

BIM, The Dutch approach

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 - N18 - BIM at the moment
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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



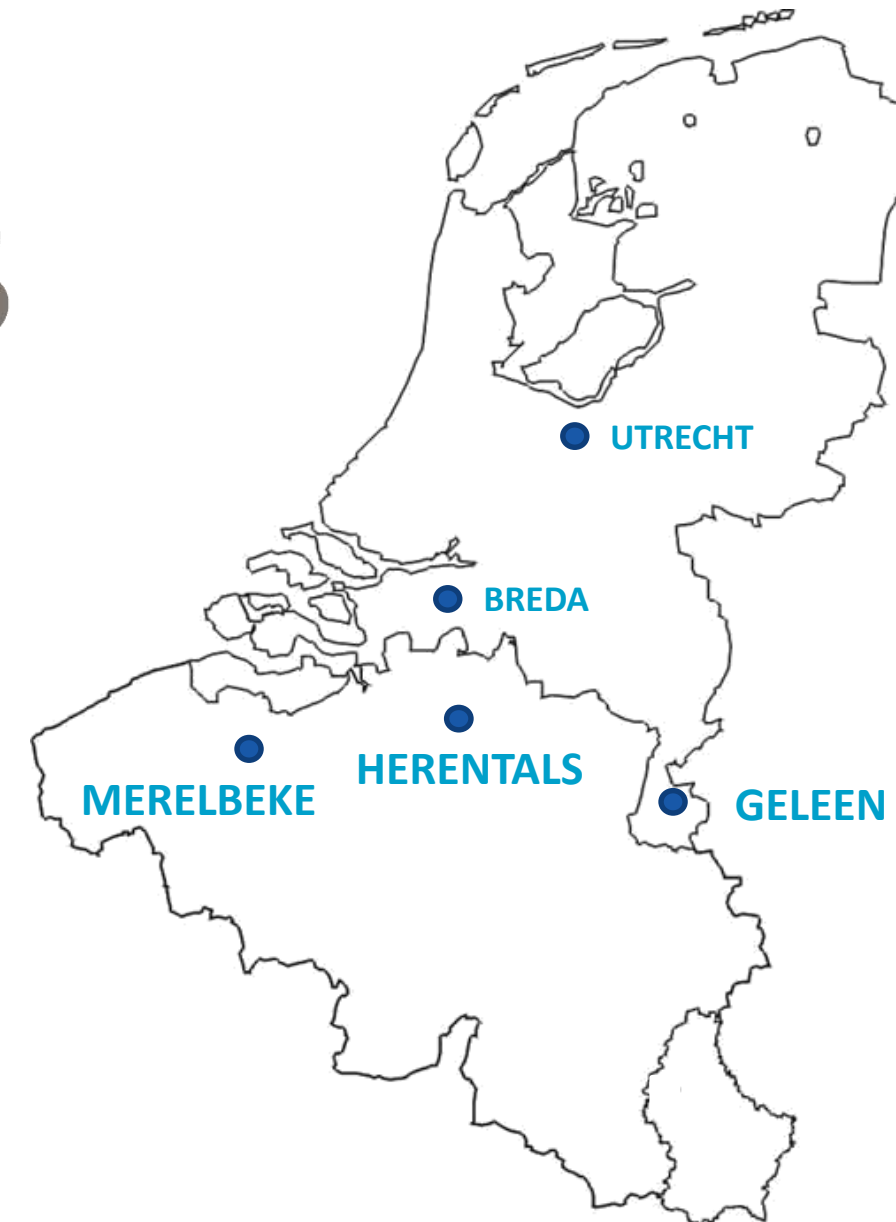
GEONIUS

Approx.

200 People



IDENTITY
Engineering firm



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

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)

Problem

- Effects for other parties

- 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**

Opportunity

2010 – Real DBFMO contracts

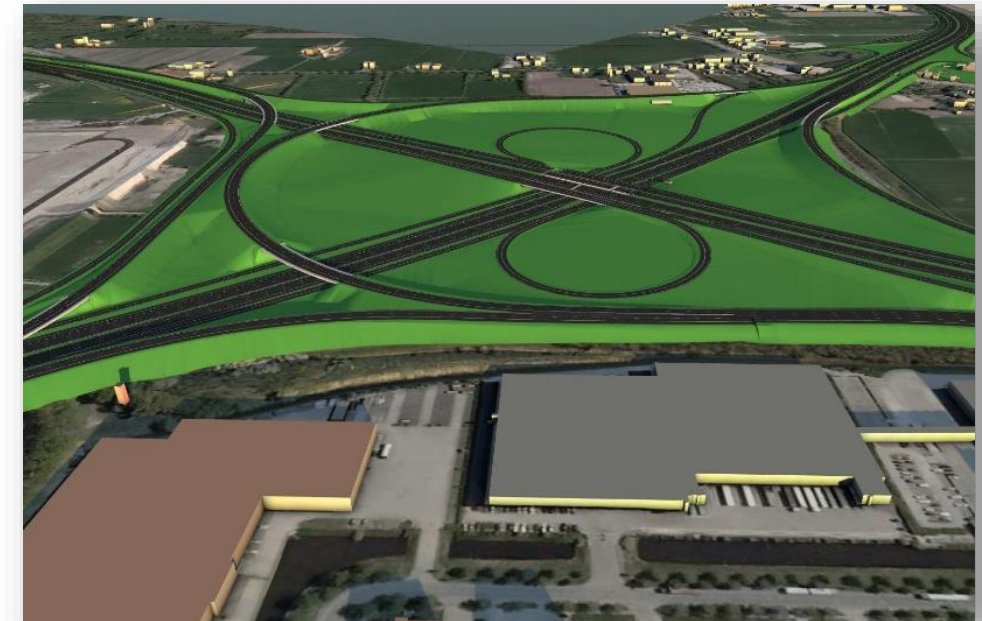
DBFMO contracts

- 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

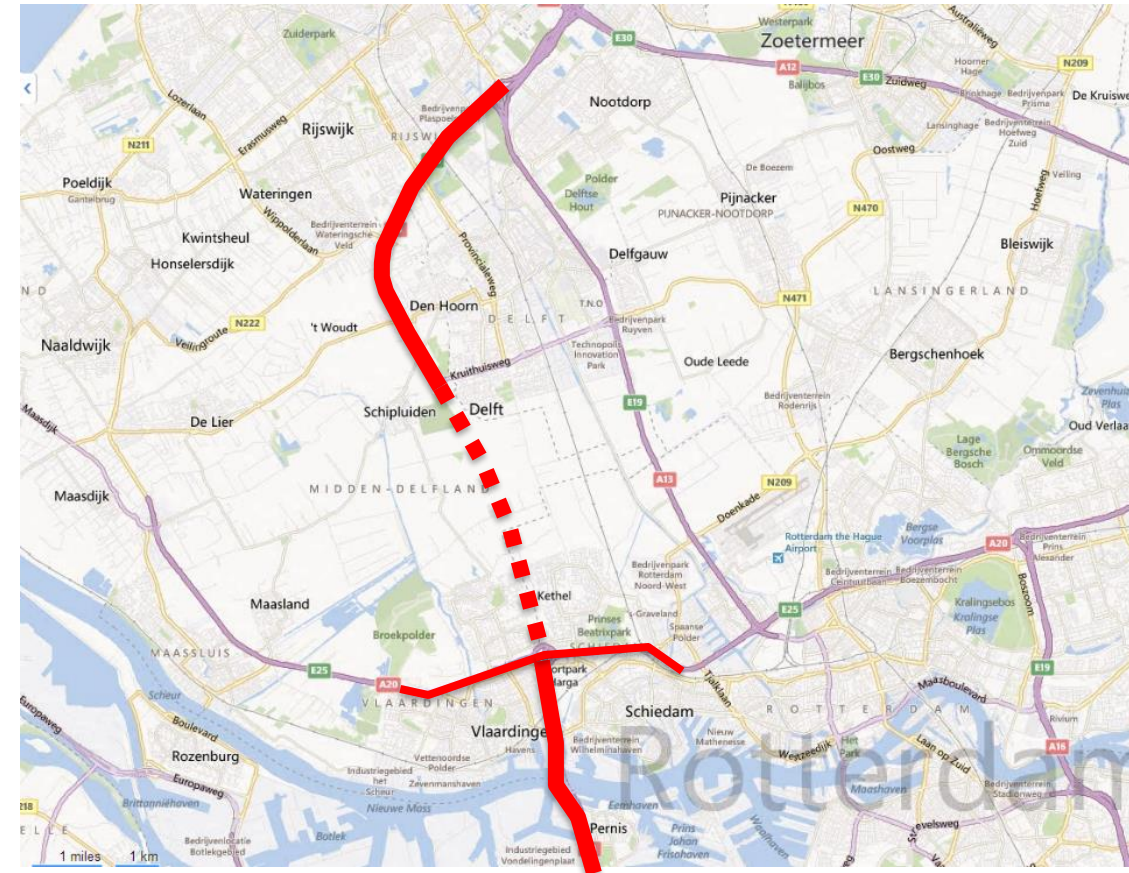
- Short timeframe (6 months)
- 700 contract documents with relevant information (PDF!)
- 60 temporary colleagues
- Large amounts of money
- Sign contract = build it !
- Road design only 1 aspect
- Huge risks involved



