



Studiedag Zee- en waterbouw in en rond Vlaanderen


Ingenieurshuis Antwerpen – 4 juni 2015

BIM en SE

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WHY BIM & SE?



Market Evolution

Project phase	Traditional contracts			Integrated contracts		
	'Regie'	Construct only	'Bouwteam'	Design&Build	Turnkey	DBFM(O)
Initiative	Red	Red	Red	Red	Red	Red
Specifications	Red	Red	Red	Red	Orange	Red
Preliminary design	Red	Red	Red	Orange	Green	Green
Detailed design	Red	Red	Orange	Green	Green	Green
Execution design	Red	Red	Orange	Green	Green	Green
Work preparation	Red	Green	Green	Green	Green	Green
Execution	Green	Green	Green	Green	Green	Green
Operate / Maintenance	Red	Red	Red	Red	Red	Green
Financing	Red	Red	Red	Red	Red	Green



Market Evolution

- Increased number of (complex)integrated contracts
 - Contracting authorities need new tools to manage projects 'from a distance'
 - Contractors need new tools to manage their extended responsibilities and manage the risks involved



Observations

- Net Margin: **2 – 4%**
- Cost of failure in construction industry
(Source USP, 2010): **5 – 13 %**

PICK YOUR FIGHT!



Statement

BIM and **Systems Engineering** are indispensable tools for both contracting authorities and contractors to manage complex, multi-disciplinary and integrate projects



Systems Engineering



Definition

Systems engineering is an interdisciplinary field of engineering that focuses on how to design and manage (tools) complex engineering systems over their life cycles



History

- First used in telecom industry to integrate different systems while guaranteeing availability
- Since 1950 in aerospace and weapon industry
- First used commercially by AT&T (1960) to increase competitiveness
- First professional platform in 1990 (INCOSE)
- In construction industry since 1999 (Netherlands: Pro Rail and RWS)
- Since then standard in Netherlands and used by other contracting authorities worldwide (under different names)



Scope

- SE as defined in ISO 15288 consists of:
 - Technical Part (Requirements, Design, Preparation, Realisation, Verification & Validation, Delivery)
 - Management Part

