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Deutscher Ausschuss für unterirdisches Bauen German Tunnelling Committee

BIM in Tunnelling

Webinar - March 18, 2021



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Designing the "I" in BIM

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DEGES Deutsche Einheit Fernstraßenplanungsund -bau GmbH (D)

DAUB/EUTF-Webinar "BIM in Tunnelling" – March 18, 2021

AGENDA



- 1. Introduction
- 2. Motivation: Designing the "I" in BIM
- 3. Result: A tunnelling data dictionary
- 4. A look in the crystal ball

DEGES: (road)ways are our goal



- 30 years of experience
- Shareholders:
 - Federal republic of Germany
 - 12 federal states of Germany
- Public contracting authority
- Project management company until handover to operation phase
- ~ 2900 km highways / ~ 40 bn €



B 90n, Ilmtalbrücke. Foto: Nürnberg Luftbild, Hajo Dietz

BIM-Projects by DEGES (already outdated again)



Extract

...

38 - A1, 8-streifige Erweiterung, Abschnitt Süd

39 - B101, OU Elsterwerda

40 - A81, Eberbach-und Brettachtalbrücke

41 - A1, Ersatzneubau Weserstrombrücke

42 - A7/A26, AS Neu Wulmstorf (o) - LGr. NI/HH

43 – A23, AS Tornesch - AD HH-Nordwest - 6-streifige Erw.

44 - A81, AK Stuttgart - AS Sindelfingen Ost, Erw.

45 - A7/A26, LGr. NI/HH - AK HH-Hafen

46 - A7/A26, AK HH-Hafen - A1/A26, AD Süderelbe

47 - A4, AD Dresden-Nord (m) - AS Pulsnitz (o)

. . . .

Currently ~70 BIM projects



AGENDA



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Motivation: Designing the "I" in BIM





- 3D-modelling is nothing "new"
- 3D-modelling is not "necessary" for engineering success

But:

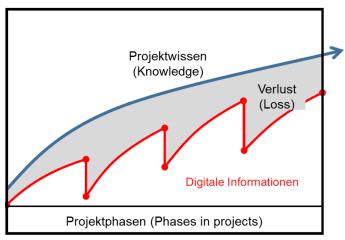
- BIM is more than only 3D-modelling
- Effective information management enables knowledge-based decision making

The "I" in BIM contributes to engineering success ... and thus also to commercial success

Motivation: Effective information management



- BIM can help reduce the loss of information when changing phases in projects
- Reducing information loss requires definition of projected (and anticipation of later) use case requirements
- Effective information management requires <u>also</u> the definition of use cases, actors, deliverables, ...



Source: Building Information Modeling - Techn. Grundlagen u. industrielle Praxis, Bormann et al. 2015

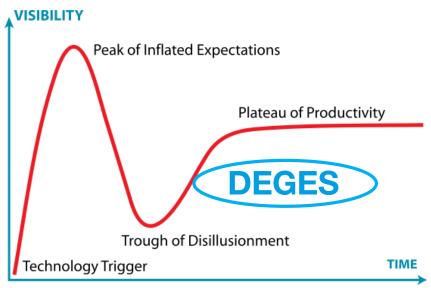
<u>First</u>, construction (and optimization) in the digital world. <u>Then</u>, realization in the real world.

Motivation: we are not quite there yet ...



Gartner's Hype Cycle

- 5 Phases of technology maturity
- Although criticised, it fits to the feeling when implementing BIM

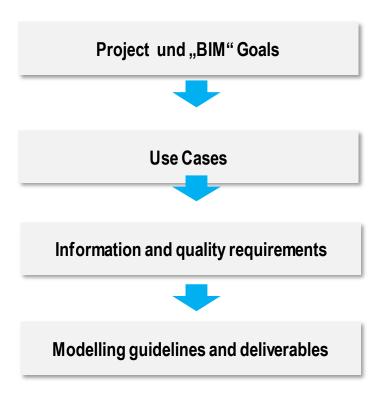


https://en.wikipedia.org/wiki/Hype_cycle

Where do you see yourself?
Where do you see your organization?

