International Journal of Latest Engineering Research and Applications (IJLERA) ISSN: 2455-7137

Volume – 08, Issue – 12, December 2023, PP – 202-207

Review of Application BIM Model for the River to Improve the Ecological Environment and Adapt to Climate Change

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Abstract: The project includes the key works of Len river, Can river, De canal and 3 pumping stations Triet Giang, Ha Hai, Ha Yen 1. In particular, the Len river head project is the largest scale item, including items of level I boat lock, level II salinity prevention culvert, traffic bridge connecting Hau Loc and Nga Son districts to create dams, raise fresh water and prevent salt water from the sea from penetrating to create a water supply for the Northern region. Ma River and Hau Loc, Nga Son, Ha Trung and Bim Son districts with a total area of 26,214 hectares of agricultural land. The project also aims to ensure domestic water sources for more than 613,000 people, provide water for livestock and production activities in industrial parks, improve the ecological environment, and combine water and road transportation in the area, minimizing negative impacts on the environment and especially on the river bed downstream of the salinity prevention project. In this study, the authors focused on researching the application of BIM model for the Len River area and Triet Giang station.

Keywords: Len River, BIM model, Value Engineering, ecological environment.

I. INTRODUCTION

BIM (Building Information Modeling) is not simply a software; the success of BIM is the workflow it can create between different members participating in a project. BIM improves and optimizes communication, especially between design and construction, between theory and practice, between construction and operation, which has actively contributed to the management and increased efficiency of projects. judgment.

BIM has changed and improved information management systematically and synchronously, managing project plans, volumes and costs well from the investment preparation stage, until construction acceptance and put the project's works into operation, bringing high efficiency to construction investment project management.

The ability to make project information available to all members makes it easier for project managers to direct and manage teams. The entire process is faster and error-free when experts can deploy their expertise when needed, reducing project isolation and fragmentation.

Design teams can also solve technical challenges in real time, understanding the project architecture so they can develop newer solutions or overcome the limitations of old solutions. Using BIM properly allows different teams to regularly compare creative ideas with the technical capabilities of each idea, making implementation more feasible.

A unified source of information allows project managers to better understand current tasks and processes, and designers and constructors coordinate to ensure consistency and timely handling of situations. actual product. This information also makes prefabricated material production, experimental design, 3D printing... simpler.

In this project, we applied BIM model to upgrade the Len River and Hoang Mai River irrigation systems to improve the ability to control salinity and adapt to climate change.

The Len River is a northern distributary of the Ma River in Thanh Hoa, Vietnam [Figure 1].