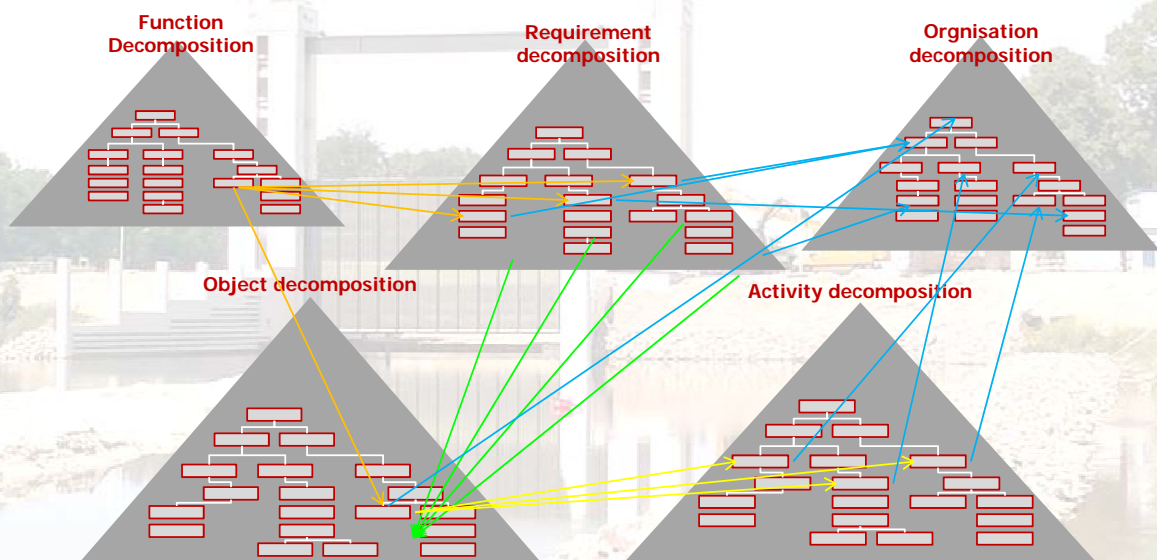


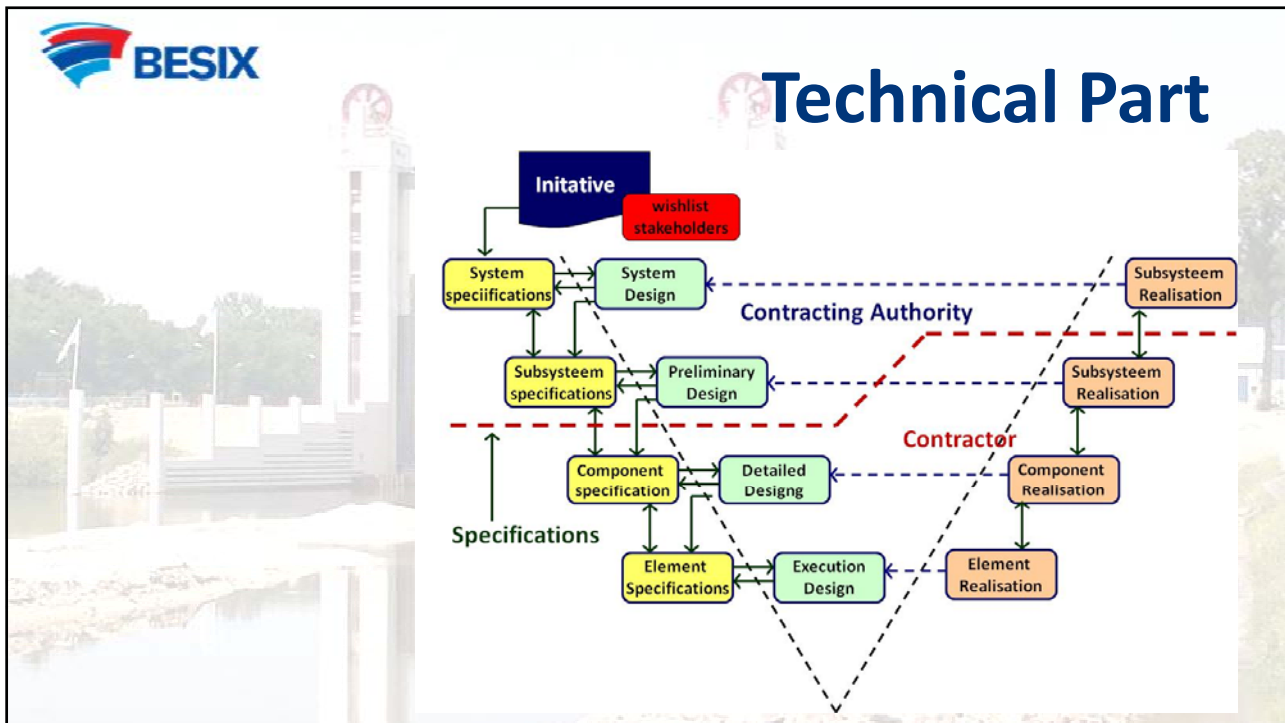
Technical Part

- 3 main principles:
 - Breakdown the project in logical and manageable parts (= structures)
 - Do not lose sight on the relations/interfaces between these structures
 - Organise your project around these structures



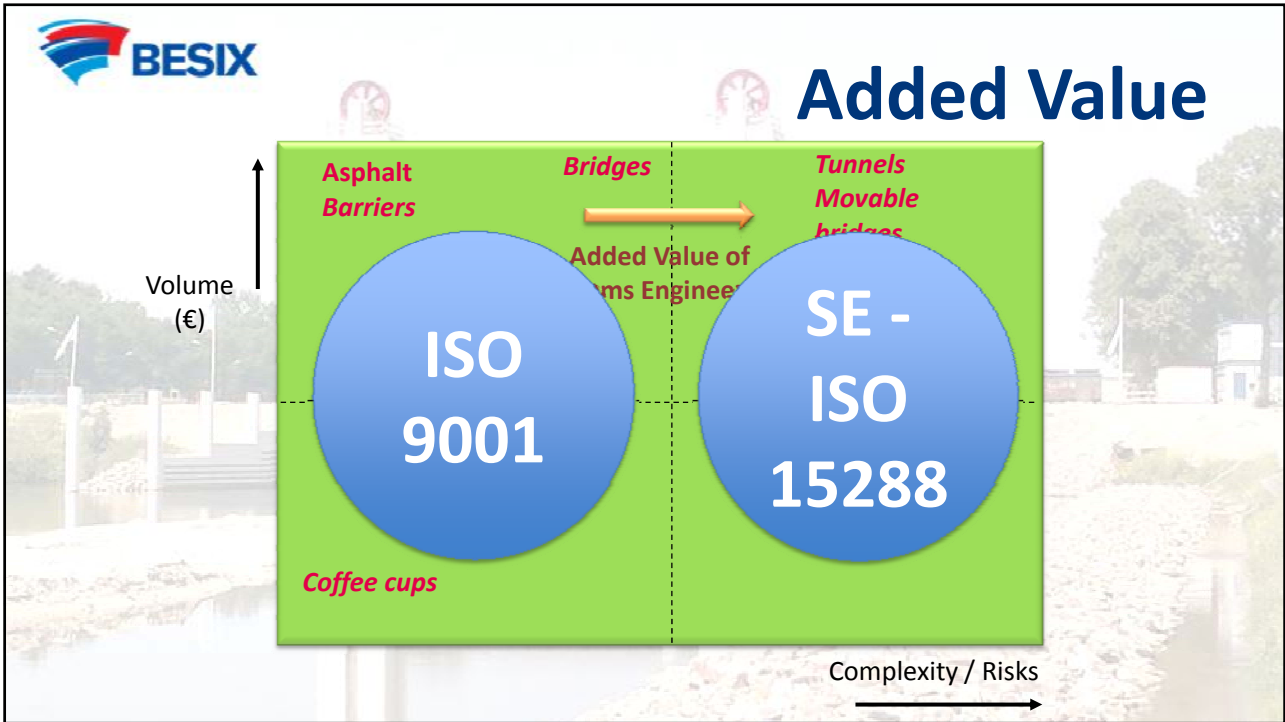
Technical Part





The diagram illustrates the 'Management Part' of a project lifecycle. It features the BESIX logo and a background image of a construction site. The text describes the SE (as defined in ISO 15288) as an overall management system, comparable to ISO 9001 but more elaborated, and notes that both contractors and contracting authorities should apply it.

