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Introduction

In this document it is intended to provide a more detailed overview of building information modelling (BIM) and how SODIS LAB works with BIM.

This document contains the following information:

• The definition and advantages of BIM
• The services SODIS LAB provides in BIM
• Selection of projects
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SODIS LAB offers a large range of services for the building and civil infrastructure industry. The main focus of SODIS LAB and its specialized services and products, is on the safe development and operation of buildings and civil infrastructure. This focus comes to light in the development, installation and maintenance of building equipment monitoring systems (BEMS) and structural health monitoring systems (SHMS). Additionally, SODIS LAB is able to evaluate terrorist and other attacks to civil engineering projects and provide recommendations for improvement of the safety of building and civil infrastructure. They are also able to manage complete BIM projects and provide full MEP, communication and security system design, 2D-3D transformation and visualization.

The company was founded in 2005, but research to SHMS and BEMS started in 1998. Currently, SODIS LAB has its headquarters in Moscow, Russia and a branch in Melbourne, Australia. In total 60 employees work for SODIS LAB, many graduated from prestigious engineering universities. It has worked on more than 200 projects for the development of SHMS and BEMS, including the Sochi 2014 Olympic venues and the FIFA 2018 world soccer cup venues.

SODIS LAB is a member of the Council on Tall Buildings and Urban Habitat (CTBUH), the leading organization for high-rise buildings, and a member of the International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII), the world’s leading organization for monitoring systems. They have received the Autodesk Innovation Award in 2013 for their rapid development on and work in building information modelling.
BIM defined

Introduction

The design of buildings and other structures requires the involvement of many different disciplines (figure 1), all with the goal of completing or managing a structure. The management of all disciplines to reach this goal is a complicated task and the use of building information modelling has grown rapidly to address this issue. Not only the management but also the technological integration of all different engineering systems is difficult.

The National Building Information Model Standard Project Committee defines BIM as follows:

Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.

Building information modelling (BIM) is a tool, both for technology and management, which assists in the complicated integration of all disciplines.
BIM as a technological tool

The design process of a building starts with an architect, designing a 3D building. This is transformed to 2D plans, description documents and many other pieces of paper for the other disciplines. Those other disciplines transform it to 3D again in which they design their system.

BIM as a technological tool is, simply said, an integrated 3D platform which allows the architect to design in 3D, handing it directly over to the other disciplines who also design in 3D in the same platform. BIM allows for the integration of all disciplines in one platform and determine the discipline interaction.

By designing directly into 3D, complex geometries become available for construction. On 2D plans these complex geometries can easily become almost impossible to design, BIM allows direct visualization but also the listing of all materials required plus the manufacturing of them. BIM models easily allow off-site manufacturing after which the parts are delivered to the site and simply installed.

Advantages:

- Clash detection between different disciplines
- Interconnection design between different disciplines
- Direct link between 3D models and 2D plans
- Visualization & rendering
- Complex geometry design & manufacturing
- Automatic parts list generation
BIM as a management tool

Using a single 3D platform for the development of a building allows the different disciplines to work together in a platform all understand. Meetings between disciplines require less explanation and much less paperwork.

Based on the 3D model, construction companies can order the exact amount of materials, and therefore reduce waste and cost. It also encourages planning and production optimization.

It is not only in the design and construction stage that BIM is of help. After building construction, BIM models can continue to be used for asset management and interior layout. Interior design companies can add their designs in the model, and having such model immediately means that all assets are listed in it as well. Renovations and repairs can easily be made as a model is directly present to work with.

Advantages:
- Better coordination and development management
- Material management, planning and optimization
- Time, cost and waste reduction
- Asset management
- Optimized future work

Worldwide requirement

BIM is rapidly being employed all over the world and it’s not only companies who see benefits in its use.
- BuildingSMART is a worldwide non-profit organisation maintaining openBIM standards [4].
- The United States has the National BIM Standards committee [5], setting standards in BIM usage. Some governmental organisations already require it for some projects [3].
- The Institute for BIM in Canada (IBC) is facilitating the use of BIM in Canada [6].
- The government of the United Kingdom requires companies to use BIM in governmental construction projects by 2016 [1].
- The government of The Netherlands requires companies to use BIM in governmental projects and therefore have set requirements on how to use BIM in their environment [7].
- The government of Australia is recommending BIM for government projects and will likely require this by 2016 [2].
- In the United Kingdom, a February 2012 survey found that 31% of construction professionals were using BIM [8].