DEGES: Employer Information Requirements





- Budget
- Timeline
- Quality
-
- Use Case 1
- Use Case 2
- ...
- Use Case n
- Data exchange formats
- Level of Information Needs (LOIN
- CDE & Workflows
- ...
- Coordinate system, model structure, properties
- Models:
 - Coordinate model
 - Environment, as-built, subsoil, utility lines, ...
 - Alignment, engineering structure, ...

Use cases in planning (and approval) phase



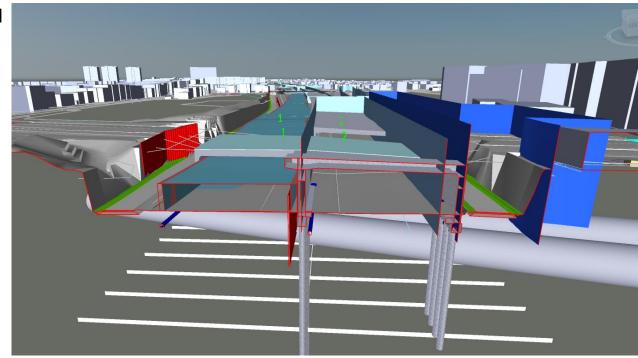


- Design preparation
- Survey of existing situation
- As-built modelling
- 3D ground modelling
- Design variants investigation
- Visualisation
- Coordination of discipline (models)
- Progress control of design
- Derivation / production of drawings
- Cost estimation and cost calculation
 - Bill of quantities, tendering, award

Use cases in construction phase



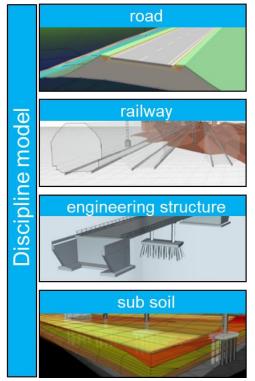
- · Bill of quantities, tendering, award
- Construction Scheduling
- Logistics planning
- Derivation / production of construction drawings
- Construction progress control
- Change management
- Invoicing of construction works
- Issue management
- (Structure) Documentation

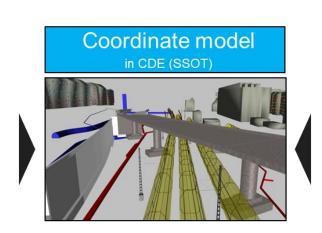


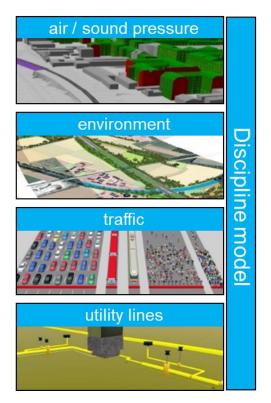
Coordinate model of Highway A7 - Hamburg Altona

From discipline models to one coordinate model









Designing the "I" in BIM



- What questions need to be answered?
- Are these questions the same throughout the project?
- What actors / roles are involved in a use case?
- What information / model do these actors provide or require?
- Is it possible to facilitate the (conventional) process?
- Are there additional process requirements (external standards and regulations)?
- What documents and data formats are exchanged?
- Who has what kind of access to the CDE?
- What kind of CDE-workflows are necessary?
- Who is responsible for a workflow step / status?



AGENDA



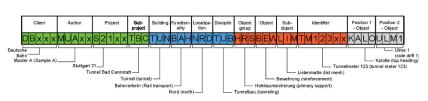
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DAUB object catalogue: a tunneling data dictionary