- SE (as defined in ISO 15288) is an overall management system
- Comparable to ISO 9001 but more elaborated
- In order to be successful both contractors and contracting authorities should apply it





Some projects

Locks
Maasbracht,
Born & Heel
Netherlands



Some projects

Locks Heumen
Netherlands





Some projects

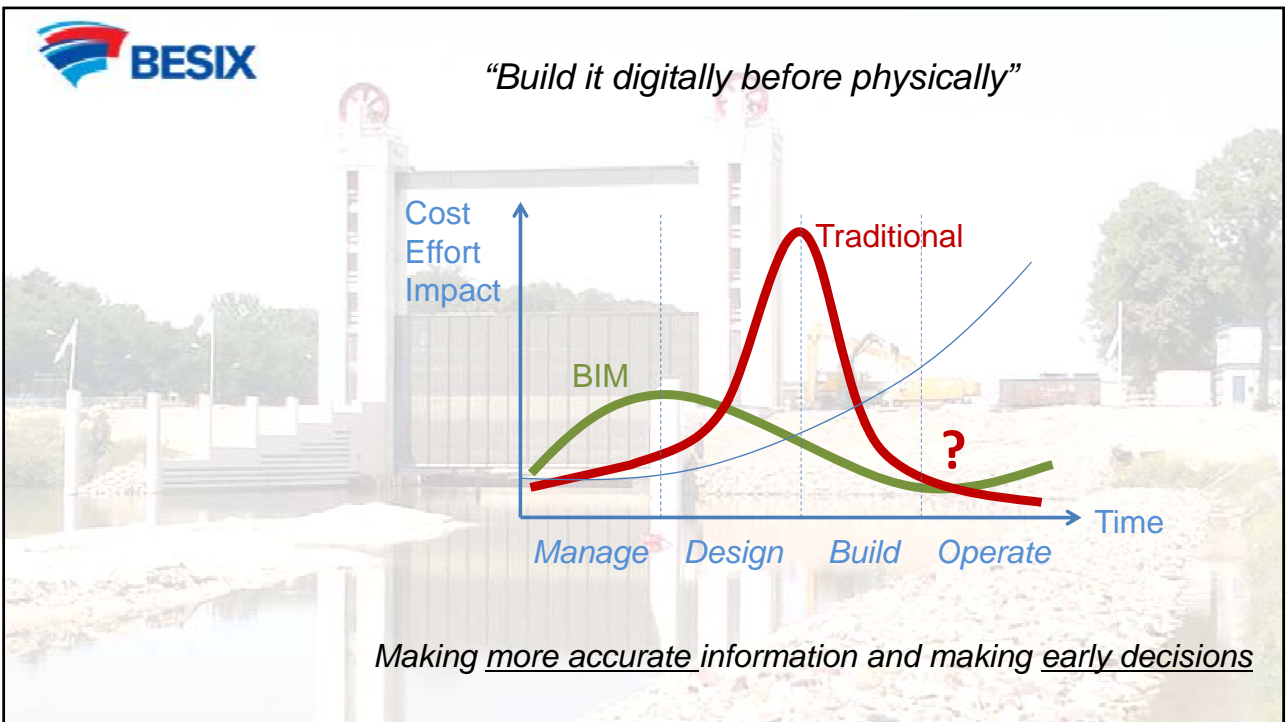
Water purification
Putte
Ossedrecht
Netherlands



Some projects

Coentunnel
(Immersed)
Netherlands



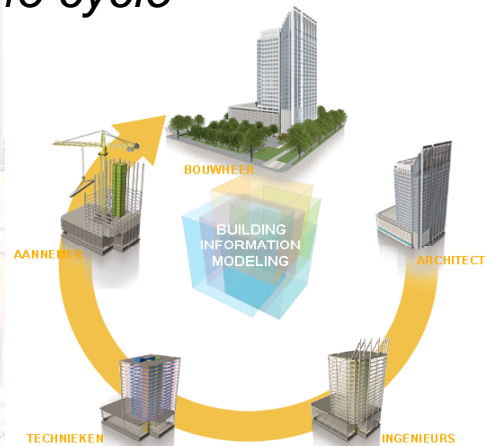




Building Information Modelling

“Process of generating and managing building data during its life cycle”

- *more than 3D modelling*
- *central data base*



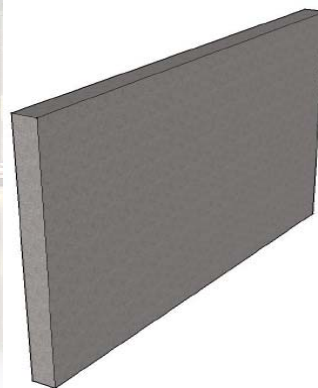
Modeling Objects

“Data structure with data fields and methods”