Summary

By designing directly into 3D and in a single system understood by many disciplines, projects will progress faster, more efficient and at lower costs. Many projects have shown a 20% cost decrease by using BIM compared to traditional design methods.

Detection of errors can easily be seen and don’t require lengthy meetings and unclear 2D documents distributed among many project partners. A single BIM management company can keep the oversight of a large project, and maintain the ‘final’ BIM file while detecting design issues and managing the correct companies associated with those issues.

A model created through BIM is easily expandable and the preferred method of asset management.
BIM Services by SODIS LAB

Introduction

It is impossible for a company to say they offer “building information modelling” (BIM). Each company can use the tools of BIM, and SODIS LAB does the same. Of course, SODIS LAB tries to leverage all benefits of BIM over the use of traditional methods, however the link between traditional methods still has to exist due to certain government regulations such as document approval.

SODIS LAB offers the following services while using building information modelling:

- BIM project oversight
- Transformation from traditional 2D plans to 3D models
  - Structural system
  - MEP system
- Design of systems directly into BIM
  - MEP systems
  - Communication systems
  - Security systems
- Visualization
- Document approval process
- Specialized tool development
- Operational management

BIM project oversight

Within a design project, many disciplines will have to work together and provide a final error-free design ready for construction. Even though certain companies might design with building information models internally, combining the models into one, detecting overlaps, issues and potential constructional issues is still to be performed. It is also common that certain companies have never worked with BIM before and that different companies work with different file types.

SODIS LAB is able to perform BIM management and provide BIM project oversight, which includes the management of all design companies, the maintaining of a working BIM model and final BIM model. SODIS LAB can combine multiple models into one, including the transformation of non-BIM models and traditional designs into BIM. This will result in a BIM model which is ready for construction, optimized for cost and construction speed and contains all assets off the building or structure, so that the model can also be used for operational asset management and is ready for the future.

The BIM project oversight can easily be combined with SODIS LAB’ own expertise of MEP and other systems design.
Transformation of 2D to 3D

Many older buildings requiring renovation or modification, or designs made with traditional design methods, can be transformed to BIM models. The engineers of SODIS LAB have been working with many projects requiring exactly this transformation. SODIS LAB prefers not to use point-cloud laser scanning, as the resulting models are unnecessary large and are difficult to be used as asset management models. Instead, models are manually created with assemblies and the special transformational tools the Laboratory SODIS LAB researchers have developed. If needed, new tools for transformation are developed specifically for the project.
System development

SODIS LAB is able to develop mechanical, electrical, plumbing, communication, safety and security systems for buildings, stadiums, bridges and other structures. This means that SODIS LAB can develop all systems needed for the operation of a building.

Together with the partners of SODIS LAB, the structural system can also be designed. In that sense, SODIS LAB can be the design consultant for certain projects.

Visualization

One of the powers of building information modelling is the possibility of visualization. As a BIM is intended to contain all assets, the visualization of the model will get as close to reality as possible without having an actual construction. The preferred method of communicating to owners, partners and potential customers, SODIS LAB can also visualize the BIM models for this purpose. SODIS LAB has already created many BIM visualizations which have been published in news media and magazines.
Document approval

Governments still require 2D documents for approval. SODIS LAB uses conventional and specially developed programs to create 2D documents from building information models as are required for government document approval.

Specialized tool development

SODIS LAB works in the preferred program for BIM: Autodesk Revit. However even Revit has limitations, and SODIS LAB has developed several tools to provide for faster and more efficient BIM usage. These tools are:

- Batch processing tools for large amounts of source data
- Several tools for automatic 2D to 3D transformation
- Integration of ANSYS modelling details into a Unified Building Model that works between Revit, ANSYS and the SODIS LAB software for visualization and structural monitoring
- Linking of planning documents directly with Google Docs

As SODIS LAB is working with more projects requiring BIM and BIM has proven a very efficient tool for complete system integration, more tools are being developed at a rapid rate. Although it is impossible to list all the tools and the new tools that will emerge soon, the availability of these tools will only benefit you as your project will be performed faster, more efficient and therefore at a lower cost.
Operational management

SODIS LAB brings BIM into the operational and maintenance stage by creating models which are used for structural health monitoring. A separate brochure on structural health monitoring is available, but it shows that BIM is not a tool for only the design of buildings. A simplified model runs in a Google Earth like environment displaying events on a computer screen of the operator. SODIS LAB has developed a specialized visualization engine based on the models from BIM to work in the operational stage, so that specialized training for operators is not necessary.

