BIM+GIS Integration methods for an Infrastructure Project in Amsterdam

GeoDesign+BIM 2018, 01.11.2018 – 02.11.2018, Amsterdam
BIM+GIS Integration methods for an Infrastructure Project
Client: ZUIDPLUS - Project realisation: HEIJMANS, FLUOR, HOCHTIEF

BIM + GIS

Infrastructure - Project

Location:
Amsterdam South

Highway A10, ca. 6 km

Shifting of Lanes,
Widening

Tunnel Constructions (2)

Bridges (2)

OVT (Railway Station)

Start of Construction 2019
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Objectives:

Recognizing and identifying at the present time, the dependencies that will occur in the future within the project lifecycle. Solution > Integrate standardized - according to official rules - Information of various disciplines (TEAM) into an entire model (WORK)

A better understanding of the relationships within the entire project. (technical – temporal > Construction Method > Costs)

Public acceptance – the model features are linked to the production documents

The model is the result of numerous recursive processes (TEAM)

(WORK) depending on the level of detail, which have to be done (++) in order to create the precise information model. In the construction phase, assumptions are confirmed or a redesign and rescheduling has to be established. The changes will be incorporated into the model.  
> The reason for the model change will be captured.
> Relevant documents will be linked to the object and stored into a DMS.

Reducing collisions (geometric, temporal, financial) already in Design and Planning phase
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Project DB for Infrastructure projects

- Tender Information
- Design Information
- Time Schedule
- BIM+GIS Storage

Tender Projekt DB

- International / National Standard – Design Requirements
- OGC - GIS
- IFC - BIM

TIME SCHEDULE 4D
CONSTRUCTION 3D Features ++

ESTIMATION
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Fundamental definitions and statements:

- Intention of all participants in the project (Client + Contractor) to use BIM during project phases
- Target of BIM -> Holistic model of all trades, including time scheduling for realization and the construction expenses for the project

Questions:

- Which BIM+GIS tools are used to reach the BIM targets? > IT Setup
- How GIS+BIM tools are used for project realization? – User Interface / On- or Offline
- Use Cases for (BIM + GIS) > Analysis of questionnaires
- Communication tools> IntraNet / Internet / Cloud
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BIM - Project Execution Plan for Infrastructure Projects:

- General inherent Project description in relation to BIM
- Staff and Responsibilities
- Used Software and Interoperability in between the Software - Tools
- Containment of models (2D, 2.5D, 3D, materials, dimensions, quantities, etc.)
- Delivery objects (details and chronologic sequence, coordinate-system)
- BIM&GIS Rules and Standards – Quality checks (?) (building smart IFC)
- Definition of rules for interaction (rules, formats for data transfer / -exchange)
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BIM + GIS Project management / Data – Information Pool

Central Data Storage for Infrastructure Projects

- Tender Information
- Design Information
- Time Schedule
- BIM/GIS Database

- Projekt Database
- BIM/GIS
- Time Schedule
- Estimation
- Etc...

- Transfer to Client
- As Built / Documentation
- Realisation Constructionphase
- BIM/GIS Database

Single source of truth repository
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BIM – Execution Plan

- Software to be used and Interoperability between the Tools (technical)
- Design Software for the trades
  Versions and Releases (Fixing during entire project phase)
- All Software products which are relevant for realizing the project will be established.
  (Important is the protocol which software was used to generate the result)
- Software for Structural - Infrastructure, Special modules, geo-technical Module
- Definition of Interfaces between the tools (!data transfer without loss!)
- Usage of database systems (Access, Concept, Administration)
- Usage of Web Technologies (Access only from project stakeholders?)
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Representation of the IT infrastructure and Interfaces for the preparation phase (partly)
Analysis of demands

- Number of Users, Software > Cost estimation for the entire IT setup

Example: MicroStation Mx, Revit, Civil3D, MS-Office, SharePoint, ArcGIS, WebGIS, .....
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BIM – Project execution plan