Elements have properties that can be accessed by functions

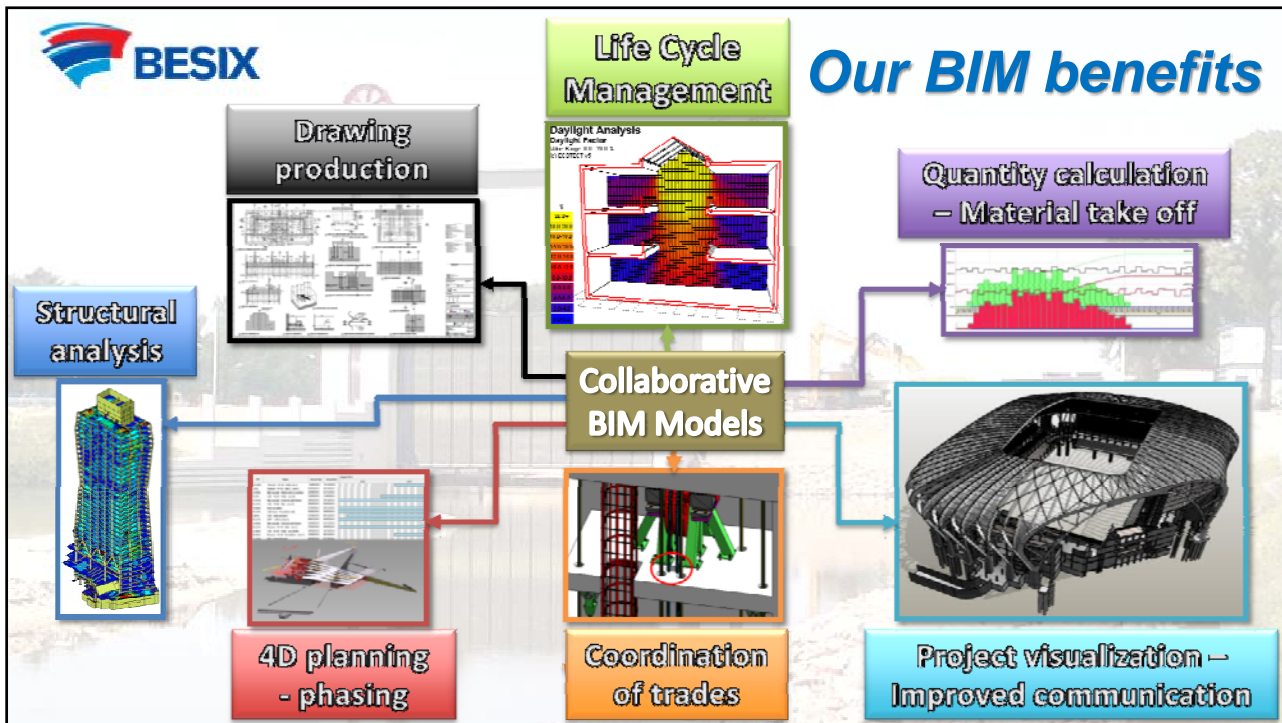
CAD

- *geometrical description*



BIM

- *location line*
- *bottom/top level*
- *length*
- *thickness*
- *creation phase*
- *demolition phase*
- *mark*
- *comment*
- *material(s)*
- *manufacturer*
- *cost*
- *...*



BESIX

Project visualization
Simandou (tender)

Jetty in Republic of Guinea

- 3D visualization during engineering
- Animation of construction stages

APPROACH JETTY (6800m)

CAUSEWAY (4050m)

OFFICIAL BOUNDARY

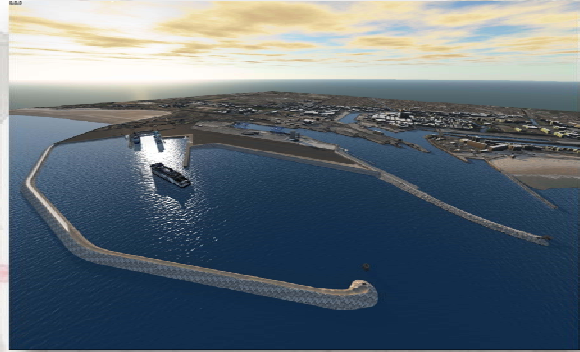
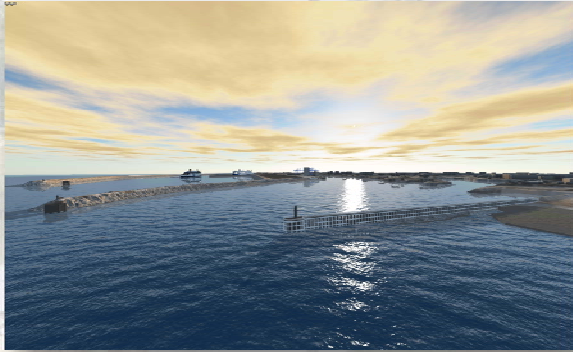
- Approach Jetty (6800m)
- Transfer Platform (9100m²)
- Access Jetty to Service Wharf and Export Wharf (400m)
- Service Wharf (283m)
- Export Wharf (810m)
- Navigation Aids
- Causeway (4050m)



Project visualization

Calais 2015 (tender)

Project presentation
GIS data from public instances



4D simulations

Lock of Lanaye

Link construction schedule and BIM model

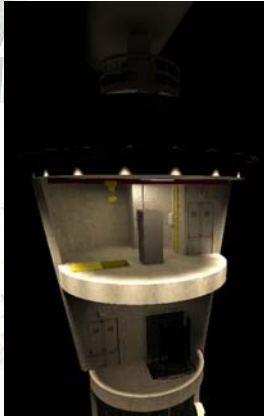




Design development

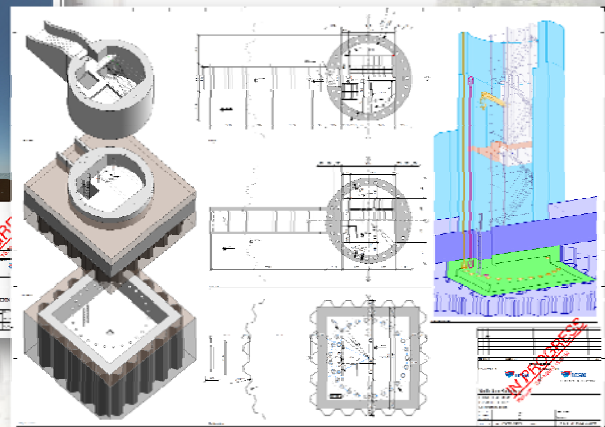
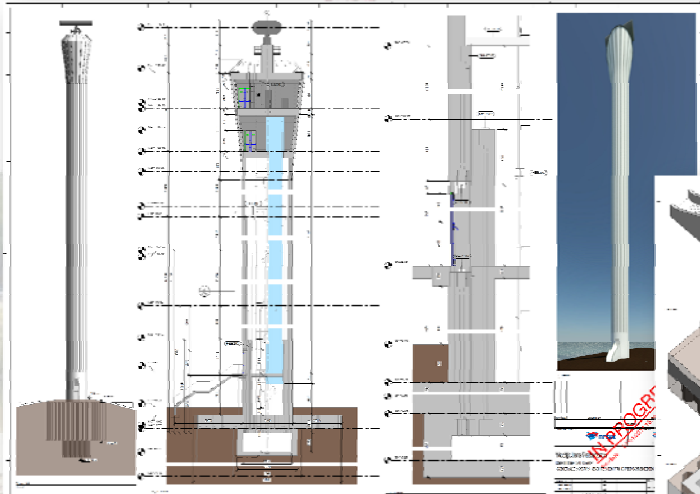
Neeltje Jans