SODIS LAB sees complete building management as the logical next step for BIM. Although a building management system like this is not yet present, SODIS LAB is looking to work with industry and research partners to develop a single software solution for fault detection and operation of all systems in a building.
Project Selection

Introduction

Since 2011 the dedicated research institute of SODIS LAB, Laboratory SODIS LAB, has worked on the question how to implement building information modelling into the operation of structures. It has developed models for many structures, mainly stadiums due to their complexity. The following are a selection of SODIS LAB’s projects where BIM is used. SODIS LAB is now using BIM for any project as it significantly improves the workflow.

Sochi 2014 Olympic Complex

In February 2014 the Winter Olympic Games were held in Sochi. For this event, a large amount of new stadiums were constructed. SODIS LAB was heavily involved in this project and developed building information models for each stadium. Special algorithms were developed specifically for the bobsled track, where SODIS LAB used its 2D to 3D transformation knowledge in creating BIM models.
All models are currently also used in the operation of the stadiums, through the building equipment monitoring and structural monitoring services SODIS LAB offers.

SODIS LAB finished the following projects:
- Bolshoy Ice Dome (Ice Hockey Arena)
- Fischt Olympic Stadium
- Adler Arena
- Iceberg Skating Palace
- Shayba Arena
- Russki Gorki Jumping Centre
- Ice Cube Curling Centre
- Bobsled Track
- Organising committee office building

**Moscow City High-rises**

The business centre of Moscow is rapidly expanding with a master plan for more than 15 high-rise buildings. When completed, the top 10 of Europe’s tallest buildings will be rewritten with more than 7 being located in this business centre.

In its initial stage, SODIS LAB worked closely with the planning authority in creating an emergency response plan for the complete area. This included the analysis of terrorist actions, how the public would react and how emergency response would deal with it. Additionally, improvements for safety were given.

Currently, SODIS LAB is involved in many individual buildings, designing and installing structural monitoring systems (SHMS) and building equipment monitoring systems (BEMS). Many of the buildings required the transformation of 2D plans to 3D models.
Baltic Sea Tunnel, St. Petersburg

St. Petersburg’s expanding city required a new ring road highway to the north of the city. This ring road would require a bridge or tunnel across the Baltic Sea inlet. However, this inlet is a busy shipping route and therefore a tunnel was required. Additionally, flood protection was needed to protect St. Petersburg from flooding. Both a submersible storm surge barrier and a 1.2 kilometre underwater tunnel were constructed at the same location.

Although originally designed without BIM technology, SODIS LAB revisited the project and re-engineered the tunnel into an extensive and more comprehensive BIM model. This model and the new visualization engine of SODIS LAB are now used for the operation of the tunnel.

Summary

Partnering with SODIS LAB will give your company a competitive edge by being able to offer your customers the benefits of the BIM technologies. Of course SODIS LAB is also directly available for project work. As SODIS LAB has both building and MEP engineers and software developers, any tasks requiring improvement or project specific algorithms can be implemented by the software developers and used by the engineers.

Seeing that the world’s governments are (soon) requiring the use of BIM, embracing the use of BIM will ensure your company’s future.

For information on how SODIS LAB can assist in your projects, please contact our international director for more information or to set up a meeting. To reiterate how SODIS LAB can assist, here are our service offers again.

- BIM project oversight
- Transformation from traditional 2D plans to 3D models
  - Structural system
  - MEP system
- Design of systems directly into BIM
  - MEP systems
  - Communication systems
  - Security systems
- Visualization
- Document approval process
- Specialized tool development
- Operational management
These references indicate mainly websites as sources for the international governmental requirements of building information modelling.

1. http://www.nationalbimstandard.org/faq.php#faq1