BIM, The Dutch approach

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Contents

Quick Introduction on :

- Jordy & Cristian
- Geonius
- The Netherlands

Some history

- Disruption of design
- Real DBFO contracts
- A4ALL, Milestone project
- Picking up BIM
- N18 BIM at the moment
- Lessons learned



Cristian Otter



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Jordy Brouwers



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- Cristian & Jordy are both Building Information Modeling (BIM) advisors within the Innovation Department of Geonius. An interdisciplinary engineering firm for Infrastructure in the Netherlands and Belgium.
- They each have 20 years of experience in the field of large infrastructural projects, both road designs and civil constructions. With their excellent cross-disciplinary knowledge they support the design teams with the implementation of **BIM**, setting up efficient **processes** and using suitable design workflows. As early adaptors of 3D design software for Infrastructural purposes, many working methods originate from their hands.
- Jordy & Cristian are the co-founders of the **Civil Infra Benelux Usergroup**. Cristian is also one the co-founders of the Revit Usergroup for Civil constructions in the Netherlands, now part of the Civil Infra Benelux Usergroup and initiator for the InfraWorks Workgroup under the umbrella of same Usergroup.

About Geonius



About Geonius

- Established in 1993 as surveying firm
- 3D design of highways for Road Authority
- Quantity calculation
- Since 2000 expansion in other fields :
 - Geotechnical
 - Environmental
 - Landscape design
 - Water
- Not your average engineering firm !



The Netherlands



The Netherlands

29% below sea level

2/3 would flood without water protection

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Amsterdam

Den Haag

Rotterdam

The Netherlands – Waterland







The Netherlands - Tunnels











The Netherlands – Heavily under construction







Some history



2000 – Disruption in designing



Major Road authorities in The Netherlands

- Rijkswaterstaat (RWS)
 - Road Authority for (Inter)national highways
- Province
 - Road Authority for main roads / semi-highways
- Municipality
 - Main roads in cities & local roads



From traditional design to Design & Build

- Effects for RWS (Road Authority)
 - Re-organization, less designers / design firms
 - Change in National Standards (no more min / max values)
- Effects for other parties

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- Contractor needed a design department
- Geonius had to change client base
 - Not only best design, but best design for lowest costs !
 - More possibilities for other design methods / software
 - Not working for, but with the contractor



Problem

Opportunity

2010 – Real DBFMO contracts



DBFMO contracts

- Design
- Build
- Finance
- Maintain
- Operate



Bidding phase example - Hoevelaken

- 400 million euro bid is fixed
- Contract requirements
- Contract wishes the more wishes the better
- 350 Stakeholders how to satisfy them ?
- Guarantee traffic flow heavy penalties
- Design is 'free' as the research & zoning decision phase is part of the contract







Bidding phase example - Hoevelaken

- Short timeframe (6 months)
- 700 contract documents with relevant information (PDF!)
- 60 temporary colleagues
- Large amounts of money
- Sign contract = build it !
- Road design only 1 aspect
- Huge risks involved





2012 – A4All a BIM milestone project



A4all project – Highway construction

- Missing link
- 60 years of struggling
- Numerous stakeholders





A4all project – Highway construction



- Sight analysis (early phase)
 - Tunnel safety
 - CCTV camera analysis
 - Clash detection
- Driving analysis in first 3 days
 - Virtual construction
 - Planning link
 - Lifecycle management







WHY we used BIM on A4all

- Lot of Stakeholders involved
- One process for the whole project lifecycle
- Collaboration of data
- Reducing design and construction errors
- Unambiguously sharing of Information
- Maintenance and facility management



WHY we used BIM on A4all

First 'serious' steps in BIM for infrastructure

The Netherlands – Minimize Impact









2013-2016 – The Dutch picking up BIM



Dutch opinion:

• Better Together with BIM



Building Information Council

- Goal is to boost, streamline and connect initiatives for the development and implementation of BIM
- Promoting knowledge about BIM by :
 - Stimulating
 - Directing
 - Conditioning