2012 – A4All a BIM milestone project

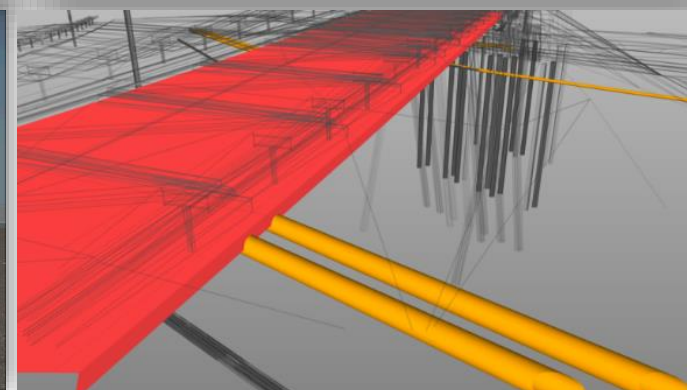
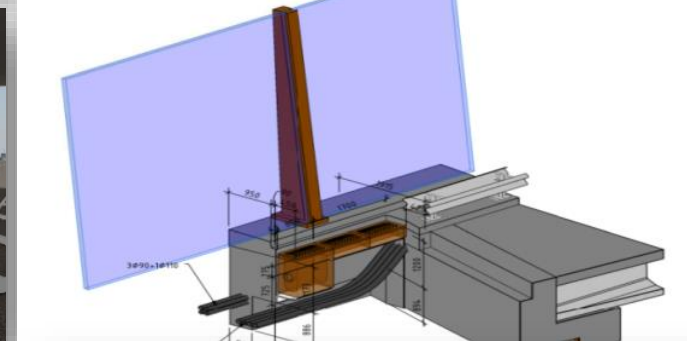
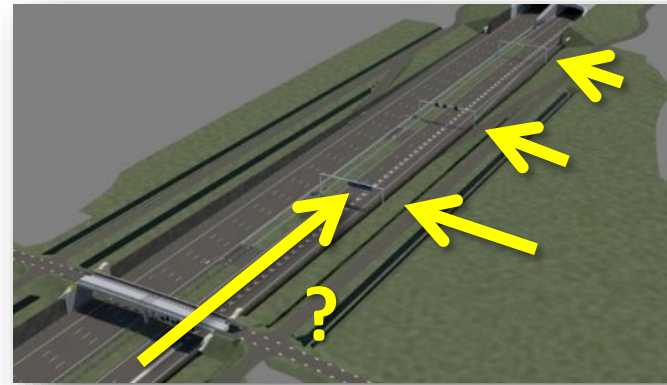
A4all project – Highway construction

