

BIM IN INFRASTRUCTURE CONSTRUCTION Martin Kríž, M.Sc.

BIM Expert

STRABAG Innovation & Digitalisation / BIM 5D®

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STRABAC

PRESENTER

Martin Kríž, M.Sc.

2002-2008

2008-2012

STRABAG Innovation & Digitalisation / BIM 5D® BIM Expert



Studies in Slovak Technical University in Bratislava Focus: Infrastructure design and construction

Ramboll Finland Oy, Espoo, Finland Design Engineer – road and street planning

- 2013-2016 **Trimble Solutions Finland (Tekla)**, Espoo, Finland Account manager, Civil Engineering and construction, BIM software solutions
- 2016-2018 **Civilpoint Oy (Vianova),** Espoo, Finland Account Manager

From 2019 STRABAG AG, Vienna, Austria BIM Expert – STRABAG Innovation & Digitalisation









BIM FOR INFRASTRUCTURE CONSTRUCTION

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3 PRACTICAL BIM USE CASES





3



WHAT DOES BIM MEAN?

Building Information Modelling (short: BIM) is a work method to support networked development, planning, construction and use of buildings with the help of software. Thereby all relevant information is modelled in a dedicated and role-based manner, combined and collected digitally, and updated intelligently throughout the lifecycle of the building structure. Digital twins of the building structure are created.



Designing

Model-based planning and analysis of building structures in the context of corporate data and real environmental information. With GIS, the BIM model data gain a georeferenced link with the real location (GeoBIM).

Planning and Scheduling of Work

From the draft to the finished working and detailed drawing – model-based coordination of the technical trades accomplishes conflict-free planning as the basis for networked scheduling of work (4D) and model-based costing (5D).

03/22 07/22

11/22

03/23



Construction (BIM2Field)

Use of model data to control fabrication and production – networked project data enable optimised logistics, efficient surveying and equipment control on a paperless building site. Quality assurance, settlement and documentation are model-based.



Use (BIM2FM)

Model-based information is taken over from the construction phase selectively in the operating phase and is used in the central management, maintenance and later sustainable exploitation processes. Modeldata also serve to embed IoT systems.



DEVELOPMENT OF THE ROAD DESIGN









DIGITITALISATION IN THE CONSTRUCTION INDUSTRY BIM – Building Information Modeling





DIGITITALISATION IN THE CONSTRUCTION INDUSTRY

BIM – Building Information Modeling

• BIM in planning phase (3D)







DIGITITALISATION IN THE CONSTRUCTION INDUSTRY

BIM – Building Information Modeling



- BIM in planning phase (3D)
- Use of innovative hard- / software in surveying







DIGITITALISATION IN THE CONSTRUCTION INDUSTRY BIM – Building Information Modeling

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DIGITITALISATION IN THE CONSTRUCTION INDUSTRY BIM – Building Information Modeling



Scheduling





EXPECTATIONS

✓ more efficient

✓ more coordinated

✓ more on-time

✓ more on-budget

✓ transparent







STRABAG BIM PILOT PROJECTS – STRABAG MAPS



BIM PILOT PROJECT ORADEA MOTORWAY

PROJECT BASIC INFORMATION

- Running project
- The project foresees the execution of a motorway as "green field project "with a total length of 18,961km. The project includes the design activities.
- The works include geotechnical works such as retaining structures, utility relocation and protection, concrete ditches, culverts, one temporary interchange, bridge construction, and road safety items.

BIM GOALS:

- BIM knowldege transfer
- BIM to field
- GIS Integration
- Quadri Integration
- Implementation of new platforms for Machine Control and progress monitoring

BIM UCE CASES:

- UC1 Existing conditions modelling
- UC3 Visualization
- **UC5** Coordination of disciplines
- UC10 QTO and Costing
- UC12 Time scheduling
- UC15 Control of the Construction process
- UC21 Machine Control



BIM PILOT PROJECT TARNAVENI BRIDGE

PROJECT BASIC INFORMATION:

- Pilot executed in 2019
- Design and build a new bridge over the river Tarnaveni Mica
- Demolition of the old bridge
- Pre-stressed beams 35,5m long

BIM GOALS:

• First BIM project in Strabag RU - BIM knowldege transfer

BIM UCE CASES:

- 3D-model production
- UC3 Visualization
- **UC5** Coordination of disciplines
- UC10 QTO and Costing
- UC12 Time scheduling
- UC14 Creation of execution drawings
- **UC15** Control of the Construction process



AMS WORK





BIM PILOT PROJECT ARGHEZI BUILDING

PROJECT BASIC INFORMATION



The building is located in the centre of Bucharest, at the intersection of Tudor Arghezi street and Jean Louis Calderon having access to both streets in the Piata Univesitatii area, in the immediate vicinity of Piata C.A. Rosetti. The terrain on which the building is located has an area of 2.098,00 sqm. The main pedestrian access is from the street Tudor Arghezi, the car access is being made from the same street, whilst the exit will be done using a separate exit ramp on street J.L Calderon

PROJECT GOALS

- To make information more intuitive and accessible (in meetings and on site) in order to create a broad interest in BIM.
- To reduce complexity, latency, and waste in building processes.
- To create as much experience and content as possible to be used in subsequent projects.