Members represent both industry and their business

Concepts Library – Netherlands

- Exchange of digital object data between parties requires **one language**:
 - aim is the unambiguous description of built environment concepts
 - concepts are described as physical and spatial objects
 - the contents of the CB-NL apply to the entire lifecycle of a project
- The CB-NL will be a smart dictionary for the Dutch built environment





Dutch Road & Water Authorities

Started in 2013 with the BIM projects by:



- Testing BIM in DBFM projects (Design Build Finance Maintain)
- Supporting BIM project and management organizations in introducing BIM
- Providing software tools, standards, models, testing, training and support
- Today, delivering in BIM is mandatory on most big projects, and some require a BIM model to gain contract (Tender Phase)



Rijkswaterstaat Ministerie van Infrastructuur en Milieu

Bidding phase example – Lock Terneuzen

- Maximum bid 700 Million Euro
- BIM / IFC model to be delivered during Tender Phase



2017 – BIM at the moment



N18- Highway reconstruction





327 3 8 355 5 no 000 m3 of sand d Data 25 years of maintenance 18-9-4 nted checkprints Gwater 9



- The project is a Design, Build, Finance & Maintain contract
- 1 Year design, 2 Year of construction and 25 years of maintenance
- Decomposition in a System Breakdown Structure (SBS)
- As Built hand over in a BIM container





System Engineering



Systems Engineering (SE)



e, foundation piles, girders (sub objects) he PBS

LEAN, Sprints and Scrum



Introduction

Infraworks supports sprints and scrum review sessions





Sprint Review

- The goal is to learn as much as possible from errors in finished products.
- The team presents what is finished and tasks that have not been accomplished or done
- Each topic is addressed with the help of Infraworks
- An item does not have to reside in full LOD
- With the client with full transparency so they feel part of the decision making process
- After the sprint review is finished the Infraworks 360 master is saved as an proposal.
 ONSBIM GEORIUS &



Software



Integral Model

The **current** process diagram





Infraworks 360



Infraworks 360 – Integral model

- Infraworks is the sole integral model
 - every design, every asset
 - link to system engineering,
 - link to 3D models and documents
- Well suited for final design with the possibility of importing Civil3D and Revit files and putting these in their surroundings
- Non-technical colleagues or stakeholders find it easy to access
- Easy sharing of design data
- Means of communicating to the public and analysis of designs and issue tracking.





Infraworks choices

- Infraworks online or mobile viewers lack functionality like tooltips at the moment.
- Engineer has access to Infraworks 360.
- Project leader and management/etc. has Infraworks (LT)
- Central workstation with large monitor for easy access of the model
- Design feed is available in Infraworks LT.
- Use multiple scenarios. You can filter your design feeds on these scenarios.
- Use a big screen for review, lean and sprint sessions.
 Preferably with touch capability.



Model Explorer

- Changed the model explorer **definition with own tooling**
- We can **filter**, set LOD and turn on or off sub types like the SBS stucture

A sub type can be existing Buildings to be demolished, Buildings that will remain, Buildings that might be required, Sound barriers, Civil Structures, Underpasses, Existing or New Culverts, etc. Normally all these would all have been "Buildings".

More information

http://autodesk.typepad.com/bimagination/ search for *json* (im.schema.json)





HTML Tooltips

- HTML tools tips is quite common
- Different coloring to these tooltips depending on the object type is useful
- Working well to identify object origin/type or source.



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Scripting

- Scripting useable for a wide range of purposes.
- Example; setup up owner, width and clearance of underground utilities like data cable, gas pipes or drainage.