- Content of model (2D, 3D, Material, Quantities, Dimensions, etc...)
- Objects to supply (details and time sequence)
- Accuracy information (LOD) – Quantity lists as well as status information for design
- Time Schedule for the delivery of the BIM – models
- Interval for updates (versions) of the BIM – models (and their parts)
- Modeling guidelines (project related Trade -Templates, Codes)
- Internal setup of models (Only 3D Objects, with quantity information or parameter controlled models, Context > derive 2D Drawings from model)
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BIM - Project execution plan

Storage system for model stages and versions (releases) - (BS 1192- 12007) (ISO 19650)

- Project Setup
- Work in Progress (WIP)
- Shared
- Published

Demands, Platform, Processes

- Internal Models for specific Disciplines
- Free for Common Usage
- Verified Design for Procurement
- As-Built Model for Maintenance
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BIM – Project execution plan

- BIM Rules, Definitions and Standards – Quality checks
- Interaction and Communication (Rules, Templates for Data transfer / Exchange)
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Communication tool Navisworks (14 - days Update with expiration date)
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Merging of Models from Trades – Clash detection

Update Interval 14 days – GIS Online Services 14 days.

Revision unnecessary. Elements consistent (Consensus)

Review: -->Change required
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GIS as Online Portal – Cloud solution
Rules, definitions are tailored as “Use Cases” by interviews focusing on demands in departments

Online Services based on „Use Case“

CAD_XREFs
3D Models
Lists

Rules ++

Specific geometric Conditions

Spatial DB
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3D Building Information System (3D BIS)

Rapid data mining and dashboard overviews for project progress (design+construction)
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Better Decisions by Integrating, Analysing Project Data in Design and Construction Phase
GIS as Support Tool for BIM
Simple Example: (Use Case: Geologic investigation)

Task:
Which kind of soil classes are covered by the Tunnel segments – create 3D Solids (+Attributes)

Data:
Geologic Investigation as Raster Data, BIM Model of Tunnel

Workflow: Raster data (GIS) to 3D Solid (BIM)
- Raster data Read and Classify
- Transform Raster to Vector data
- Transfer BIM via IFC to GIS
- Multiple Intersections by Vector data
- Volume Calculation based on tunnel-segments sorted by Soil classes
- Presentation of Sections in MS-Excel -> Geo Processing
- Transfer to Solids (BIM) 3D Solids with Attributes
**BIM+GIS**

Main Advantage: BIM+GIS

Setup a Geo Processing Chain

Unique Identification

Export to common formats > MS Excel, on demand

Transfer of defined Codes for tunnel segments and soil classes to the result

Volume calculation

Output: Soil Volumes by Construction Segments
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USE CASE: Ecology

Trees and vegetation – habitats – rough time scheduling
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Simple Example Logistics

Information about general Logistics Items and Locations.
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Requirements

**Education**

- Personnel – Educate to handle both technologies -> BIM+GIS
- Knowledge of BIM+GIS for infrastructure projects (particulars)
- General Expertise in infrastructure – Design, Work preparation and Realization
- Collective Work *(TEAM)* into an integrated platform

**Support of the Management for new Technology GIS/BIM (Geo-design)**

- Generate better Understanding in Project Departments for **BIM / GIS**
- Recognition of Advantages by using the new technology BIM

**Development of project tailored solutions**

- Realization of project specific Workflows
- Usage of external expertise
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Summary:

In order to merge the "technical data" of a project it is important to set up common rules in order to be able to integrate all trades into the overall model in a simple and structured way.

Use cases for each area are to be discussed and their way of implementation determined.

Standard templates for the software tools used must be created. Layer, Object description

Employees must be trained. Software knowledge is a basic condition.

Target:
Cloud-based efficient WEB (BIM+GIS (3D ++)) with analysis functions for project stakeholders.
We are building the world of tomorrow.

Thanks for your attention.

"Das Ganze ist mehr als die Summe seiner Bestandteile"

"Het geheel is meer dan de som van zijn bestanddelen"

"The whole is more than the sum of its constituents"

Questions are welcome !!!