



Velsertunnel: Integrated BIM for failure free retrofitting of a motorway tunnel The Netherlands

Presented by : dr. ir. Jan Van Steirteghem









Integrated BIM for the failure-free retrofitting of a motorway tunnel

Innovation creates a fixed link between contractor and stakeholders



Chuzhou-Nanjing 7th November 2018



PROJECT: RENOVATION OF VELSERTUNNEL











As-built information consists only of 60-year old drawings > UNCERTAINTY EU Directive 2004/54/EC on safety requirements for tunnels in TEN-T network > QUALITY High density of Traffic & Safety equipment and installations > COMPLEXITY Tunnel closure contractually limited to 9 months > DEADLINES



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INTRO – RISK-DRIVEN BIM-STRATEGY



TECHNICAL PROJECT INNOVATION • OF THE YEAR

1. First think Risk identify and analyse key risks to project goals, for each phase

2. It's all about the process! define mitigating measures + implement control processes focused on managing the key project risks

3. Risk-driven BIM strategy risk management as driver for *BIM Execution Plan !*



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INTRO - THE BIM GOALS





Aim for zero failure project > First-time-right!

> Create a single common data environment
> Integrate all engineering processes
> Focus on requirements & interface management









bim as in Building Information Modelling

- 1. to improve the conceptual / architectural /engineering process
- 2. to integrate and coordinate all design disciplines, to avoid clashes
- 3. to automate the production of drawings, quantities, planning, ...

BIM as in Building Information Management

- 1. to assure project quality (scope, time, budget)
- 2. to integrate the project management information and processes
 - 3. to reduce failure costs > to manage project risks



CAPTURING THE AS-IS REALITY





As-is survey by static laser scanning:

- accuracy \rightarrow 5 millimeters
- fast \rightarrow 2 night closures
- complete \rightarrow all details included
- flexible \rightarrow single survey, multi measure

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CAPTURING THE AS-IS REALITY



Modelling in Civil3D & Revit:

- object-oriented model
- direct from point-cloud

AITES

- model on a need-to-know basis
- point-cloud always in background

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CAPTURING THE AS-IS REALITY









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PAYING FOR THE AS-IS REALITY





	Scan cost	Design cost	Renovation cost	Maintenance cost
	[EUR/m²]	[EUR/m²]	[EUR/m ²]	[EUR/m²/year]
	0.76	185 (x243)	870 (x1144)	17.6 (x23)
	24000 EUR (2 nights + 2 days)	80% of 10.5mio EUR	80% of 49.5mio EUR	80% of € 1 mio EUR/year
	2x1600mx10m = 32000 m ²	45500 m²	45500 m²	45500 m²
	6.01	190 (x31)	891 (x148)	18.0 (x3)
	2200 EUR (1 day + 1 day)	7.5% of 10.5mio EUR	7.5% of 49.5mio EUR	7.5% of 1 mio EUR/year
	12 rooms; 366 m ²	4165 m²	4165 m²	4165 m²
in general (for buildings)	2 à 4 **	-	400 à 1000 *	110 *





MODELLING THE RETROFIT REALITY





BIM coordination as a constant control process



Integration of highway design (Bentley MX, Civil 3D)

with structural design (Revit)



and technical installations (AutoCAD 3D, Plant 3D)











MODELLING THE RETROFIT REALITY





BIM coordination as a constant control process







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METHOD: SYSTEM ENGINEERING





Systems Engineering (ISO 15288)







METHOD: SYSTEM ENGINEERING



Traditional workflow – document-based



Because information is:

implicit, unstructured and unrelated Chuzhou-Nanjing 7th November 2018 dr. ir. J. Van Steirteghem, Director Engineering



METHOD: SYSTEM ENGINEERING



All non-geometric project information is managed in a SE-database





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Virtual Design & Construction in the project reality



Non-geometric project mgt information > in SE Database Geometric project mgt information > in BIM System

- Up-to-date information: anytime, anywhere
- Direct communication: office <> field
- Fully integrated & managed with/from SE Database
- SE consistent: explicit, structured, related



Non-geometric + geometric

project mgt information

> on mobile devices





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Virtual Design & Construction in the project reality











Virtual Design & Construction in the project reality





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Display

Visibility



Took

Select & Search *

Project *

FROM BIM TO VIRTUAL REALITY





Extending the value of the BIM model to Simulation Applications







FROM BIM TO VIRTUAL REALITY





Extending the value of the BIM model to Simulation Applications







Virtual Design & Construction in the project reality





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EXTENDING THE VALUE OF THE **BIM-**MODEL





During Engineering

> central model for design & interface meetings> simulation of camera installations

During Construction

> 4D-planning
> central source for all setting-out activities
> validation of as-built survey <> as-designed data (first-time-right!)

During Operations

> 4D-planning of inspections & preventive maintenance
> briefing of maintenance crews & training of safety personnel
> asset management

CONCLUSIONS & RECOMMENDATIONS





BIM ... Beyond the image

- 1. Information Management should be part of overall Project Strategy
- 2. Integrating all information (geometrical and non-geometrical) pays off!
- 3. Information you develop during the subsequent project stages is an asset with a tangible value
- 4. Discussing risks an opportunities with your client with respect to information can help to build a strong relationship based on trust which will lead to a win/win situation











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