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 8 if ((SOURCE['LAYER']).match(/.*RF Reggefiber.*/)){USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.SLEVATION_OFFSET =-0.8;USER_OW_KL_weg.SLZE_X =-0.05;USER_OW_KL_weg.SLZE_Y =-0.05;USER_OW_KL_weg.SLZE_X =-Data";) 9 if ((SOURCE['LAYER']).match(/.*LC Enexis.*/)){USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.SLZE_X =-0.05;USER_OW_KL_weg.SLZE_Y =-0.05;USER_OW_KL_weg.SLZE_X =-0.05;USER_OW_KL_weg.SLZE_X =-0.05;USER_OW_KL_weg.SLZE_Y =-0.05;USER_OW_KL_weg.SLZE_X =-0.05;USER_OW_KL_WEG.	7 if ((S leidin =0.0 ="Da	OURCE["LAYER"]).m gen/Data";USER_O\ 15;USER_OW_KL_we ata";}	natch(/.*EF Eu W_KL_weg.ELI eg.SIZE_Y =0.	rofiber.*/)){USI EVATION_OFFS 05;USER_OW_	ER_OW_KL_v ET =-0.8;US KL_weg.NAM	veg.MANUAL_STY ER_OW_KL_weg. E ="EUROFIBER"	/LE = "Pipeline/Ka SIZE_X ;USER_OW_KL_v	abels en veg.TAG
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 10 if ((SOURCE['LAYER']).match(/.*LC KPN.*/)){USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.ELEVATION_OFFSET =-0.8;USER_OW_KL_weg.STZE_X = 0.05;USER_OW_KL_weg.STZE_Y = 0.05;USER_OW_KL_weg.NAME ="KPN";USER_OW_KL_weg.TAG ="Data";} 11 if ((SOURCE['LAYER']).match(/.*LC UPC.*/)){USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.STZE_Y = 0.05;USER_OW_KL_weg.NAME = "UPC";USER_OW_KL_weg.TAG = "Data"; 12 if ((SOURCE['LAYER']).match(/.*Trent.*/)){USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.STZE_Y = 0.05;USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.STZE_Y = 0.05;USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.STZE_Y = 0.05;USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.STZE_Y = 0.05;USER_OW_KL_weg.NAME = "TRENT';USER_OW_KL_weg.STZE_Y = 0.05;USER_OW_KL_weg.NAME = "TRENT';USER_OW_KL_weg.TAG 	9 if ((S leidin =0.0 ="Da	OURCE["LAYER"]).m gen/Data";USER_O\ 5;USER_OW_KL_we ata";}	natch(/.*LC En W_KL_weg.EL eg.SIZE_Y =0.	nexis.*/)){USER EVATION_OFFS 05;USER_OW_	_OW_KL_we ET =-0.8;US KL_weg.NAM	g.MANUAL_STYLE ER_OW_KL_weg. E ="ZIGGO";USEF	E = "Pipeline/Kabe SIZE_X R_OW_KL_weg.T.	els en 'AG
 11 if ((SOURCE["LAYER"]).match(/.*LC UPC.*/)){USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.ELEVATION_OFFSET =-0.8;USER_OW_KL_weg.SIZE_X = 0.05;USER_OW_KL_weg.SIZE_Y = 0.05;USER_OW_KL_weg.NAME ="UPC";USER_OW_KL_weg.TAG ="Data";} 12 if ((SOURCE["LAYER"]).match(/.*Trent.*/)){USER_OW_KL_weg.MANUAL_STYLE = "Pipeline/Kabels en leidingen/Data";USER_OW_KL_weg.ELEVATION_OFFSET =-0.8;USER_OW_KL_weg.SIZE_X = 0.05;USER_OW_KL_weg.SIZE_Y = 0.05;USER_OW_KL_weg.NAME = "TRENT";USER_OW_KL_weg.TAG 	10 if ((S leidin =0.0 ="Da	OURCE["LAYER"]).m gen/Data";USER_O\ 15;USER_OW_KL_we ata";}	match(/.*LC KP W_KL_weg.EL eg.SIZE_Y =0.	N.*/)){USER_C EVATION_OFFS 05;USER_OW_	OW_KL_weg.1 GET =-0.8;US KL_weg.NAM	MANUAL_STYLE = ER_OW_KL_weg. E ="KPN";USER_(Pipeline/Kabels SIZE_X DW_KL_weg.TAG	en
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Bookmarks for Navigation

Create bookmarks for easy navigation. You can search those.

