drawing
- Constructing BIM Model Based on 2D Deepening
- BIM model integration collision check
- Provide collision check report
- Modify the integrated layout according to the collision report
- Cycle this process until after zero collision
Progress Planning, Tracking, Analysis
Progress Control

Tower crane, climbing mould, steel column between the cross conflict, restricting the progress of the entire project construction. Tower crane every 4 layers to climb once, climb once need to stop 7 days before they can adjust the construction process. Through continuous simulation, continuous adjustment, and ultimately from 7 days to 2 days. This is a total of 150 days for the total duration!

Tower crane vs steel structure
Tower crane support beam vs climbing mould body
Climbing frame body vs steel structure
Template layer progress simulation (secondary structure, electromechanical, fine decoration)

Simulation of construction progress of steel truss

Curve wall construction progress simulation

Simulation of the construction progress of the first road

... ... ... ...
Quality Control

Tiantan Hospital project in March 2015 began to enter the secondary structure of construction, BIM technical staff to introduce Guangda of 5D products in the secondary row of brick function, in the large-scale construction, the first model construction, the second masonry wall The layout of brick, issued a brick map, auxiliary block material required to use plans to guide the procurement of materials and accurate delivery, reduce material waste, to avoid secondary handling.
Brick and Ceiling Arrangement

Washroom Tiles Arrangement  Room Ceiling Panel Arrangement
Quality Control

Analysis of construction process simulation and quality control points
Pingan project 81-83 layer steel structure 3D Scanning

Quality Control

误差着色图
Cost Management

- Project steel volume of 13,000 tons, the Ministry of Commerce to achieve refined steel management, control process costs, subcontracting project settlement to provide data support, the cumulative savings of more than 120 tons of steel.
- At the same time the use of 5D platform to achieve split water extraction material planning, follow the progress of the project dynamic generation of funds, resource consumption and other curves, real-time comparison.

Generating a rollover bill comparison subcontract reporting plan, precision control of steel consumption
# Cost Management

<table>
<thead>
<tr>
<th>范围</th>
<th>项目名称</th>
<th>项目特征</th>
<th>单位</th>
<th>数量</th>
<th>单位</th>
<th>金额</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>立体楼</td>
<td></td>
<td>x3</td>
<td>10</td>
<td>522</td>
<td>522</td>
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<tr>
<td>2</td>
<td>景观工程</td>
<td></td>
<td>x1</td>
<td>5</td>
<td>522</td>
<td>522</td>
</tr>
<tr>
<td>3</td>
<td>道路工程</td>
<td></td>
<td>x1</td>
<td>3</td>
<td>54</td>
<td>54</td>
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<tr>
<td>4</td>
<td>绿化工程</td>
<td></td>
<td>x1</td>
<td>2</td>
<td>356</td>
<td>356</td>
</tr>
</tbody>
</table>

**Tender Price**

**Budget Cost**

**Actual Cost**
In accordance with the conventional way to report, each time two business people, need 3 days
In accordance with the BIM way to report, each time only need to move your fingers, the computer will calculate the amount of work
Compared to the relief of a business staff, reported speed increase hundreds of times, more convenient nuclear volume, tracking with easy
Cost Management

Cash Flow Analysis

Commercial Cloud Analysis
Management of Sub-Contract Bill Work

《BIM General Contracting Management Outline》

BIM Technical Assistance Regular Meeting

File Management Based on Network Platform
Large Tower Crane Erection at High Altitude
Thank You