MANAGEMENT DECISION & ARTIFICIAL INTELLIGENCE FOR LARGE-SCALE INFRASTRUCTURE CONSTRUCTION PROJECT

SPEAKER: MR. MA XIAOYU
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INDUSTRY TRENDS
1.1 Industry Outlook

"New supply" is coming
—— BIM technology will usher in explosive growth

BIM applications in various regions of China

- **Huadong Region**: 17% (2014), 25% (2015)
- **Southwest Region**: 10% (2014), 20% (2015)
- **Shanghai**: 32% (2014), 48% (2015)
- **Huabei China**: 49% (2014), 20% (2015)
- **Beijing**: 58% (2014), 23% (2015)
- **Central China**: 35% (2014), 65% (2015)

BIM implementation in all regions of our country has increased significantly.
The implementation of BIM in all regions of the country increased significantly, and the application rate of BIM in Shanghai, Beijing and other regions exceeded 50%.

The higher the BIM application rate, the higher the ROI of the user.
BIM application rate of more than 30% of the project, user profit is much larger than other users.

BIM is emerging technology for information and intelligence.
The owner's requirement for the quality, cost and progress increase, the use of BIM technology project management has become a new demand; project participants use BIM technology to provide better service to the owner have become a new supply.

China BIM user's return on investment

- **BIM application rate of less than 15%**:
  - 2014: 29%
  - 2015: 41%
- **BIM application rate of 15% - 30%**:
  - 2014: 30%
  - 2015: 30%
- **BIM application rate of more than 30%**:
  - 2014: 20%
  - 2015: 38%

Loss, breakeven, and profit.
1.2 Industry Outlook

BIM market demand grows rapidly

The United States Market Research released the "Global BIM Market" report. By 2022, the global BIM market will reach 11.7 billion U.S. dollars and its CAGR will reach 21.6% in 2016-2022. Demand in the Asia Pacific region will increase dramatically as a result of the construction industry's rapid growth and the government's mandatory use of BIM's supporting legislation. It is estimated that by 2021, the Asia Pacific region will dominate the market. The growing business and infrastructure development activities in countries such as China, India and the United Arab Emirates provide the Asia Pacific region with predictable market opportunities.

BIM demand companies and demand direction

- Owner company
- Design company
- Construction company
- Consulting company
- Consulting
- Software
- Training
- Operation and maintenance market
1.3 Team members

**XIAOYU MA**
General manager

Young Entrepreneur, founder of Tianhe Construction, Tianjin, China. Research on intelligent construction and simulation, information integration and so on for large infrastructure projects. Now he is a researcher of the center for intelligent building simulation of Tianjin University of Technology, a research fellow of Construction Industrialization and Integrated Technology Research Center, and a distinguished expert of Beijing Green Building Association.

**Tengteng Jiang**
Software Engineer

Software development engineer, BIM engineer, project experience 10, graduated from Tianjin University of Technology wisdom building simulation center.

**Kebin Zhao**
Administrative Operations Department

Finance Leader, and Chief of Administrative Services, worked in Market Risk Management in the United States Cloudparticle Company.

**Lipeng Li**
Cost Consulting Division

BIM engineer, good at BIM cost management, project experience 8, graduated from Tianjin University of Technology wisdom building simulation center.

**Yangsu Jin**
Education and Training Division

BIM engineer, specializes in training system development, project experience 8, graduated from Tianjin University of Technology wisdom building simulation center.

**Xi Zhang**
BIM Consulting Division

BIM engineer, specializes in emerging technology research and development, project experience 12, graduated from Tianjin University of Technology wisdom building simulation center.

**Kunkun Fan**
Education and Training Division

BIM training director, good at consulting bim + ppp, project experience 6, graduated from Tianjin University of Technology wisdom building simulation center.

**Zipeng Zhao**
BIM Consulting Division

BIM engineer, specializes in BIM virtual simulation, project experience 8, graduated from Tianjin University of Technology wisdom building simulation center.
1.4 projects introduction

**Project Name:** Tianjin Rail Transit line Z4
**Commissioned by:** Tianhe Dacheng Building Cloud Technology Co., Ltd.
**Project Description:** Based on BIM technology, assisting construction cost control, completing the process of nuclear, the amount of work, contrasting the gap between the traditional algorithm and the new algorithm to provide index for similar projects.

**Project Name:** DoubleTree by Hilton, Hainan Xinglong Binhu Resort
**Commissioned by:** Wanning Kaide Investment Co., Ltd.
**Project Description:** Combining the construction conditions at the scene, a digital model of engineering measurement consistent with the actual construction was built to measure payment finely for the progress payment, and the project won the second prize of the 5th Longtu Cup National BIM Contest.

**Project Name:** South China Sea Pearl Bridge
**Commissioned by:** China Construction Sixth Engineering Division Co., Ltd.
**Project Description:** Based on the BIM simulation technology, it helps to optimize the pre-construction design scheme, dynamic simulation of the construction process and virtual construction, provide construction technology and construction schedule optimization, and assist the construction site management.
### 1.4 projects introduction

**Project Name:** Hainan Sanya new airport reclamation project  
**Commissioned by:** China Construction Sixth Engineering Bureau Co., Ltd.  
**Project Description:** Based on the collaborative platform to achieve wisdom building, simulation, optimization of construction programs, supporting decision-making, to build domestic large-scale marine construction project and intelligent construction of the patent cluster.