- Missing link
- 60 years of struggling
- Numerous stakeholders



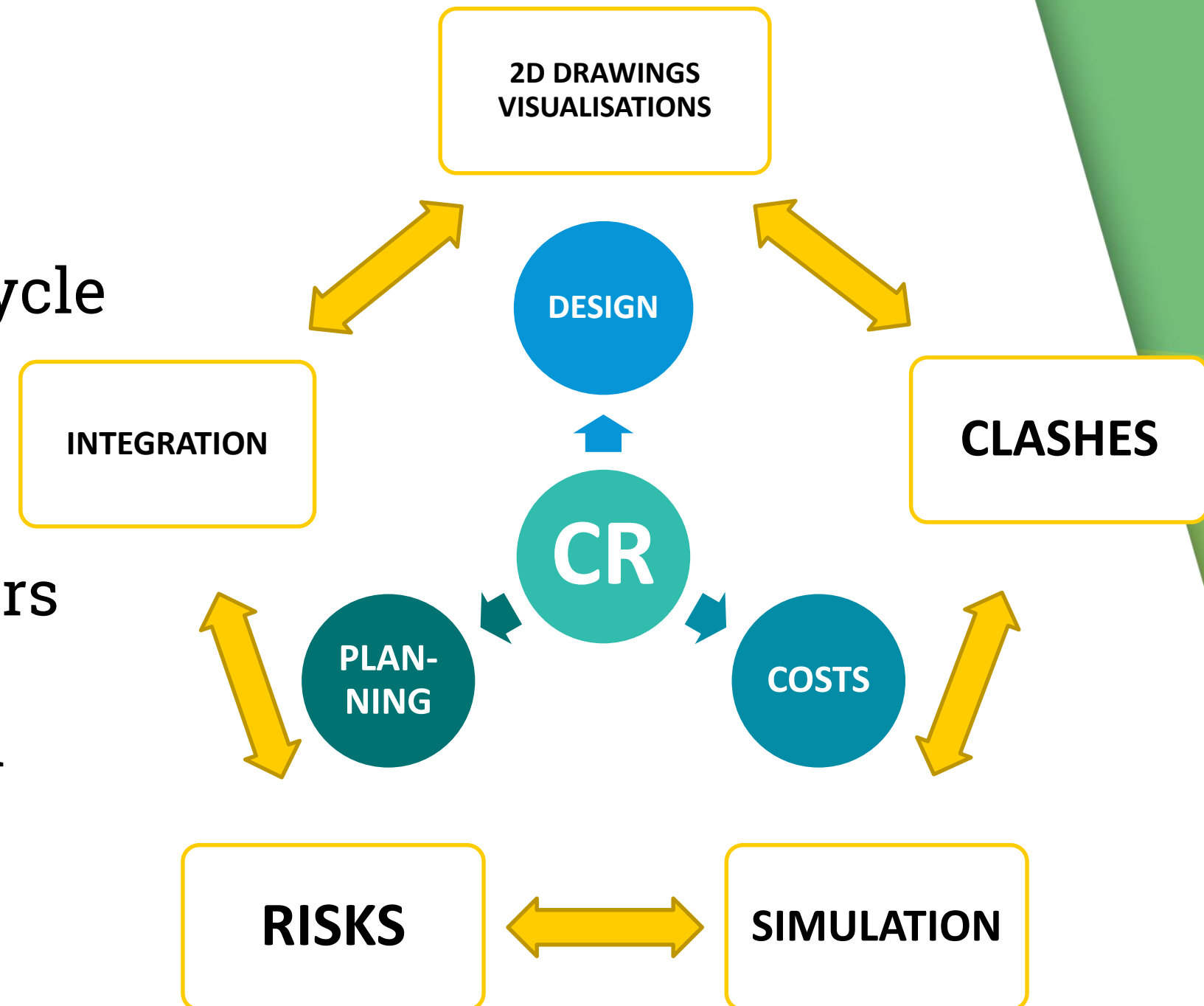
A4all project – Highway construction

- 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

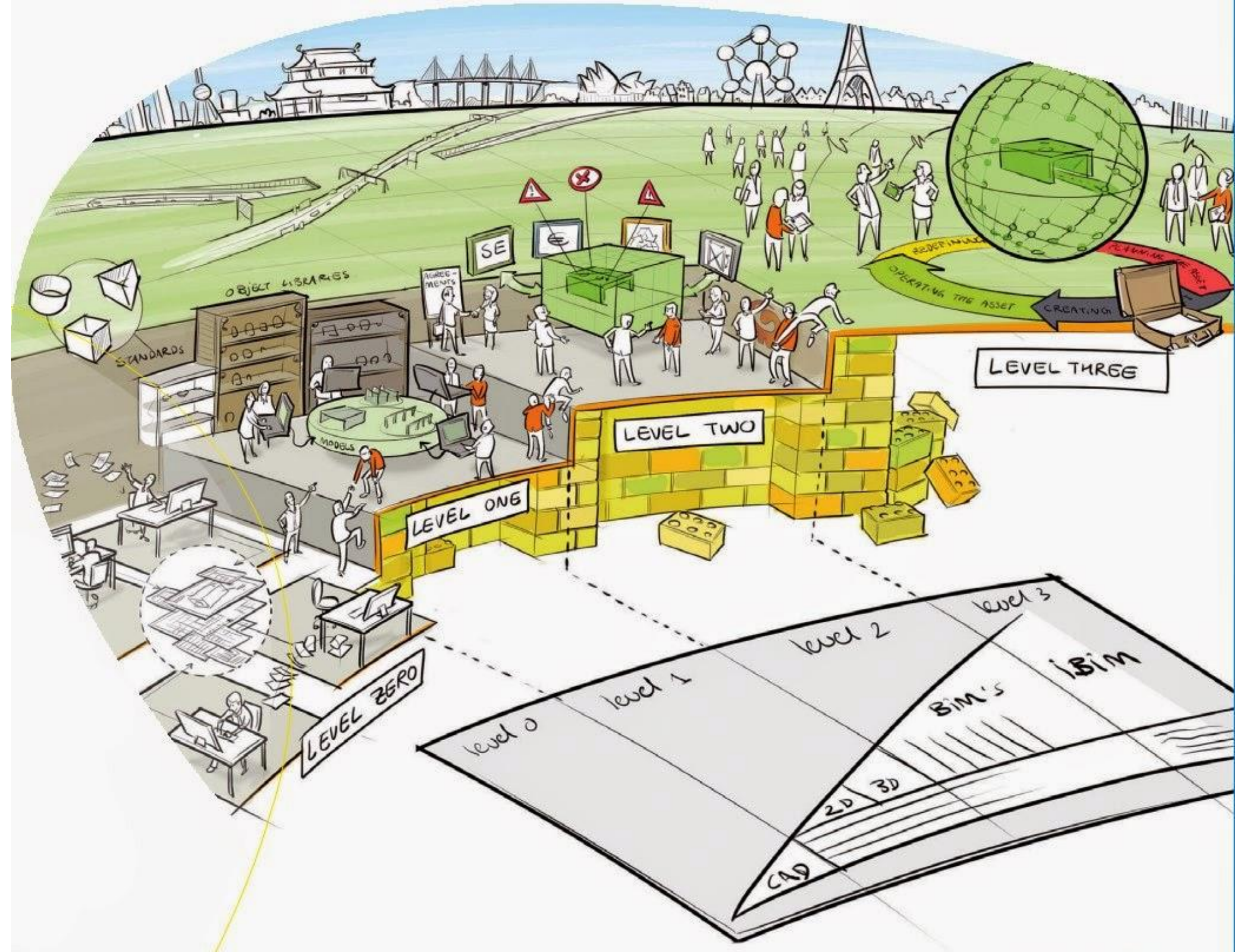
The Netherlands – Minimize Impact



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



CB • NL 

Dutch Road & Water Authorities

- Started in 2013 with the BIM projects by:



Rijkswaterstaat
Ministerie van Infrastructuur en Milieu

- 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)

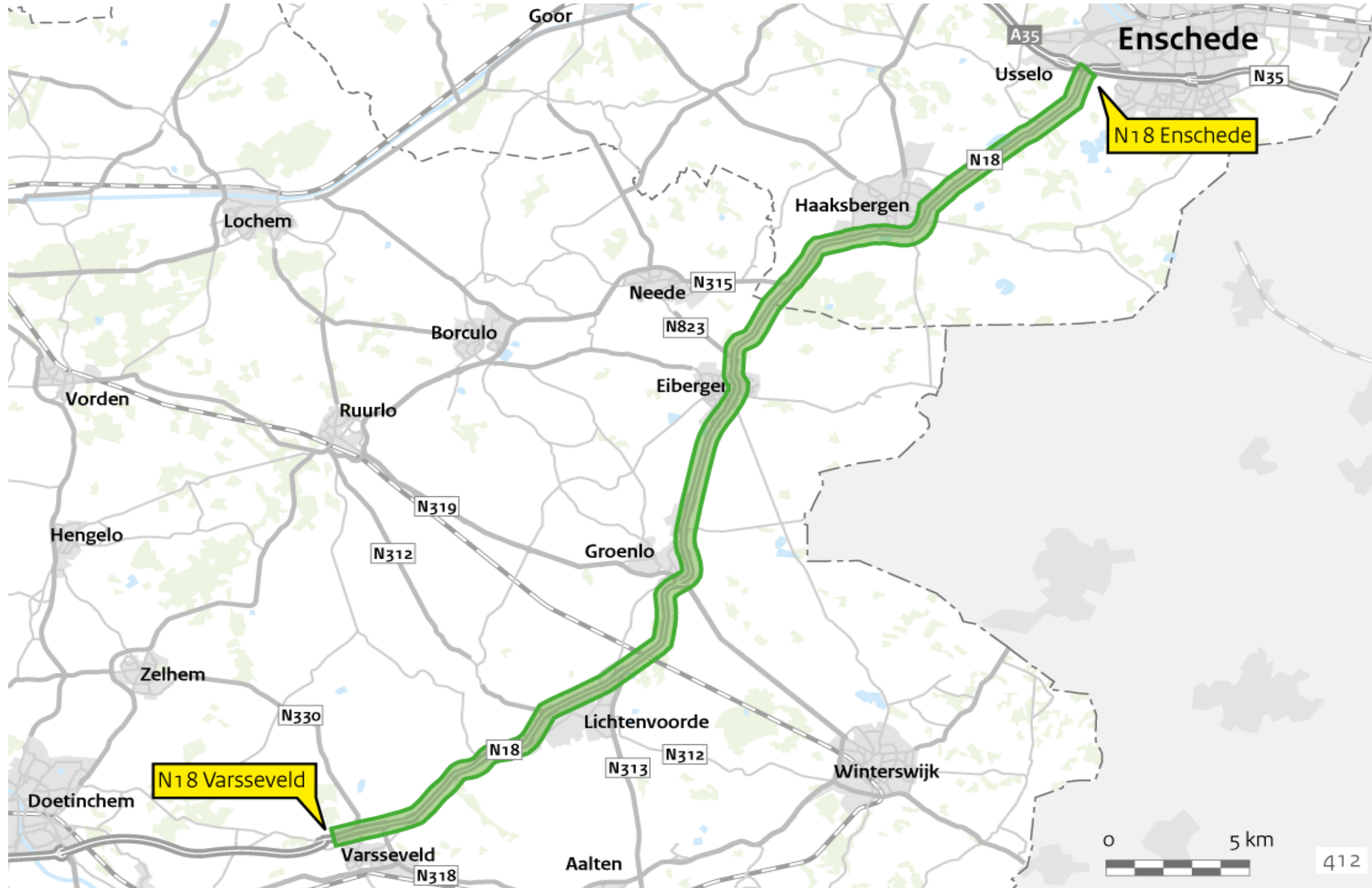
Bidding phase example – Lock Terneuzen

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



2017 – BIM at the moment

N18– Highway reconstruction



N18 in numbers

27 kilometers of freeway

150+ Civil3D corridors

25 Revit models

150+ Centre Alignments

2 years of construction

412.000 tons asphalt

585.000 tons secondary building material

200+ People with data access

24 civil structures

45 kilometers of local road

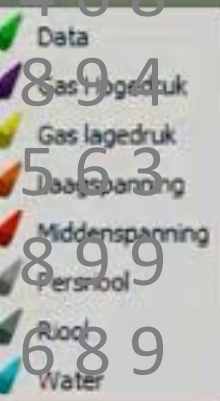
1.100.000 m3 of sand

387.000 tons subbase

57 Designers

25 years of maintenance

0 Printed checkprints



N18

- 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

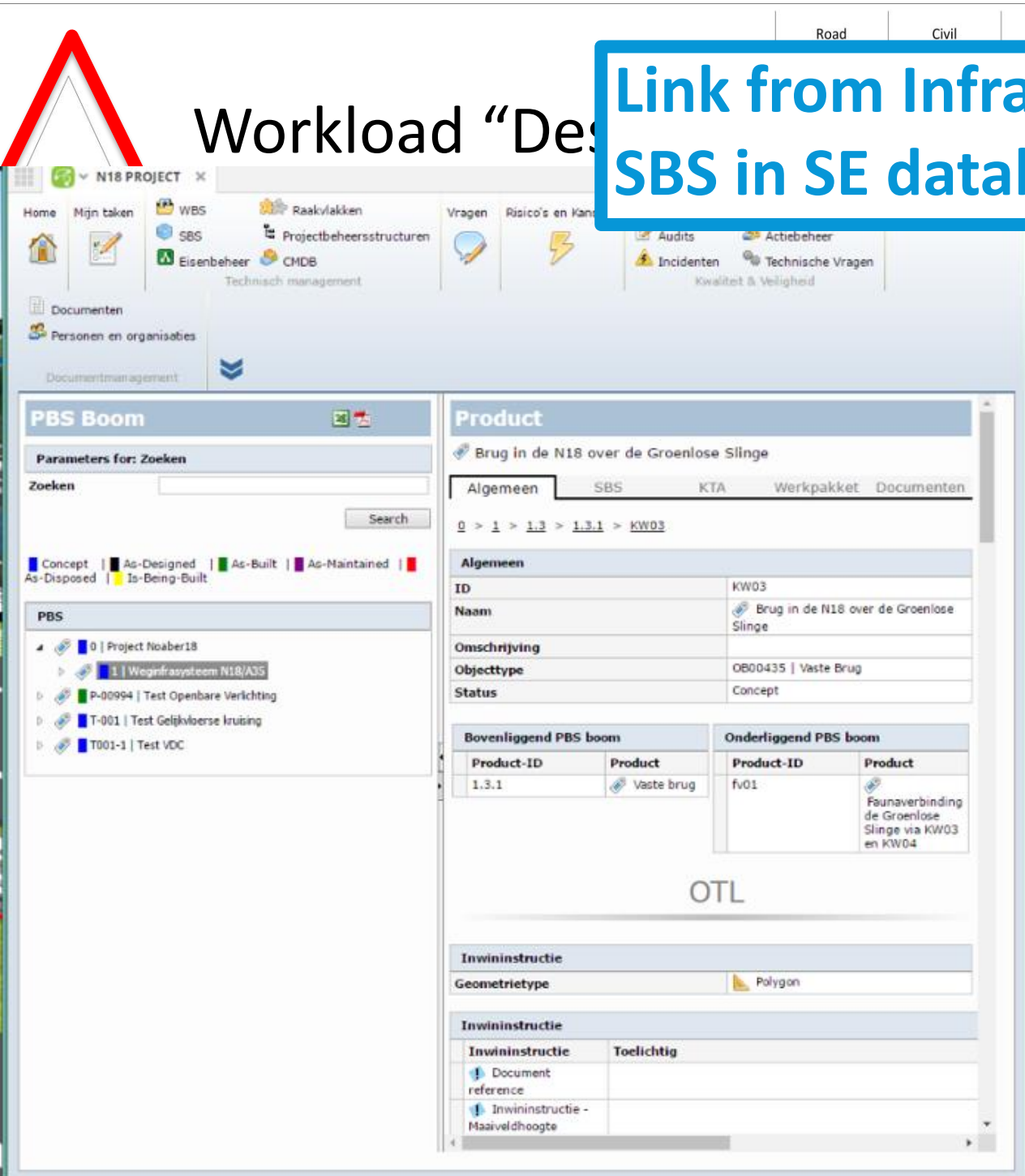


Systems Engineering (SE)