- each (civil) structure
- each area of interest





Scenarios and Proposals

- Scenarios used as project areas. You are able to quickly select or show only a certain project area.
 remember you can filter design feeds as well
- Proposals used as Sprint Review milestones
- Each proposals represents a version of the model which has been subject to the client's approval.
- Able to go back to a previous state
- Show progress of design or change by switching proposals.





	Name
	1 Wegvak_02
	2 Wegvak_03
	3 Wegvak_04
	4 Wegvak_05
	5 Wegvak_06
	6 Wegvak_07
	7 Wegvak_08
	8 Wegvak_09
	9 Wegvak_10
	10 Wegvak_11
	11 Wegvak_12
	12 Wegvak_13
	13 Wegvak_14
Lappond Parad Parad Parad Parad Parad Parad Parad Parad Parad Parad	

Requirements, Documents and 3D models

Use tooltips to link requirements, drawings, **3D model** and other documents (e.g. SharePoint) to Infraworks Objects



demo





PROJECT					Christian Otter			
n 😬 WBS 🌼 Raakviak SBS E Projectbel Eisenbeheer 🍣 CMDB Technisch manager	ken Vrager Neersstructuren	Risico's en Kanse	n Afwijkingen	 Risico's VG Actiebeheer Technische Technische Veligheid 	M Vragen			
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	ref	Document						

Communication with Client



Configuration Management Database (CMDB) to link geographical information from Infraworks to the system engineering database and document management system.



Communication with Client

Need to **import** the design data into GIS systems like ArcGIS or QGis for analysis like overlay or Boolean



N18



Lessons Learned





See more on http:///www.onsBIM.nl



BIM building blocks

BIM

Technical aspect

Human aspect

BIM building blocks

Geonius 'onsBIM'

Technical aspect

Human aspect





Geonius BIM Vision

- BIM is most about people, not technology
- See BIM as a integral part of the process
- Work together, regardless of used software
- Bring in (external) help if you need it
- If possible, create 1 team on 1 location





Constructability or coordination ? Focus on max. 3 goals Think before you act

Constructability or coordination



or









Example primary and secondary BIM goals







Example - BIM Uses

Toepassingen Matrix

Versie: 0.3 Datum: 29-4-2015

		Тоер	assen?			Dis	cipline (I=	Input lever	en, N=Nut	ttig voor di	scipline, T
	Opsteller: J. Brouwers	V=JA	?=NTB				(Ontwerp			
Nr.	Оnderwerp	X=NEE	P=Pilot	Verkeer	Wegen	ĸw	DVM	Vorm- geving	WVB	geluid	Overig
1	Raakvlakmanagement (primair doel)							·			
1.1	Integraal overleg m.b.v. model		JA	N	INV	INT	IN	INT	N	IN	
1.2	Clashdetectie		JA		INV	INT	INT			INT	
2	Communicatie (primair doel)										
2.1	3D Wegbeelden (weganimatie per rijbaan en animatie in vogelvlucht over het weggedeelte) t.b.v. oplevering contract		?								
2.2	3D Zichtlengten (op ooghoogte van de bestuurders c.q. automobilist)		?								
2.3	3D Zichtgebieden camera's voor de wegverkeersleiding t.b.v. oplevering contract		JA	NV	I	Ι	N			Ι	
2.4	Visualisaties t.b.v. uitvoering		?								
2.5	Aanleveren BIM-Model/Visualisaties t.b.v. architect		JA		I	Ι		NV		I	
2.6	Visualisaties & animaties t.b.v. OG en overige stakeholders (INTERN)		JA		IV	Ι	I	I		Ι	
2.7	Visualisaties & animaties t.b.v. communicatie met externe partijen (stakeholders/omgeving etc.) (EXTERN)	JA			IV	Ι	I	I		I	
2.8	Ontwerp in omgeving plaatsen (Augmented reality)		?								
2.9	Gebruik BIM-Model als Game Engine t.b.v. trainingen, analyse scenario's etc.		?								
2.10	Opdrachtgever heeft (online) toegang tot (een gedeelte van) het BIM-Model		?								
3	Conditionering (primair doel)										
3.1	Vastleggen en toegankelijk maken (linken) conditioneringsgegevens		JA							I	I
3.2	Geotechnische / milieutechnische lengteprofielen		JA		N	N					IVN
4	2D Documentatie (secundair doel)	,		,							
4.1	Genereren 2D tekeningen uit Revit		JA			INV					Τ
4.2	Genereren 2D tekeningen uit Civil 3D / MX		JA		INV			N			
5	Calculatie m.b.v. BIM (secundair doel)	,									
5.1	Genereren hoeveelheden uit Revit		JA			IV			N		T
5.2	Genereren hoeveelheden uit Civil 3D / MX / MAP3D	JA			IV						
6	Planning m.b.v. BIM (nog niet vastgelegd)										
6.1	Verkeersfasering uitgezet in tijd									T	
6.2	Grondverzet uitgezet in tijd										
6.3	Uitvoering Kunstwerken										
6.4	Uitvoering aanleg wegen										1
6.5	Uitvoering Geluid Beperkende Constructies										1
		1		i			i	1	i	+	+