**Project Name:** Airbus A330 Widebody Passenger Aircraft Completion and Delivery Center  
**Commissioned by:** Tianjin Bonded Zone Tianbao Construction Co., Ltd.  
**Project Description:** The project uses BIM technology to realize the entrusting units' real-time monitoring on the progress, cost of the design, construction and supervision units, setting up information sharing platform during the construction phase, and transferring them to the construction units for use.

**Project Name:** Tianjin Airport Economic Zone Bombardier first project  
**Commissioned by:** Tianjin Bonded Zone Tianbao Construction Co., Ltd.  
**Project Description:** BIM visual simulation for pipeline layout of mechanical and electrical equipment during project construction, improve installation efficiency and construction schedule, and save information in asset management platform.
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PROJECT OVERVIEW
2.1 Project introduction

Position

The Sanya artificial island reclamation project is located in Hongtang Bay, Sanya, Hainan province. This project is invested and developed by Hainan Airlines Group, and the investment amount is over RMB 200 billion yuan.

Significance

The land-reclamation project of Sanya new airport is a key state project with the approval of the State Council, a gateway airport of the South China Sea and the radiation of southeast Asia. It’s of great importance to restart the maritime silk road and realize the great strategy One Belt And One Road in the South China Sea Area.

The Overall Introduction

The overall layout of the project can be divided into three parts: the aviation ground operation zone, the empty airport commercial zone and the auxiliary service area of the airport. The reclamation area of the airport is $2.4 \times 10^7$ m$^2$. 
2.2 Technical Difficulties

Major challenges for the project:
- Safety in the process of steel cylinder processing and storage
- The stability of the shipment of the steel cylinder
- Accurate positioning of the cylinder
- Workload of extracting complicated structure
- The material damage after the typhoon
- How to deal with the multi-profession information collaborative management

What can I do?

Why choose it?

- The infrastructure construction of this project
- Large marine project
- Emphasis on the development

Bentley Digital Platform
VCR
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BIM TECHNOLOGY APPLICATION
3.1 Application system of BIM technology

3D model:
- MicroStation
- PowerCivil
- gINT
- GEOPAK

Data collaboration:
- ProjectWise
- Private cloud

Data Format
- Date source — 2-D data source: dwg, dgn
- 3-D data source: dwg, dae
- Output file and format
  - dgn, I.dgn
  - 3MX, obj, fbx etc.

Workplace
The project-level working space to set up object of land reclamation

Model display:
- Lumen RT
- Descartes
- Context Capture Navigator

Model analysis:
- SACS
- MOSES Navigator

“Big BIM” = “Bentley Information Model”

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<th>Staffing structure</th>
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- Staffing structure
- Organization structure

- 3D model: MicroStation, PowerCivil, gINT, GEOPAK
- Data collaboration: ProjectWise, Private cloud
- "Big BIM" = "Bentley Information Model"
The application project of the reclamation BIM simulation technology in Sanya new airport is a system based on the object of the reclamation project, and optimized the BIM simulation and decision system, amongst the model is the basic carrier of BIM technology application. Therefore, the Bentley series softwares are used to create the three-dimensional model of artificial island.
3.5 Material-oriented damage to the disaster

Image extraction

Typhoon caused a large number of stone loss that is out of the sea, then how to conduct on-site measurement work before and after the typhoon accurately and rapidly?

Hainan Province is a subtropical monsoon climate. It has experienced typhoon 2~3 times all year round, and the typhoon has great destructive power.

Using the exploratory research method, to put forward the solution of "based on the depth of learning, the disaster damage after the typhoon."

Process

Start→Image acquisition→Input image→Image pretreatment→Threshold segmentation→Morphological processing→Connected region calibration→count→Finish

Results

the project data processing capabilities can be improved, the accuracy is improved by 32.54%.

Grayscale: $F(x, y) = \frac{0.299R(x, y) + 0.587G(x, y) + 0.114B(x, y)}{3}$

Development results will be used in typhoon disasters and other applications, the current system is still under development. The measurement method also provides new ideas for similar projects.
3.6 Cloud-based smart construction sites

Implementation points of intelligent construction sites: Application of Bentley project management ideas and models; ProjectWise-based information collaboration platform; accurate, timely and comprehensive information collection system. Using Bentley series of software and other software to serve the project, the establishment of the whole process of digital control and management platform.
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PROJECT SUMMARY
Through the use of Bentley series of software and other related software, steel cylinder processing, steel cylinder transportation, steel cylinder vibration sinking efficiency increased by 25%, 28%, 30%; groove excavation engineering, the engineering of the island dike structure, the engineering of post-disaster loss calculation accuracy increased by 18%, 20%, 32.54%. 
Project summary

- Sanya reclamation project is a key supporting project of exploring the BIM technology optimization of large-scale infrastructure construction and auxiliary decision.
- The land-reclamation project is a key state project of applying BIM technology to One Belt And One Road strategy. In the aspect of intelligent construction informationization, it provides a useful case for similar national key projects.
THANKS

For more information
Email: zhenmo@126.com