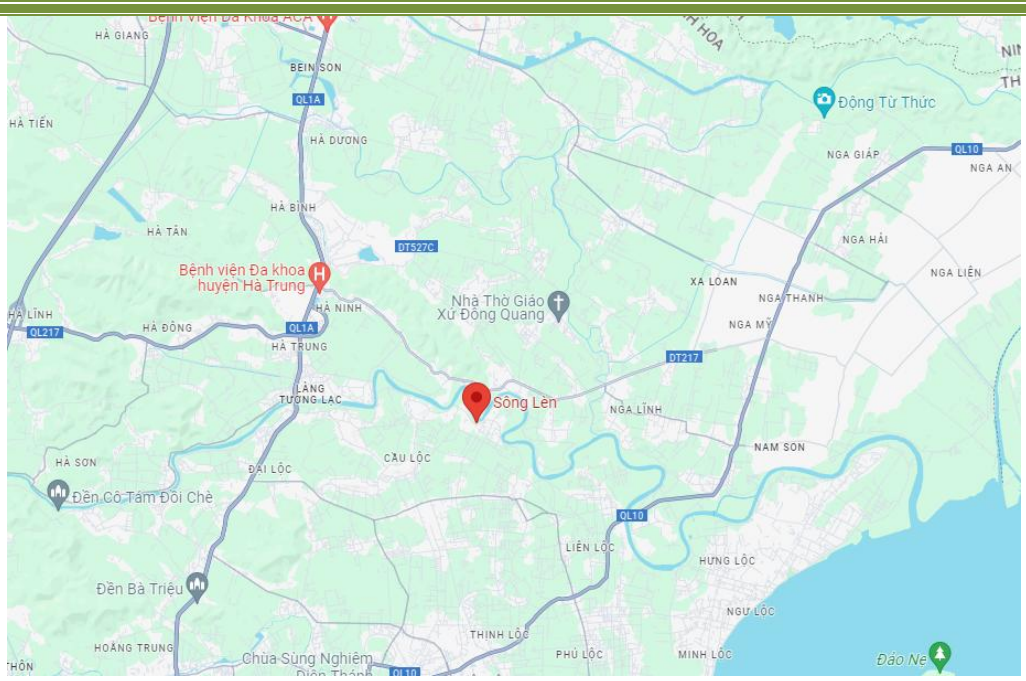

Figure 1: Len River, Vietnam

The river is separated from Ma River in Vinh An commune, Vinh Loc district and Ha Son commune, Ha Trung district, flowing eastward into the Gulf of Tonkin at Sung estuary (Lach Sung) located between Nga Thuy and Nga communes. Son and Da Loc, Hau Loc. Len River is the natural boundary of Ha Trung and Nga Son districts (on the left bank) and Hau Loc district (on the right bank).

Len River has a total length of about 34 km, flowing across Highway 1 at Do Len bridge, about 130 km south of Hanoi. National Highway 1 crosses the Len River with the Do Len bridge. Another bridge is Tham Bridge, started in 2014, on Highway 10.

Another case study to apply for Triet Giang pumping station:

Construction location: The project area is in Ha Trung district and Bim Son town, Thanh Hoa province, with geographical location:

North latitude from: 19º59'13" to 20002'44.80"

East longitude: from 105049'29" to 105°55'21”

And there are adjacent boundaries as follows:

The East borders Nga Son district

The West borders Thach Thanh and Vinh Loc districts

The South and Southwest border Hau Loc and Yen Dinh districts

The North borders Ninh Binh province. [1,2]

II. RESEARCH METHODS

1. Collecting documents and statistic data

Through the process of working with construction contractors to coordinate the extraction of volumes of main items for IPC2 payment, the Consultant has collected documents to serve the construction phase. The specific list of collected documents is according to the following table:

- List of acceptance items for IPC2
- IPC2 volume

2. Extract volume from IPC2 payment servicing model

Based on the collected documents on the volume list calculated for IPC2, the Consultant proceeds to extract the main items from the model. Detailed volume according to the following table.

Value Engineering (VE) is a systematic and structured approach that improves projects, products and processes. VE is used to analyze manufactured products, design and construction projects, and business processes.

The general process of conducting VE follows the following order:

Step 1- Orientation: clarify the goals of the meeting such as: What needs to be done; What do customers need and or want; What are the desired characteristics?

Step 2- Information: Information about the project (including design) under consideration is collected to identify the functions of the whole project or each project part. Specific information to collect includes:

- Needs of investors and operators: are the basic requirements that the project must satisfy to serve the basic purposes of investors and operators;
- Customer desires: are things that customers would enjoy if they had but do not serve their needs;
- Project constraints are factors that constrain the design, such as site area, regulations, etc.
- Budget constraints: total amount of money committed to the project, expressed in terms of initial capital and costs for the entire project life cycle;
- Time for design and construction as well as time customers are still interested in the project.

Step 3- Creativity: During the creativity phase, the project technical team will make suggestions to select functions to include in research, usually only some functions requiring high costs are selected. There are a number of commonly used creative techniques, such as Brainstorming, Gordon technique, Synectics technique...