IFC Projekt	(IFC Projekt)		(IFC Projekt)	((IFC Projekt)																						
Ebono 010 Auftraqqobor	Appurzung spillen spillen antar Duno 020	Abkürzung 6 stellen	Ebono 030 Prnjekt	Abkürzung 3 stellen	(bono 040 Failprujakt	Abkürzung 3 Sfellen	Ebono 050 Baumork	Abkürzung 3 Shillen	Ebono 060 F uktionalität	Abkürzung 3 Stellen	Ebono 070 Lukaliriore	Abkürzung		one 080 -uerk	nellet	Ebene 090 Objekt gruppe (farblich hervurgehabene Zellen rind als Platzhalter für det ailliertere Ausarbeitungen vargeschen)	Abkürzung 3.35ellen	Ebono 100 Objekt		Ebono 110 Tailubjakt		Ebono 120 Idantifikatur	Abkürzung 7 stellen	Ebono 130 Lago 1 - Objekt	Abkürzung 4 Stellen	Ebono 140 Lego 2 - Objekt	Abkürzung 4 Stellen
Berliner Verkehrsbetriebe	xxBVC Firma Muster A		Stuttgart 21	\$21 /	Albabstiegstunnel	AAT					ABC	AE	30 Au	ısrüstung /	NUR	50 Hz (Platzhalter)						Abschlagsnummer_X			FIRS		BERG
DEGES	DEGE: Firma Muster B	MUST	Tunnel Rastatt	TRA /	Albvorlandtunnel	AVT	Baugrund	BGR	Anfahrt	ANF	Dornstadt	DO	DR Br	andschutz E	BRS	Abbruch	AB	Abhängung (Zwischendecke)	AHG	Ankermörtel	AMO	Abschlagsnummer_Y	B0000	Full-Round	FUL	Kern	KERN
Deutsche Bahn				xxx F	Fildertunnel	FΤU				AUF				ückenbau E	3KB	Abdichtungssystem		D Abschlauchung	ASL			Abschlagsnummer_Z	B99993	Gewölbe	GEW		KER1
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							Überwerfungsbauwerk			NHS OB/w					- [Gelände		Auskleidung		HDI-Block	HDB HDS JK JS					Ulme 2 Ulmenstiel	U2ST
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							Verbindungsbauwerk			PBU RAD RTR					- [Geotechnische Messungen / Monitoring	ME	S Bagger		Injektionskörper	JK					Ulme Ulmenstiel	UUST
							Verzweigungsbauwerl	V2W	Radverkehr	RAD					- [Hohlraumsicherung	HR	Banderder	BAN	Injektionsschlauch	JS					Unten	UNTE
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								1	Unterführung	UEB UTF					- 1	Kabelgefäße	KG	Beleuchtung	LEU	Lanze	VEL LEI LIM			Strossenfußverbreiterung	STFV		
								ı	Unterwasser	UNW					- 1	Leit- und Sicherungsstechnik (Platzhalter)		Beschichtung		Leibung	LEI			xxx - Leer	XXXX		
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- Tunnelling data dictionary in German & Englisch (release 2021)
- ~ 200 objects with ~ 100 sub-objects
- Alphanumeric abbreviations used for object code (14 levels / 54 positions)



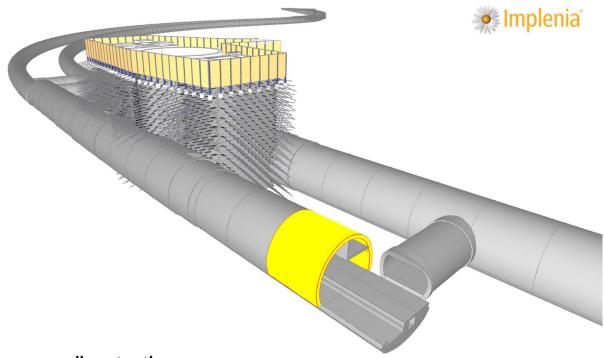
DAUB object catalogue: Application to models