■ Struct

Workload “Des

Link from Infraworks objects to SBS in SE database



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

LEAN, Sprints and Scrum



Introduction

- Infraworks **supports** sprints and scrum review sessions

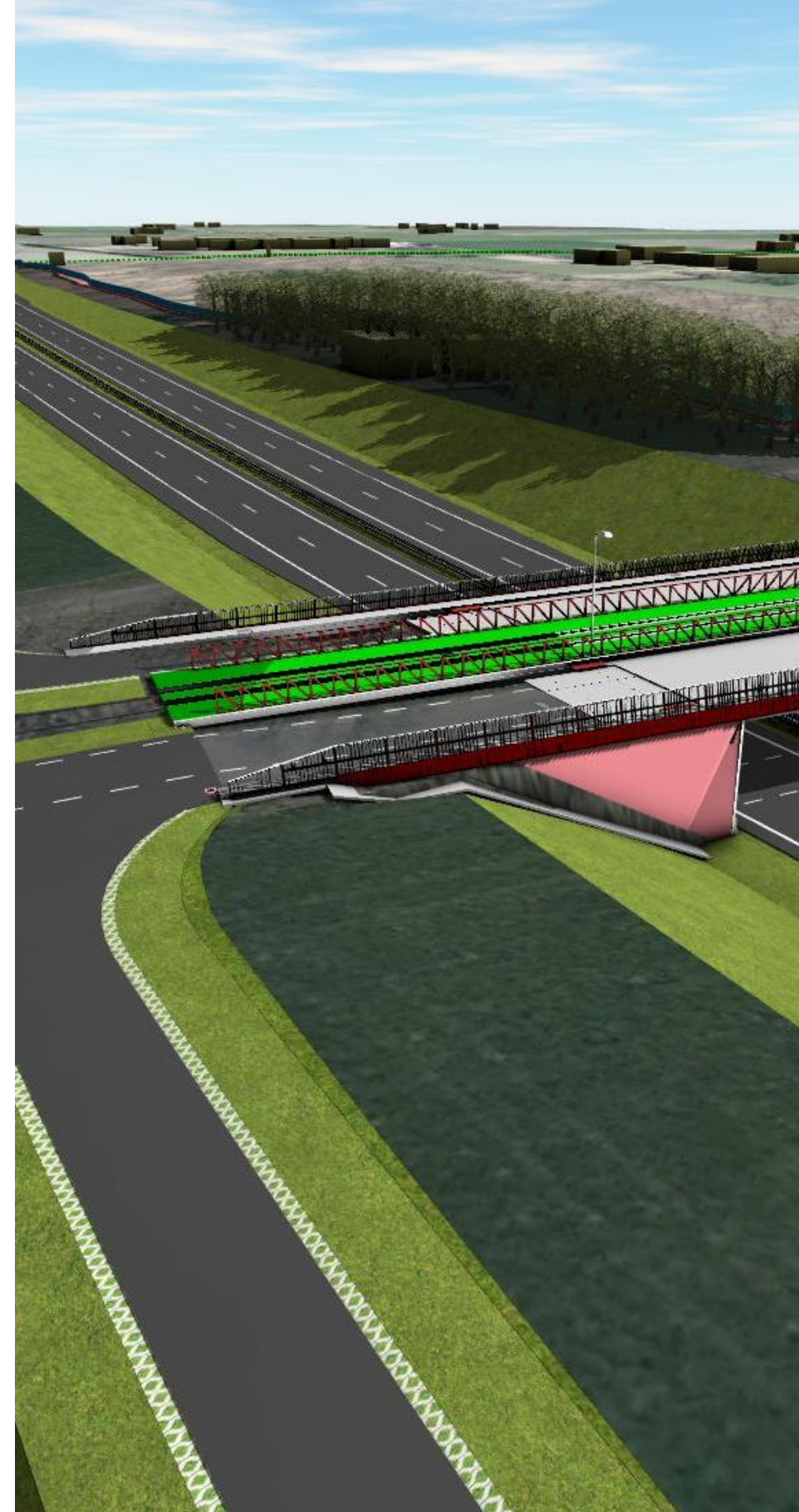


Sprint Review

- 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**.

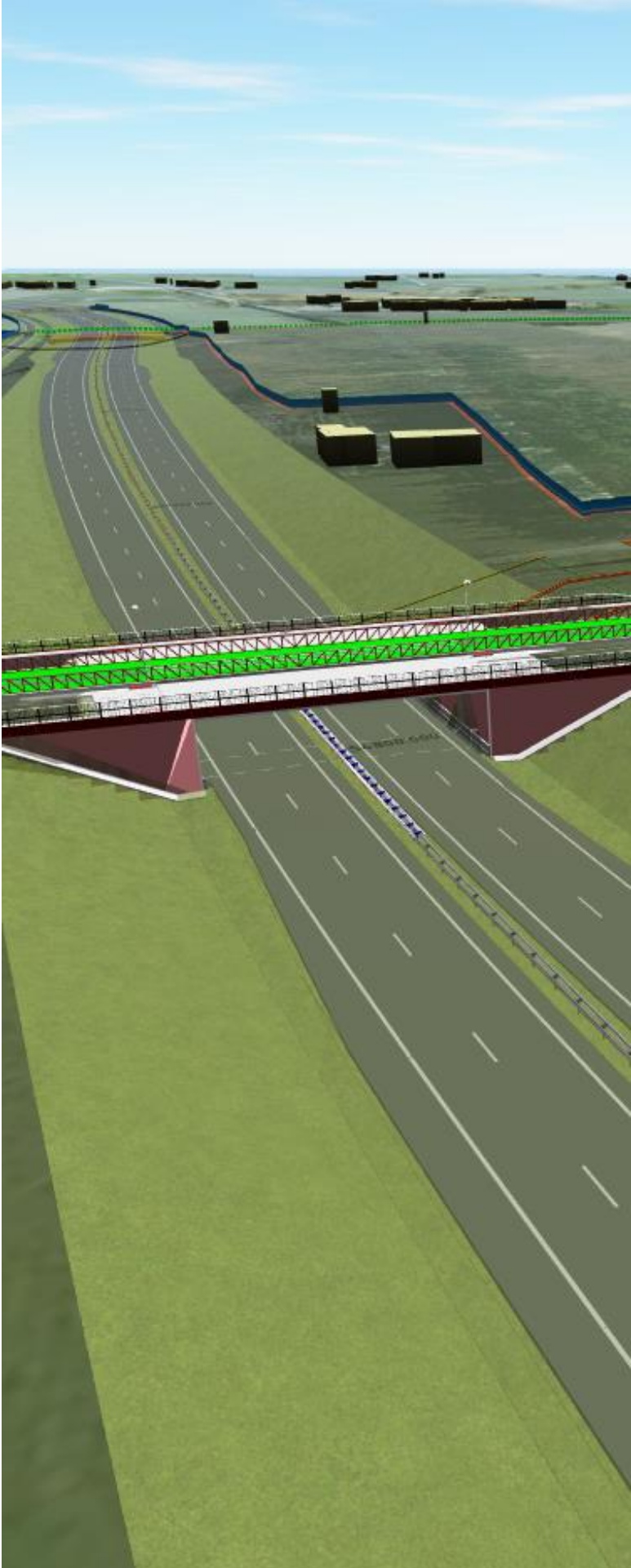
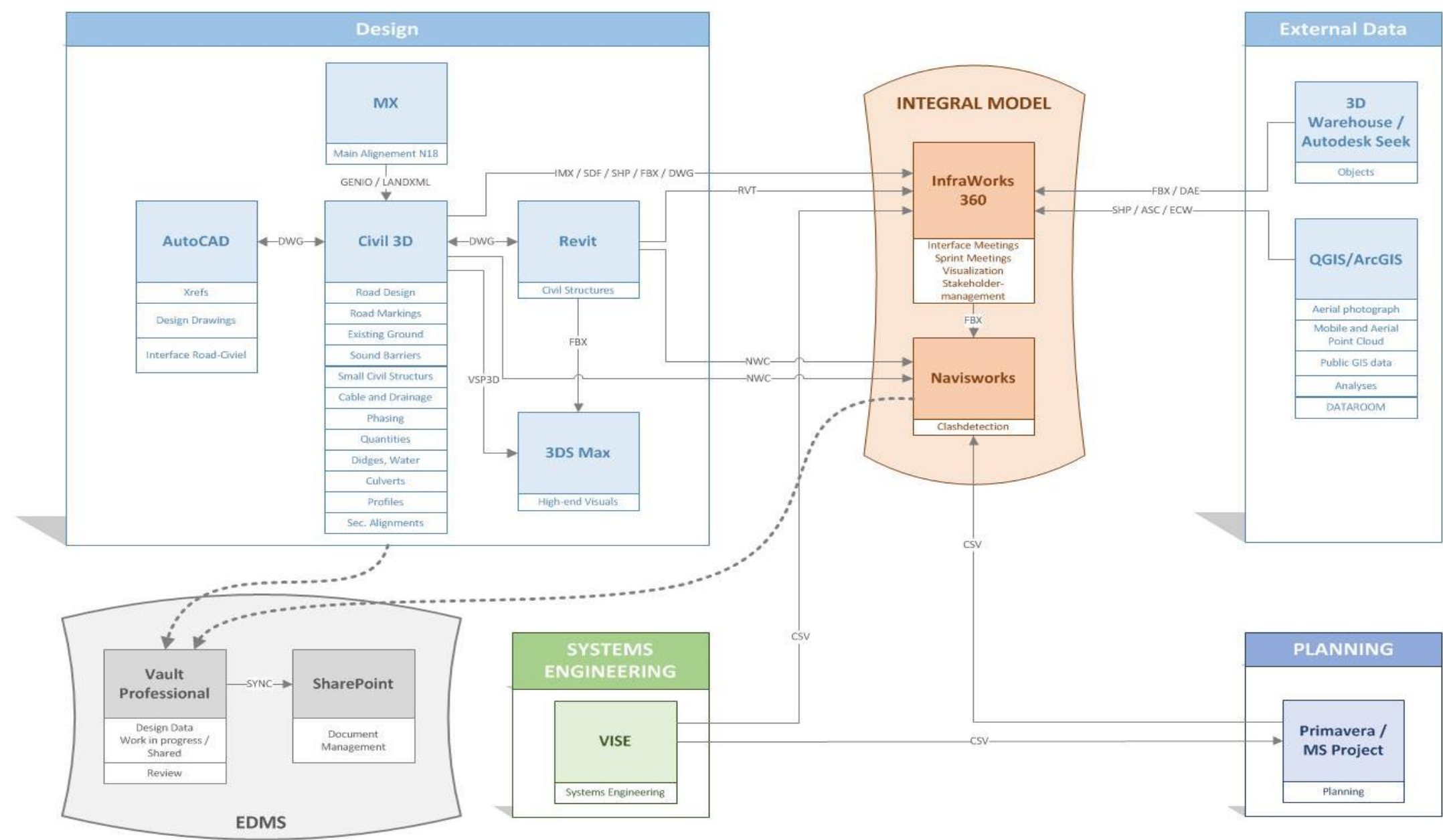