Step 4- Evaluation: The value engineering team evaluates the ideas proposed during the creation phase using one or several techniques. In general, evaluation techniques involve voting with votes assigned to weights, this stage is used to filter down the ideas produced in the previous stage to a few ideas for ease. More managers put in more in-depth research.

Step 5- Development: Accepted ideas, selected in step 4, are researched in detail in terms of technical feasibility and ability to bring economic benefits. Outline designs are made to identify costs and people also often use cost models for the entire project life cycle and software to support calculations during this phase.

Step 6- Presentation: The ideas that have been thoroughly researched and clarified will be presented in the form of drawings, calculations and cost estimates and then the value engineering team will present these results to the organization. organization to deploy this valuable technical activity.

Step 7- Feedback (learning from experience): It is very important that the costing engineer is informed in detail about the ideas that have been put into practice and has the opportunity to verify the design and cost estimate results of the project technical team. It can be said that the job plan is considered the foundation of the value management methodology, so it is often reviewed by organizations.

III. RESULTS

At this stage, BIM application in the construction phase [3, 4]:

Surveying is the most important step to get understanding of the study site (Figure 2). When using BIM, the building is simulated and presented with a visual 3D model on a computer. Designers will easily communicate design ideas to project members, helping them understand better, while also helping to evaluate and choose options more quickly, accurately and effectively.

Figure 2: Some photos of the construction site of Len River

BIM applications during the construction phase: 1) Overall construction site; 2) Update changes during construction; 3) Build and use 4D models to manage and update progress; 4) Extract volume during construction phase; 5) Evaluate projects using value engineering (VE)

BIM helps designers calculate the energy needs of the building. From there, it is possible to change and adjust the design plan so that energy use is economical and effective, ensuring the sustainability of the project. The BIM application model in this project specifically simulates the construction process according to time schedule, helping the implementation of the plan to be monitored more closely and actually implemented in the construction of this project (Figure 3- 8).

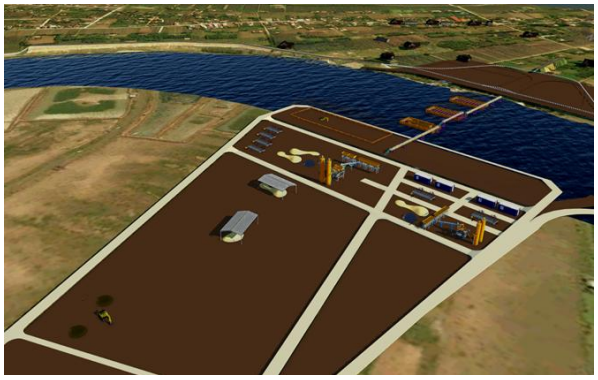

Figure 3: Construction site of Song Len

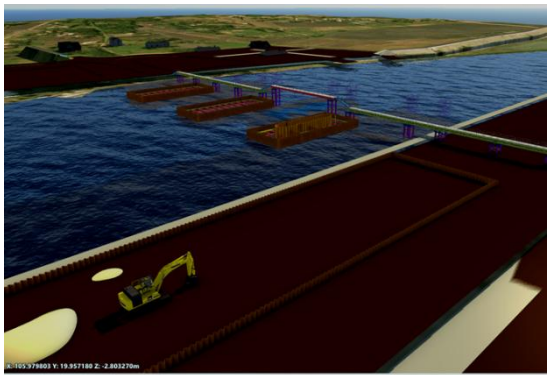

Figure 4: Site plan of Song Len - excavation work to construct the boat lock

Figure 5: Construction site layout of Song Len

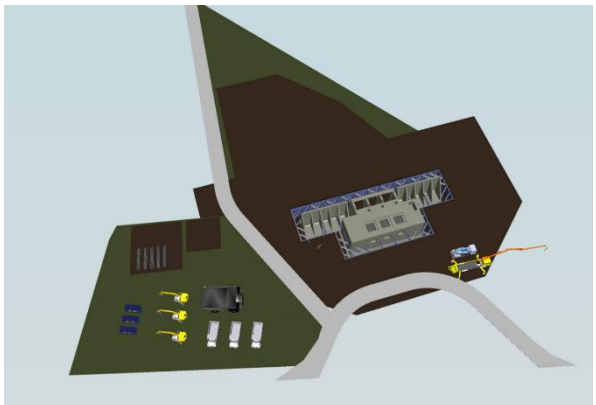

Figure 6: Construction site of Triet Giang station

Figure 7: Construction methods of station and wing walls of Triet Giang Pumping Station