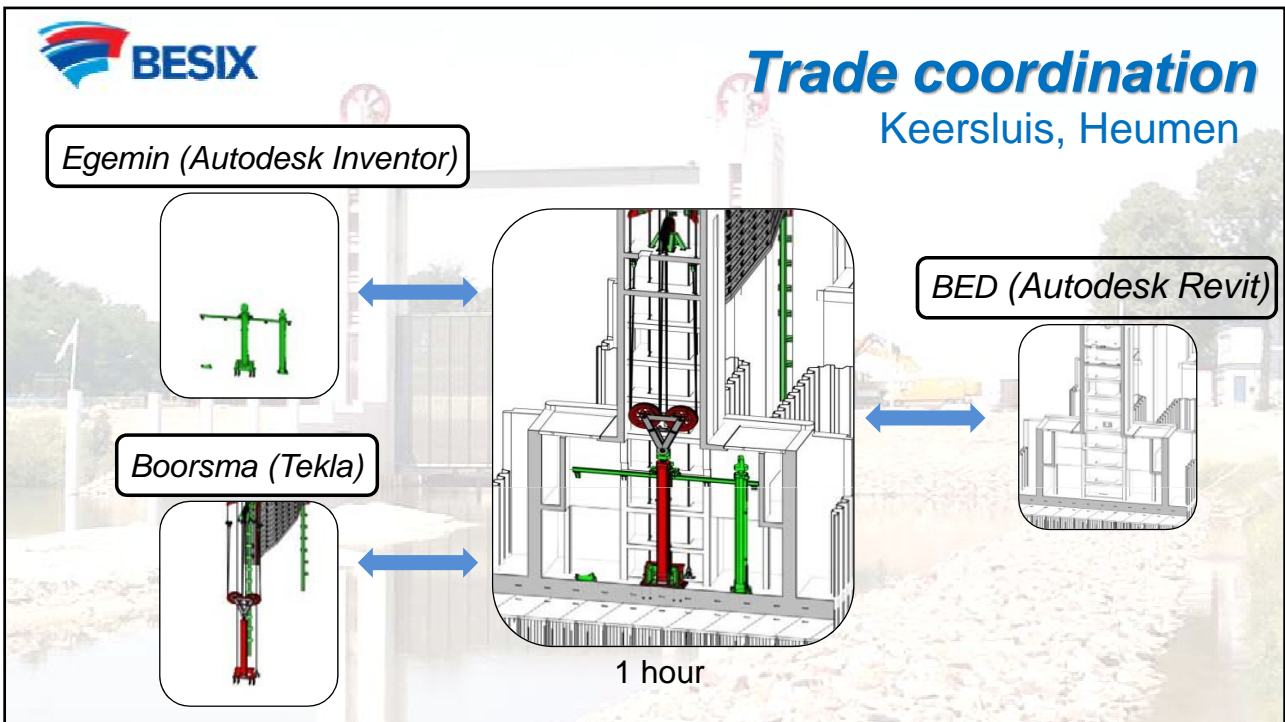
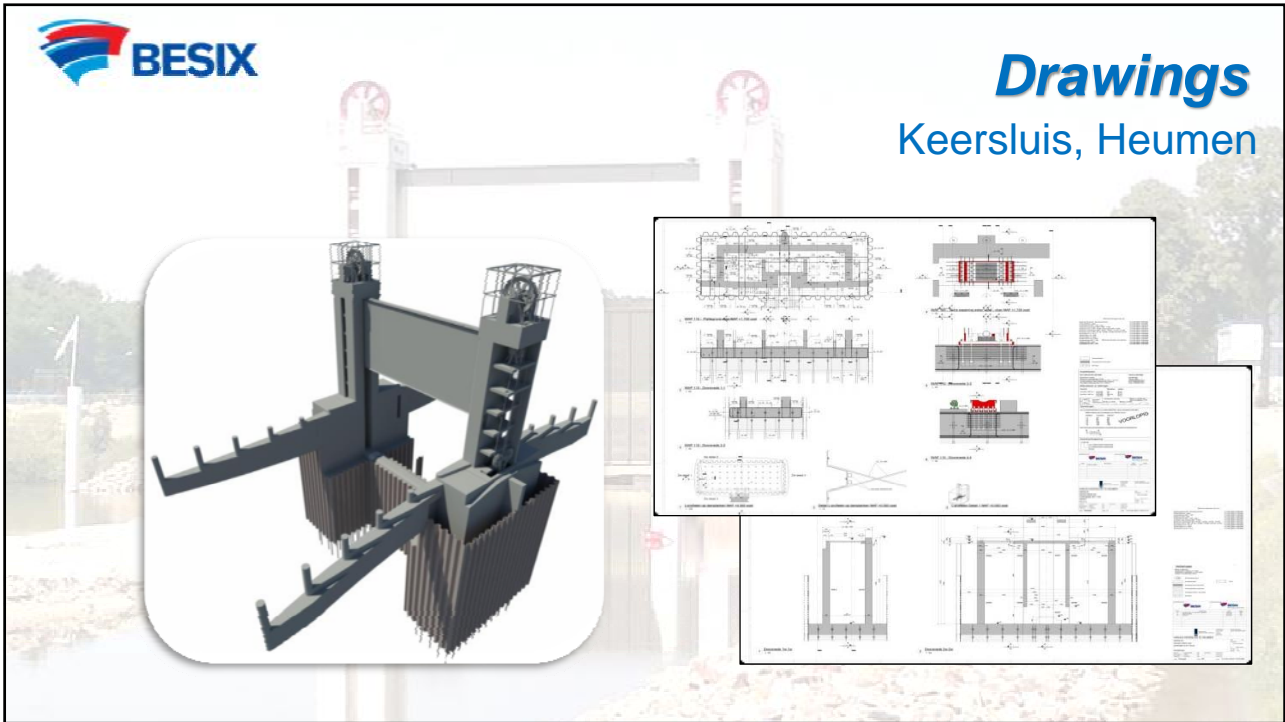
- Trade coordination from conceptual till detailed design
- Preparation of building permit drawings
- Client presentation