Software



Integral Model

The **current** process diagram

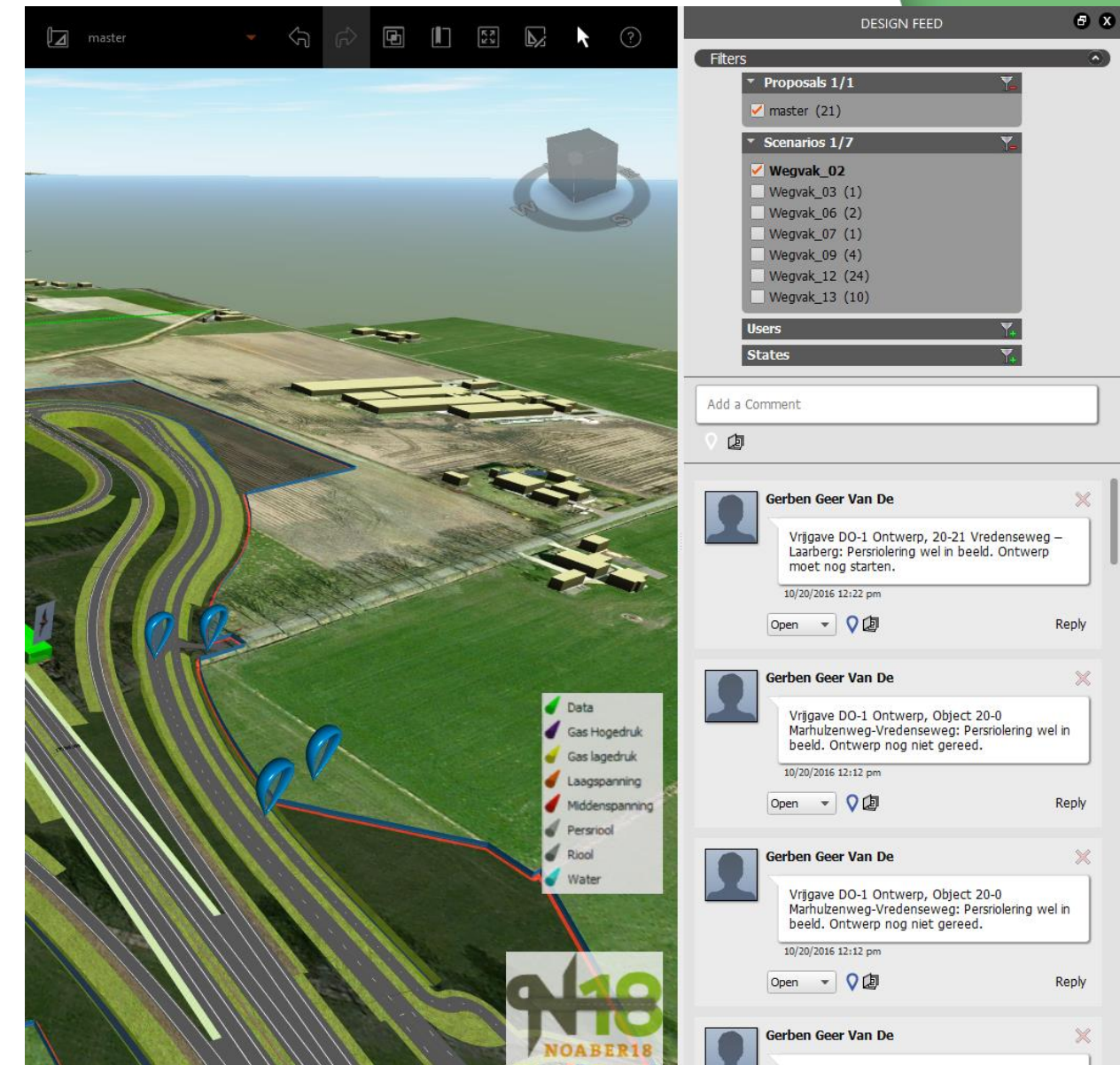


Infracore 360



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.