Example - software use





Example - data exchange chart

Datastroom bestaande toestand

Model	Aanlever- Verantwoordelijke	Soort data	Herkomst	Aangeleverd bestandsformaat			Proces programma
3D nulsituatie		AHN2	Nat. Georegister	AHN2.TIFF	eenmalige download	→	Global mapper
3D nulsituatie		DTM	MX export	x-bs-dtm export-MX.dwg	eenmalige import	-	Civil 3D
Waterhuishouding		?	?	?	eenmalige import	-	?
Kabels & Leidingen		Opgeschoonde KLIC	KLIC	SHP /SDF			eenmalige import
Luchtfoto		PDOK foto	Nat. Georegister	PDOK.TIFF	eenmalige import		Global mapper
Luchtfoto		Uit contract	RWS	*.ECW	eenmalige import	->	Global mapper
Gebouwen		BAG / AHN2	Nat. Georegister	*.GML/*.RCS	eenmalige import combinatie van data	->	Global mapper
Bestaand areaal		DTB	Nat. Georegister	*.GML / *.RCS	eenmalige import	-	Global mapper
Gemeentegrenzen		Bestuurlijke grenzen	Nat. Georegister	*.GML	eenmalige import	-	Global mapper
Kadastrale ondergrond		Kadastrale info	Kadaster	?	eenmalige import	-	Global mapper
Plangrens		Uit contract	RWS	x-nw-kd-tracegrens.dwg	eenmalige import	-	Civil 3D

Datastroom ontwerp

Wegontwerp		ALM	MX	ALM_????.TXT	GENIO import	_▶		<u> </u>
Wegontwerp		DWM	MX	DWM_????.TXT	CENIIO import	-		
				_	Geniompor			
?		?	?	?	3D import		Civil 3D	
					· ·		(gedocumenteerd in	-
DVM / OV		?	?	?	? import	-	ontwerndata in Civil 3D')	
								′
								(res
Wegyakkan EHU		,	2	,	##	_		
wegvakkentitio		:	-	•	import	-L		1
Geluidsmodel		?	?	?	## import	→	?	<u> </u>
								, ,
Waterhuishouding		?	?	?	import	→	?	<u> </u>
	[]		[]				==	
Landschapsontwerp		3D model	3DS Max	??.FBX			import	
Kunstunkan		3D model	Revit	77 RVT			##	
Kunstwerken		30 moder	nevit		L		import	

Werkgebied BIM manager







2017 – What's next ?





Proposed development of the internet where everyday objects are connected to the network and can exchange data.

Most important aspect: Possibilities that arise when physical objects and the virtual model gather together

Some tips !



Tips – Don'ts

- Don't wait for standards or BIM mandate, start NOW.
- Don't push people to other software they don't want.
- Don't start without your goals set.
- Don't try to change everything in 1 week.
- Don't try to change people if their not BIM-minded.
- Don't get trapped in technical issues work around them

nded. round them

Tips – DO's

Geonius adopted & invested in BIM in an early stage.

As a result, we are very competetive and are involved in very LARGE projects. If we would start again, the only thing we would change is start with BIM even earlier...

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