Design development

Neeltje Jans

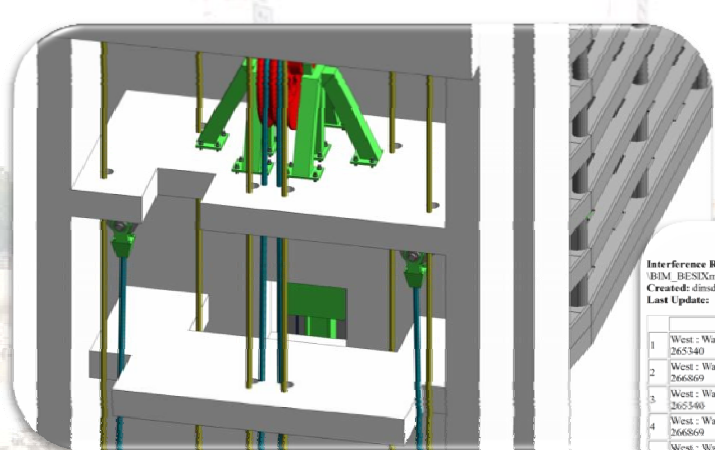






Clash detection

Keersluis, Heumen




Manually (2 hours)

Automatically (5 min)
Interference Report

Interference Report Project File: B:\BIM - Conferences and users\meetings\2011\BIM_BESIX\management\6032011\KeersluisHeumen_local_ivandenbergh.rvt
Created: dinsdag 1 maart 2011 15:30:30
Last Update:

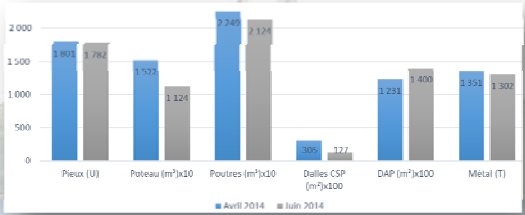
	A	B
1	West : Walls : Basic Wall : 1000mm : id 265340	Boorsma_11feb2011_inclbetonwerk.rvt : Generic Models : PL.AAT 884047 : PL.AAT 884047 : id 2182
2	West : Walls : Basic Wall : 1000mm : id 266869	Boorsma_11feb2011_inclbetonwerk.rvt : Generic Models : PL.AAT 884047 : PL.AAT 884047 : id 2182
3	West : Walls : Basic Wall : 1000mm : id 265540	Boorsma_11feb2011_inclbetonwerk.rvt : Generic Models : PL.AAT 884008 : PL.AAT 884008 : id 2230
4	West : Walls : Basic Wall : 1000mm : id 266869	Boorsma_11feb2011_inclbetonwerk.rvt : Generic Models : PL.AAT 884008 : PL.AAT 884008 : id 2189
5	West : Walls : Basic Wall : 1000mm : id 266869	Boorsma_11feb2011_inclbetonwerk.rvt : Generic Models : PL.AAT 883746 : PL.AAT 883746 : id 2230
6	West : Walls : Basic Wall : 1000mm : id 266869	Boorsma_11feb2011_inclbetonwerk.rvt : Generic Models : PL.AAT 882737 : PL.AAT 882737 : id 2273
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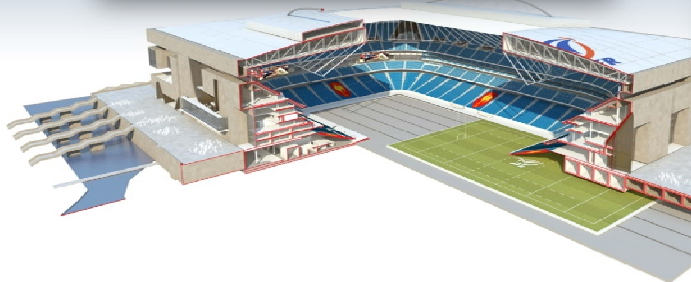
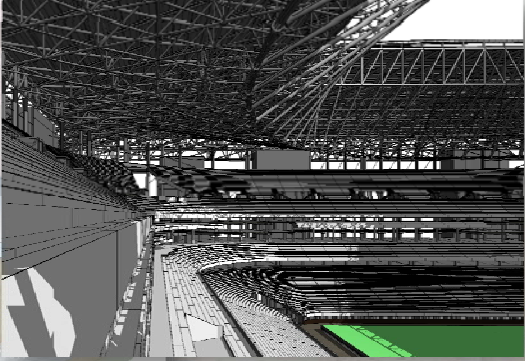
Quantity take off


Grand Stade FFR

Illustration of structural concept






Material	Avril 2014	Juillet 2014
Pieux (U)	1803	1762
Poteau (m²)x10	1525	1124
Poutres (m³)x10	2349	2124
Dalles CSP (m²)x100	36	177
DAP (m²)x100	1238	1400
Metal (T)	3958	1302




Challenges and difficulties



Difficulties

- hard to recruit BIM staff
- even harder to recruit BIM staff with technical expertise
- few subcontractors can deliver a model





Difficulties

- collaboration with rest of 'traditional CAD' technical office
 - BIM helps for highlighting clashes but does not solve them!*
 - Coordination should be reviewed in models and not on drawings*
 - Share information*
- software limits: file size, number of shop drawings, complex geometries...
- open standards are not (yet) perfectly reliable
 - BIM is easy to blame!