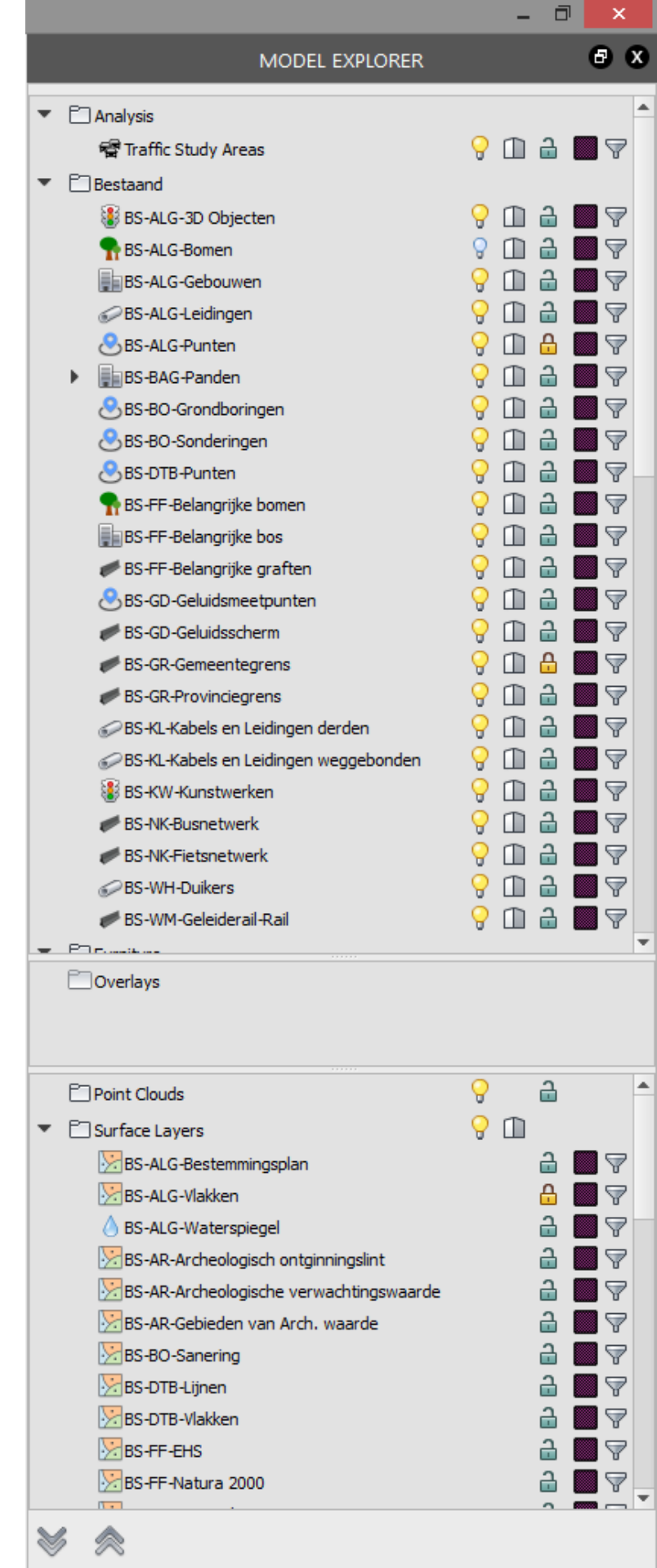
Model Explorer

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

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**”.

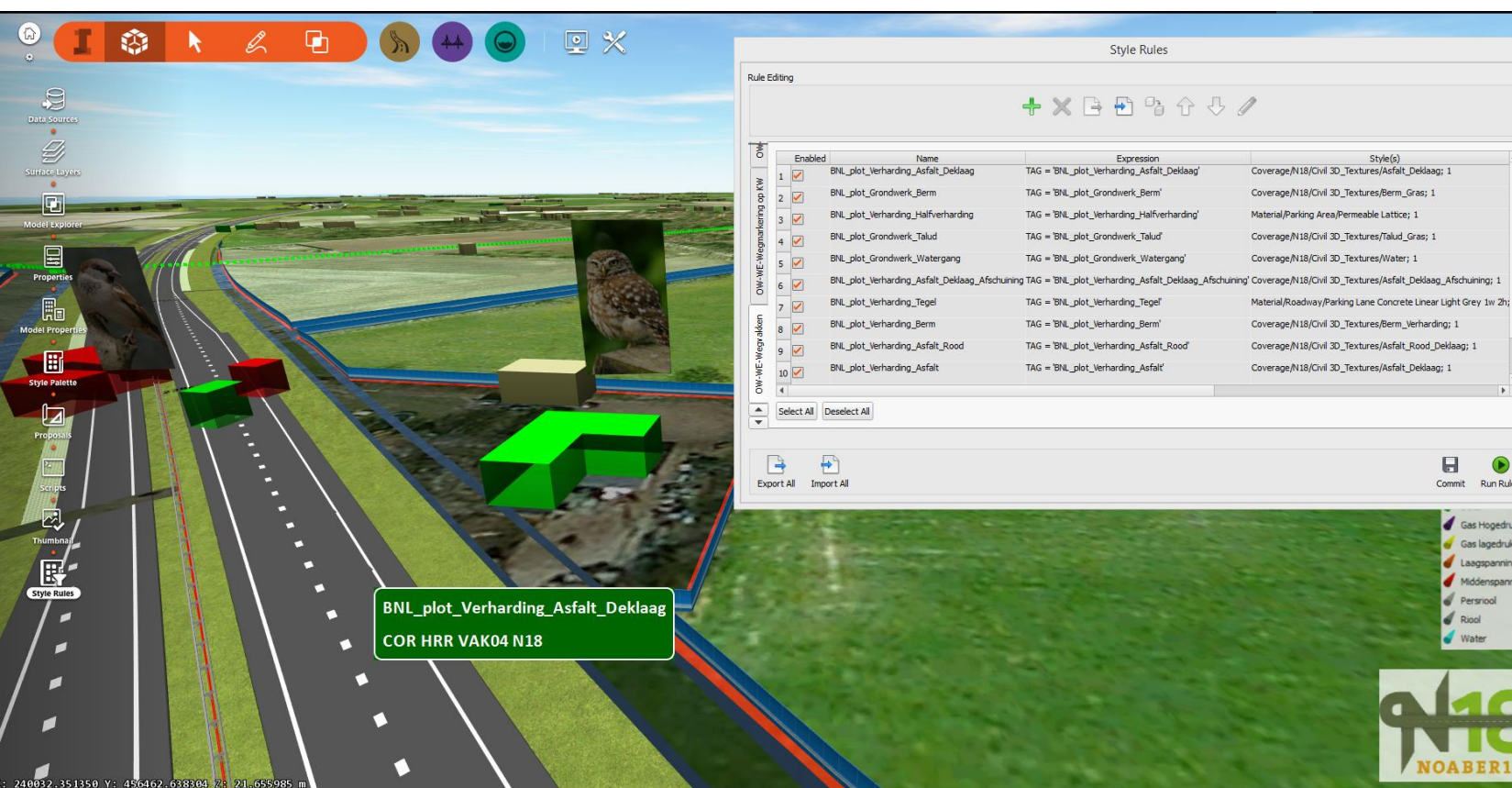
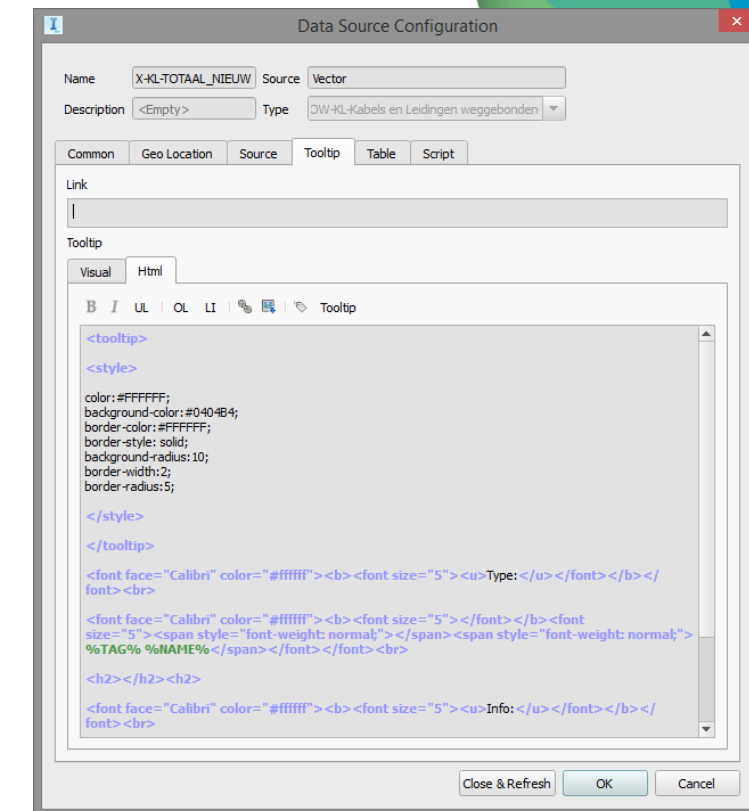
More information