BIM USE CASES

- UC 3 Visualization for better communication
- UC 5 Geometric Collisioncheck
- UC10- Quantity Take-off Work Estimation
- UC12- Construction process visualisation / Schedule based on model data
- UC15- Scheduled target/actual comparison / Model based performance preview
- **UC18-** Defect management



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3 BIM USE CASES



USE CASE MANAGEMENT

- Analysing of the project
- Definition of practical Use cases for every project
- Internal BEP



Use ca	ses (It. Stufenplan BMVI)	IST	2018	2019	2020
UC 1	Initial data collection				
UC 2	Feasibility studies (investigation of the planning variants)				
UC 3	Visualization				
UC 4	Design and verification				
UC 5	Coordination of the disciplines				
UC 6	Control of the progress of design				
UC 7	Creation of the drafts and design for approval				
UC 8	Planning and testing of the work safety and occupation health				
UC 9	Approval management				
UC 10	Cost estimation and calculation				
UC 11	Bill of quantities, submission, tendering				
UC 12	Schedule planning and execution				
UC 13	Logistic planning				
UC 14	Preparation of the execution plans				
UC 15	Control of the construction progress				
UC 16	Change management for the changes in the plans				
UC 17	Billing for construction services				
UC 18	Defect management				
UC 19	As-built documentation				
UC 20	Use for operation and maintenance				
UC 21	Machine control				





COMMON DATA ENVIRONMENT

- SINGLE SOURCE OF
 TRUTH
- Data available for everybody from everywhere







MODELING OF EXISTING CONDITIONS





- UAV METHOD
- MOBILE MAPPING
- CONVENTIONAL SURVEY
- 3D terrain survey (pointcloud) DTM for modeling works











3D MODELLING



- Internal modeling works based on 2D design (dwgs,pdfs)
- Defining requirements for external designer to deliver correct BIM model
- BIM models consisting of solids (earthworks, superstructure, BoQ ...)
- Model full of non-grafical information (attributes)
- Models are based on National Data standard
- Outputs for: Machine control, logistic planning, Scheduling and BoQ





SCHEDULING AND LOGISTIC PLANNING

• MASS HAUL LOGISTIC



TIME SHEDULING

BILL OF QUANTITIES

- Derivation of BoQ •
- BOQ based on national data standart SFDI •
- BOQ connected with the model in iTWO .



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AUGUMENTED REALITY

- Trimble SiteVISION AR
- Models out of Trimble Connect
- Visualize the solid model on site, measuring, making notes, photos etc.quality control
- Checking of elevation and position of machine control surface models





MACHINE CONTROL

- Extracting earhworks and road structers as surface out of BIM model
- Machine Control for earthworks, paving and drilling/piling
- Online communication with machines over platforms
- Controlling based on the data from machines



PROGRESS MONITORING

- Analyzing of the as-built data
- Volume based monthly reporting
- Control of the construction progress
- **1. BASED ON THE DRONE DATA**
- 2. BASED ON THE DATA FROM MACHINE CONTROL



Cilový konec : 30/06/22



Doudleby obchvat



Trimble WorksOS

lý projekt 21/03/22 - 14/06/22

vhodnocení kvality údajů

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BIM STANDARDISATION – EXAMPLE FROM CZECH REPUBLIC



*slight delay – from beginning 2023

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BIM STANDARDISATION – EXAMPLE FROM CZECH REPUBLIC

NATIONAL DATA STANDARD IN CZECH REPUBLIC

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100 Objekty pozem. komunika	í			-															
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PKCategory Reference Hlavni trasa

IMPLEMENTATION OF DATA STANDARD

	100 Objekty pozem, komunikas						-															
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		x	x	x	x	násyn/aktivní zóna	1	1	1	1	3	1	11+51+F1+71+M3+F1	3DPovrch	P11	P5	P5	P4	<u> </u>			
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		0	0	x	x	svahová žebra								3DPovrch			P5	P3	_			
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		0	x	x	x	přídlažba	1	2	1	1	1	1	I1+52+E1+Z1+M1+F1	3DTěleso		P2	P2	P1	+	x	×	
		0	0	x	x	rásypy (např. mezi svodidly)	1	2	1	1	1	1	11+52+E1+Z1+M1+F1	3DPovrch		P2	P2	P1	+			
	záchytné systémy	х	x	x	x	tábradli	1	2	1	1	1	1	I1+52+E1+Z1+M1+F1	3DTěleso	P5	P3	P3	P3	\perp	x	x	
	II	x	x	x	x	svodidlo	1	2	1	1	1	1	11+52+E1+Z1+M1+F1	3DTěleso	P5	P2	P2	P2	1			
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THANK YOU! MARTIN KRÍŽ STRABAG

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