Future challenges

- Link with structural analysis
 - geometrical model vs. analytical model
- Bill of quantities
- Planning resources and cost (5D)
- BIM on site & Tablets (code bars...)
- Scan to BIM

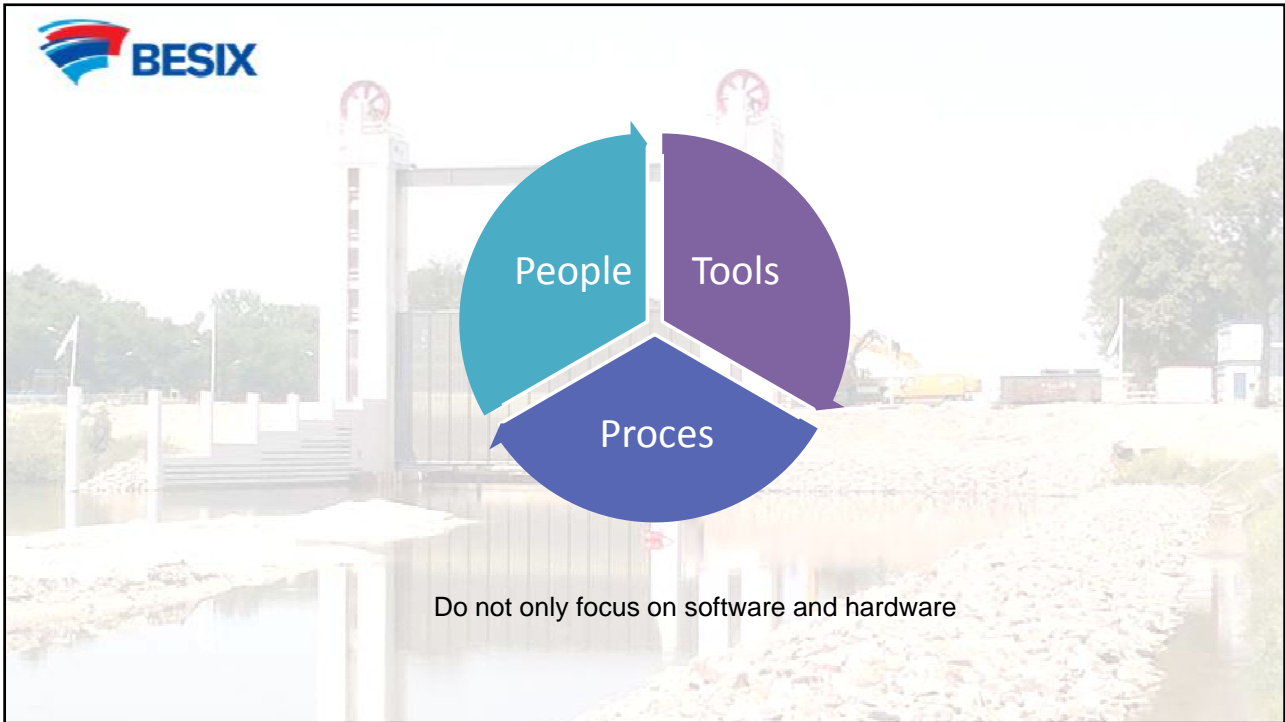


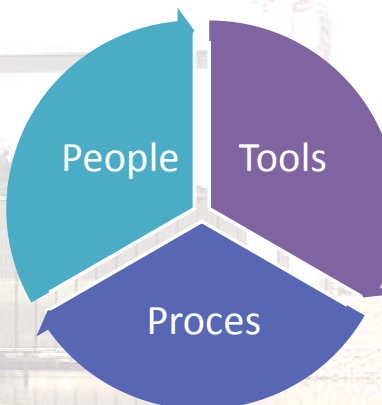
Implementation difficulties

- How to share/receive models? Legal liability...
- Change in practice: construction knowledge earlier in the project
- Earlier involvement of subcontractors e.g. MEP
First 3 to 6 months often in 2D since MEP, façade... come later in the contract