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



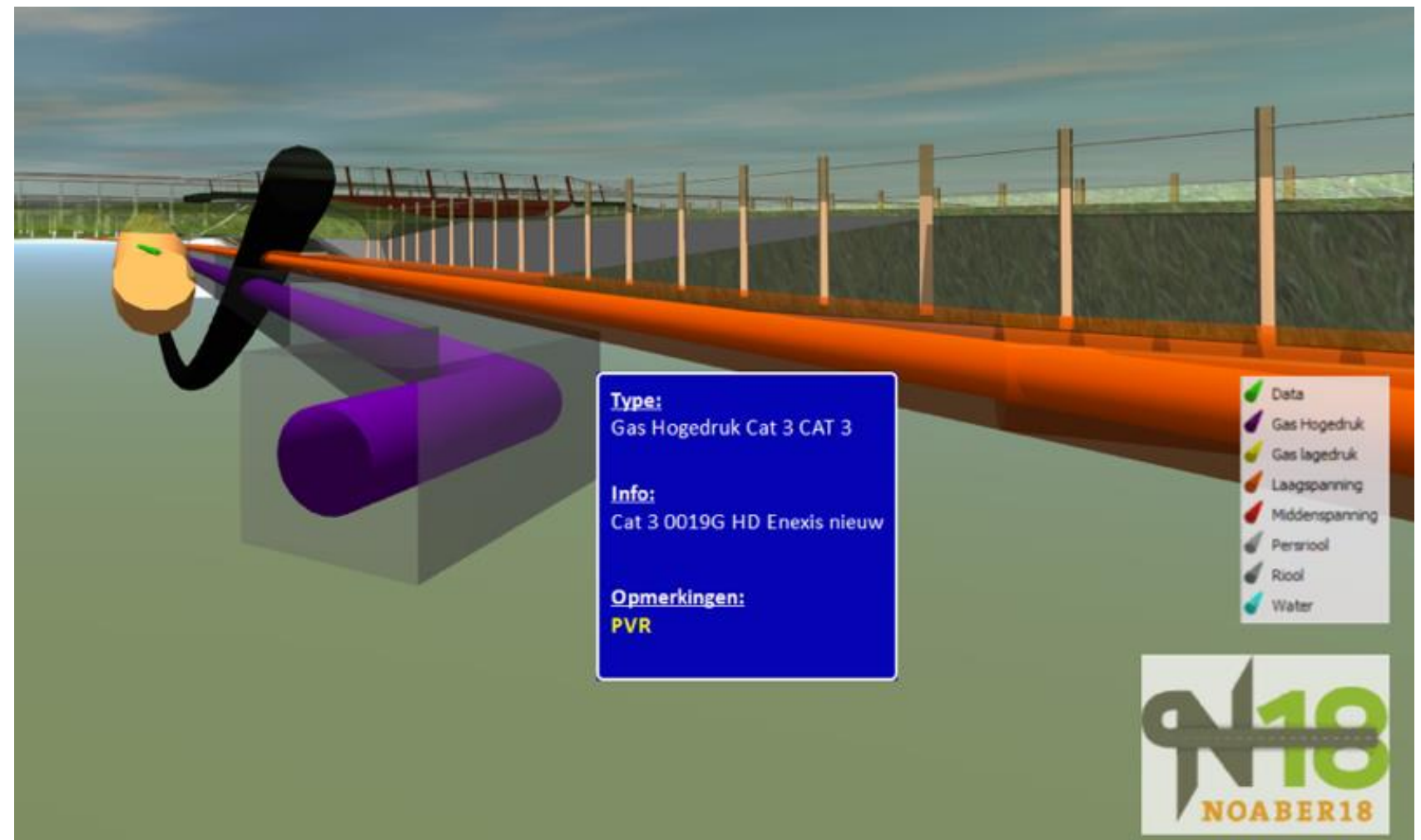
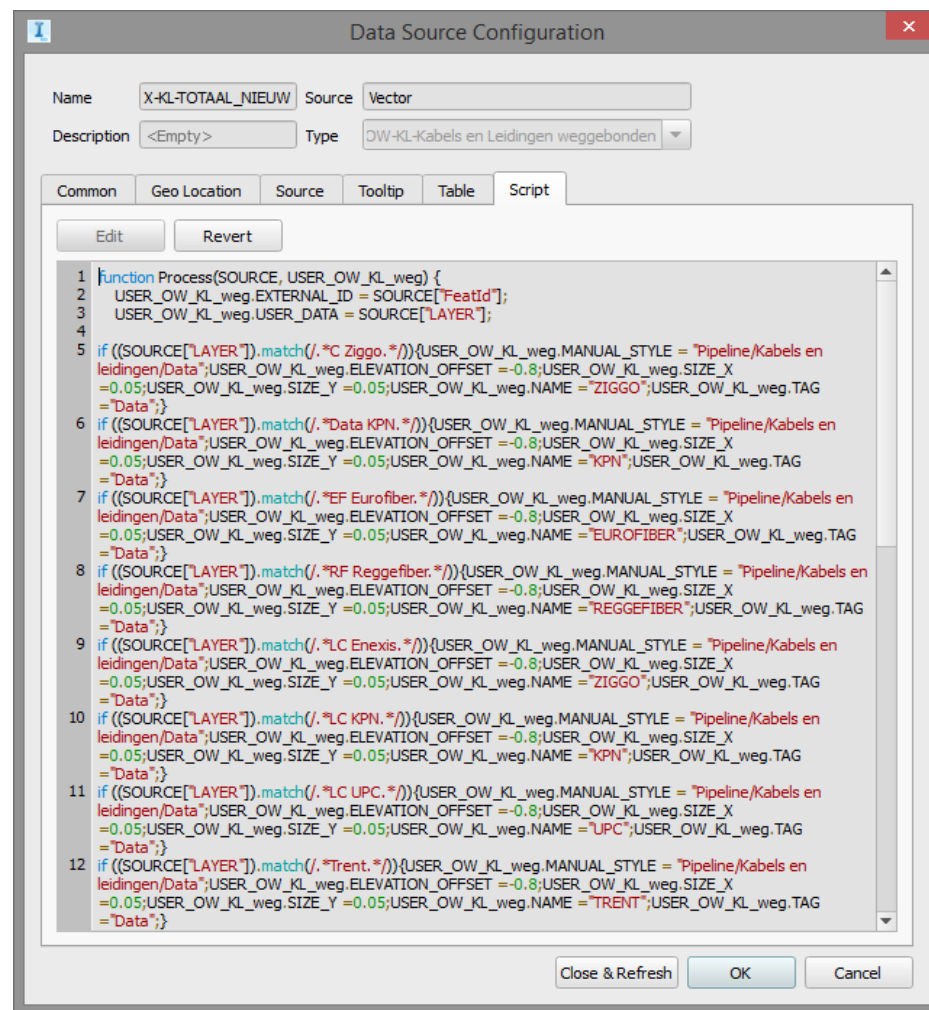
HTML Tooltips

- 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.



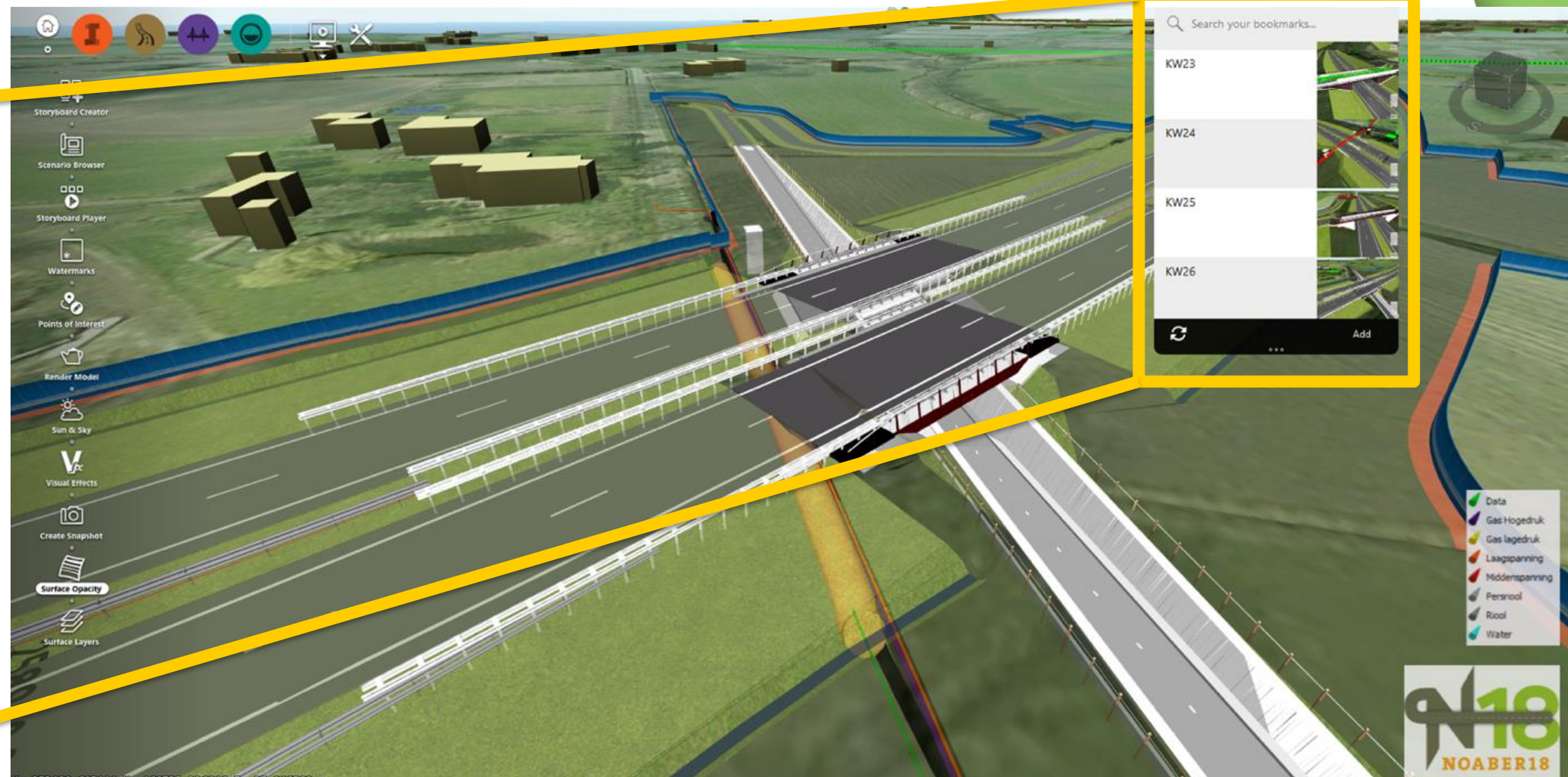
Scripting

- 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.