83 Sonderguerschnitt Ost false

March 18, 2021

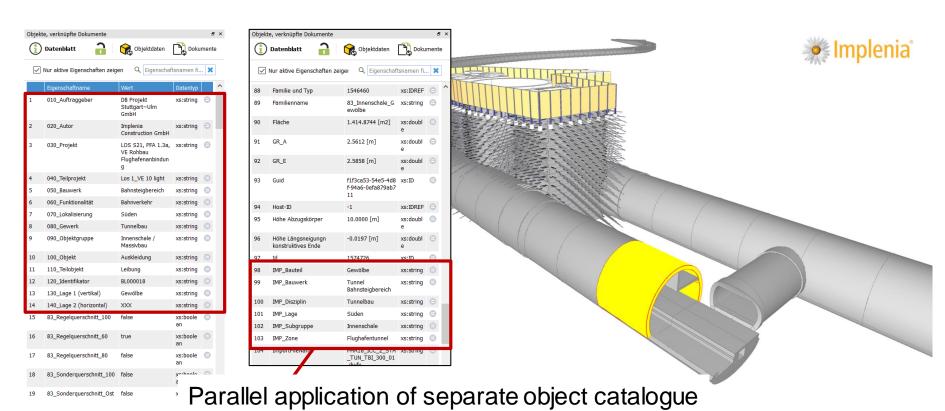


14 properties according to the14 levels of DAUB object code

DAUB object catalogue: Application to models

(e.g. company-specific)





March 18, 2021

18

AGENDA

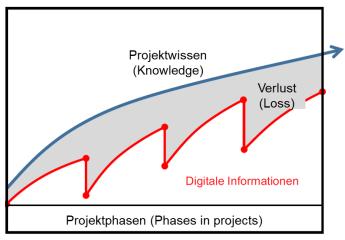


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Quick summary



- 3D-modeling is not necessary for engineering success (but it helps;-)
- The "I" supports engineering success with knowledge-based decision making
- Reducing information loss requires definition of projected (and anticipation of later) use case requirements
- DAUB provides a tunneling data dictionary



Source: Building Information Modeling - Techn. Grundlagen u. industrielle Praxis, Bormann et al. 2015

<u>First</u>, construction (and optimization) in the digital world. <u>Then</u>, realization in the real world.

What's next?



- DAUB is working on properties in relation to defined use cases for tunneling
- DAUB object catalogue will be moved from excel to database solution

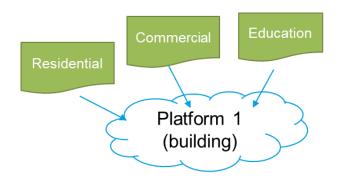
 DAUB is (also) working on the concept of interconnected data dictionaries

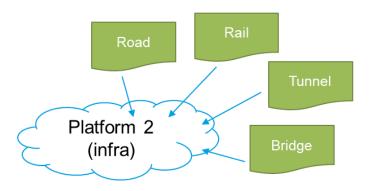


Image from Xuxuxu97 on Pixabay.com

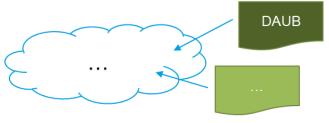
Interconnected data dictionaries







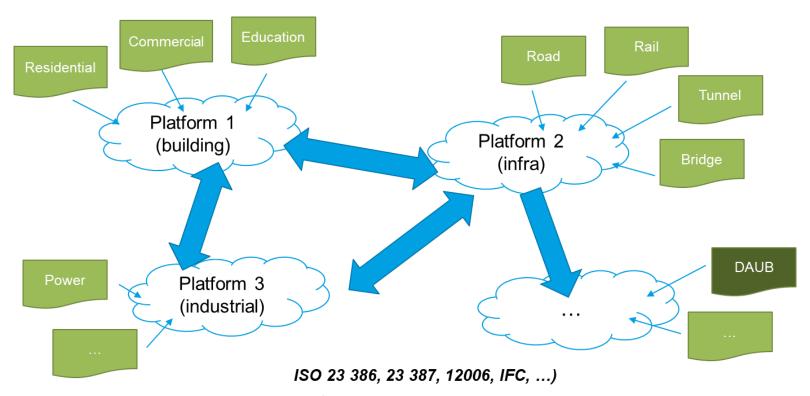




ISO 23 386, 23 387, 12006, IFC, ...)

Interconnected data dictionaries







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Thank you.

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