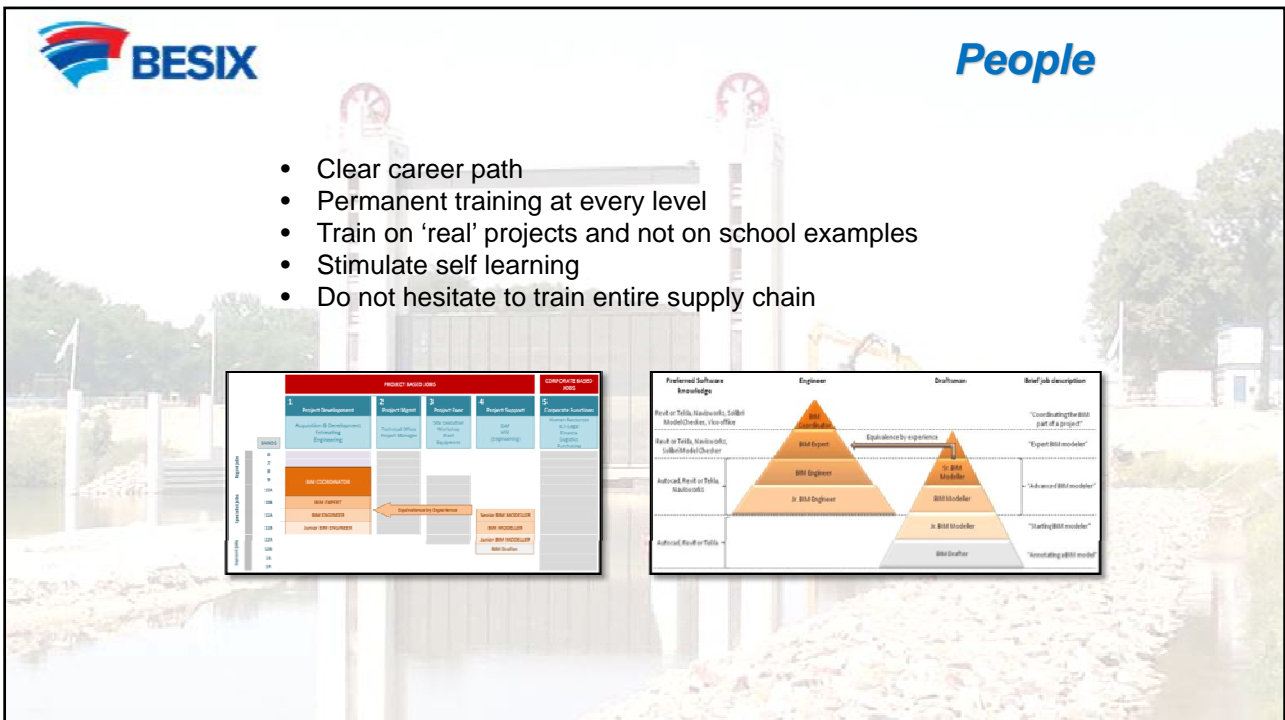


*Attention points during **BIM** implementation*



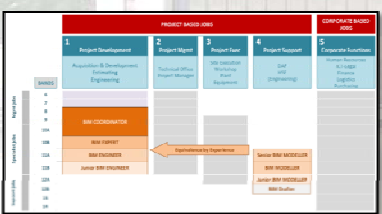


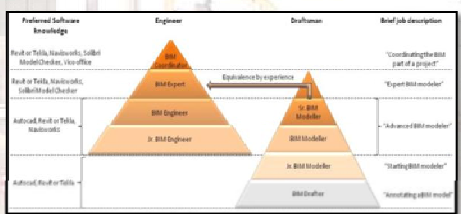
Do not only focus on software and hardware



People

- Clear career path
- Permanent training at every level
- Train on 'real' projects and not on school examples
- Stimulate self learning
- Do not hesitate to train entire supply chain







- Project: BIM protocol/deployment plan is essential.
Contractual/financial part is often forgotten
- Analyse before you optimize. Understand your environment and adapt BIM to it. Tailor made BIM!
- Implement in steps
2D → 3D → 4D → 5D
design dpt → tender dpt → planning dpt. → construction site
- Define BIM metrics – KPIs
mandays/drawing, m² modelled/manday, cost per clash, coordination cost...



Added value of BIM for integrated project types

- shift in risk allocation → virtual construction
- improved project control for client
- facilitates asset management during post construction phases (FM – O&M) for all stakeholders
- enhances design verification (link with SE)

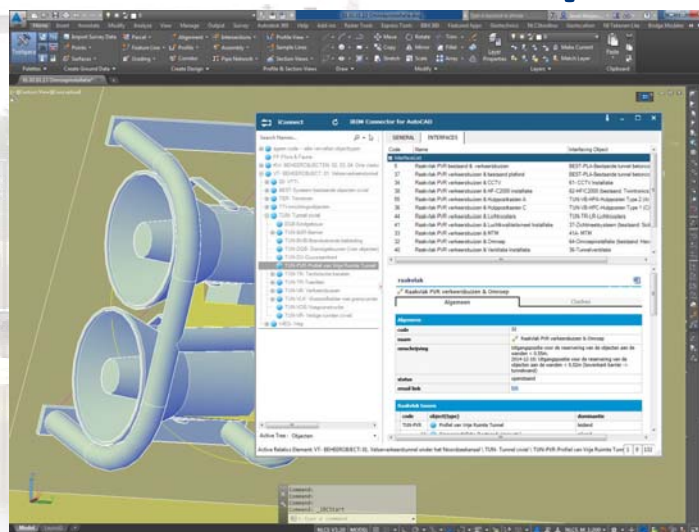


Latest Developments

- BESIX has developed a ICT tool to support its SE processes
- This tool is now applied on all integrated and complex projects
- BIM and SE are integrated in one single tool

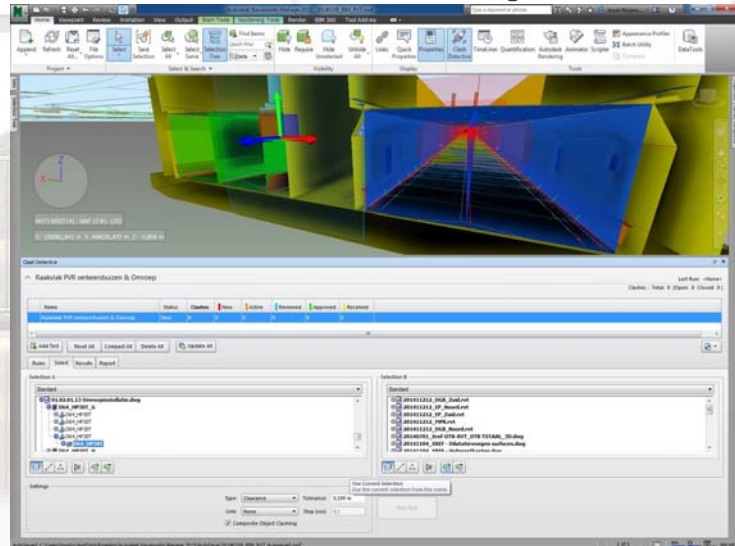


Latest Developments





Latest Developments



Concluding Remarks



Concluding Remarks

- BIM and SE are indispensable tools for both contracting authorities and contractors for integrated and complex projects
- BIM and SE should remain a mean not a goal
- We are convinced they are necessary to reduce cost of failure in construction business



Now it's your turn!



SHOOT FIRST
Ask Questions Later