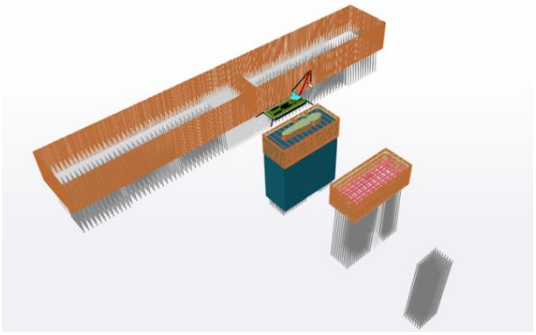

Figure 8: Figure 6. Song Len construction site (March 22, 2022)

IV. CONCLUSION

BIM has a significant impact on increasing overall productivity, along with many other effects throughout the entire construction investment project implementation process. The main advantages that BIM brings to project managers can be clearly seen as follows: 1) Communication management: Documentation using visuals improves collaboration between the different parties that participate in the project. Parties share insights and work together to improve project outcomes, helping to make better and more accurate decisions. Provide real-time project reports, helping partners understand the work and helping customers trust the product. 2) Cost management: Increase the accuracy of estimates, optimally use materials and equipment, minimize project risks, well control progress, volume and quality, financial planning... leading to Reduce project costs, increase efficiency in overall cost management. 3) Quality management: Project quality is better. Project management is improved, the quality of finished products is higher. 4) Progress management: Better planning and management is one of the advantages of BIM that increases productivity during the construction phase, minimizes wasted time, optimizes material planning, prefabricated components, equipment, and thereby ensure the progress of all project phases. 5) Change management: Integrating different plans from members into the same system allows for immediate conflict detection, quick unification of technical content, and synchronous and timely handling. for changes and limitations that arise during project implementation stages.

Some obstacles when integrating BIM for projects:

BIM creates a holistic and continuous workflow, which is essential for project managers to achieve as they use procedures and regulations to establish a common environment that benefits all parties. relate to. Designers use BIM to create a feasible model for construction, cost managers need to make accurate estimates, and supervisors use it to ensure quality, safety, and construction progress factors. build. The project manager must ensure that the product created achieves optimal results in the overall control problem.

During the construction process, there still needs to be coordination between relevant parties and adjustments to actual increases or decreases. Differences between BIM design phase and actual implementation phase still need to be anticipated by project managers to be addressed accordingly, often including: clear goals, detailed plans and supply chains identify.

We can point out three important issues that project managers often encounter during the BIM integration process: 1) Level of application: Carefully consider applying the appropriate level of BIM to the project, an inappropriate choice can lead to members recommending the complete elimination of BIM. 2) Development vision: After deciding on how to approach BIM implementation, it is necessary to create an appropriate vision for BIM implementation that includes unit-wide goals, processes that will be transformed, and roadmaps. expected course of these changes. 3) Implementation form: There needs to be unity among departments, from leaders to employees, when implementing BIM. If the proposal comes from only one of the two sides, the risk of failure is very high. 4) However, it is necessary to pay attention to complying with the roadmap for applying BIM in construction activities.

According to the general assessment from the Central Management Board of irrigation projects, up to now, although there are many items behind schedule, the overall progress of the entire project basically still meets the set milestones. If relevant parties make joint efforts, the goal of completing and putting into use this large irrigation project in 24 months is still feasible.

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