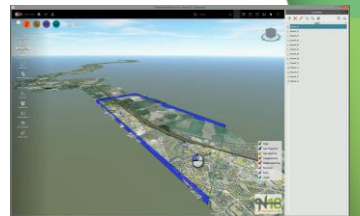
Bookmarks for Navigation

- Create bookmarks for easy navigation. You can search those.
 - each (civil) structure
 - each area of interest



Scenarios and Proposals

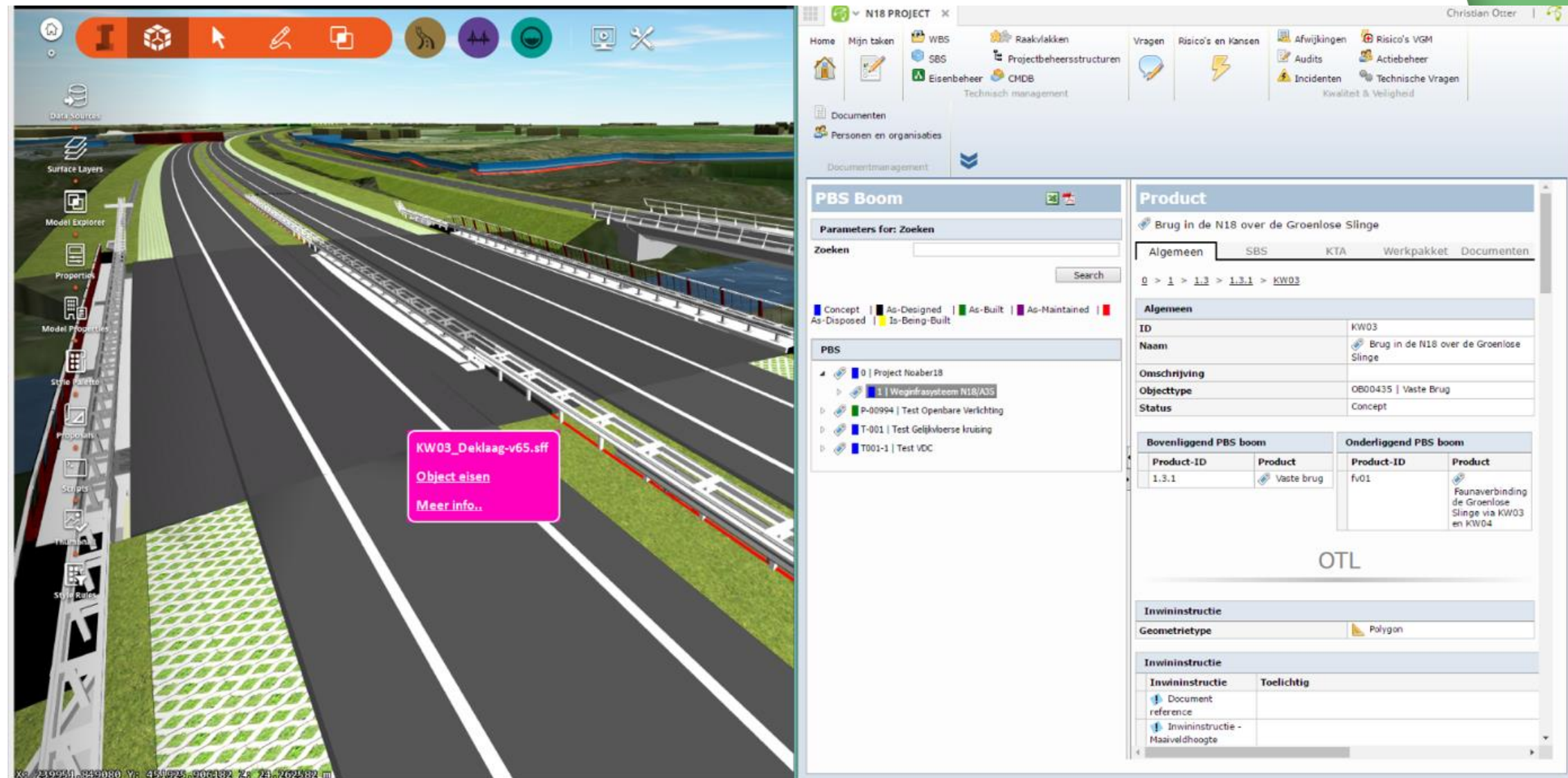
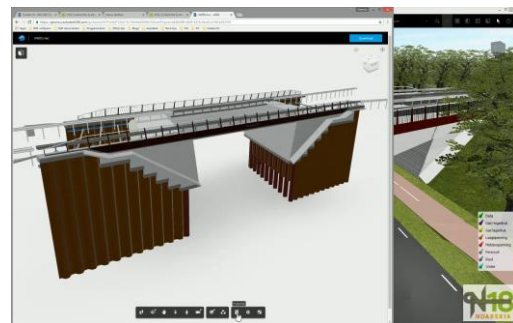
- Scenarios used as **project areas**. You are able to quickly select or show only a certain project area.
 - remember you can filter design feeds as well
- Proposals used as Sprint Review **milestones**
- Each proposals represents a **version** of the model which has been subject to the client's approval.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



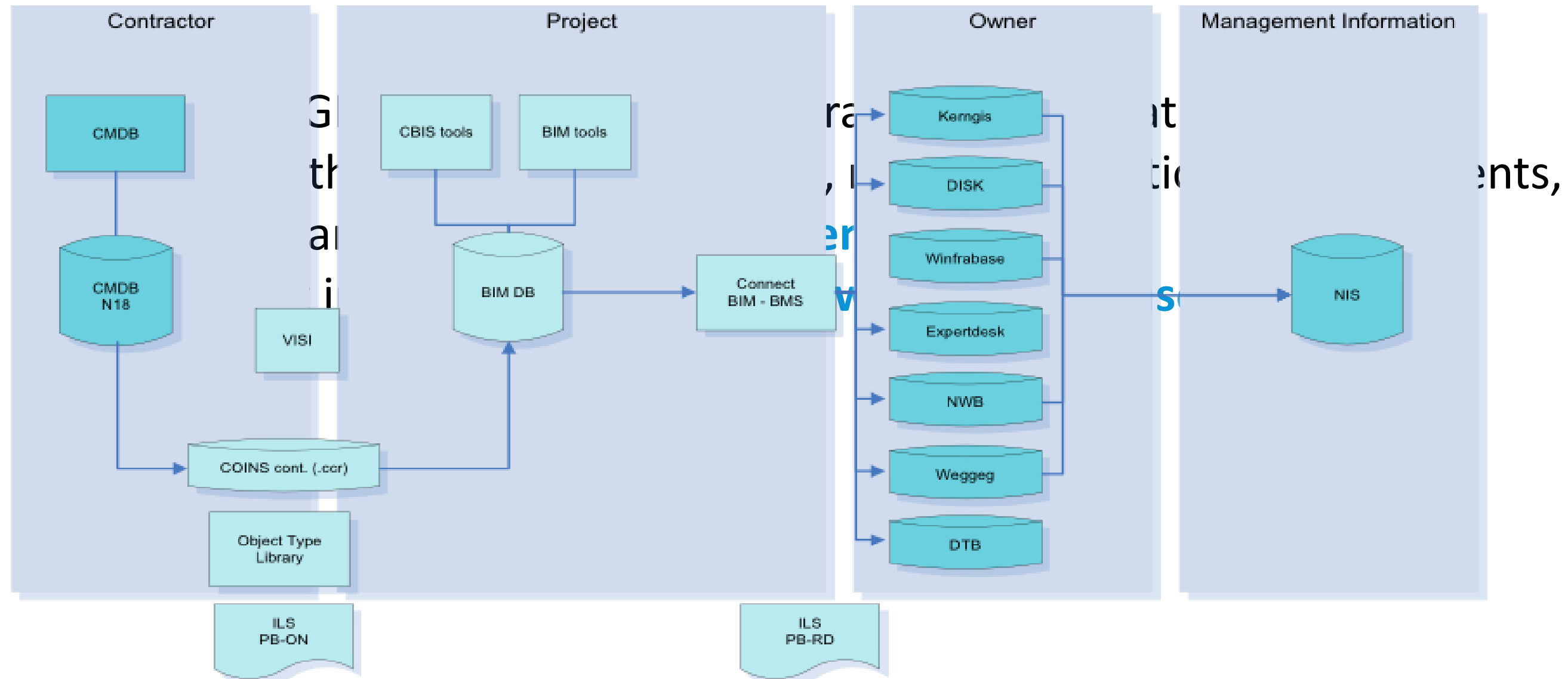
Requirements, Documents and 3D models

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

demo



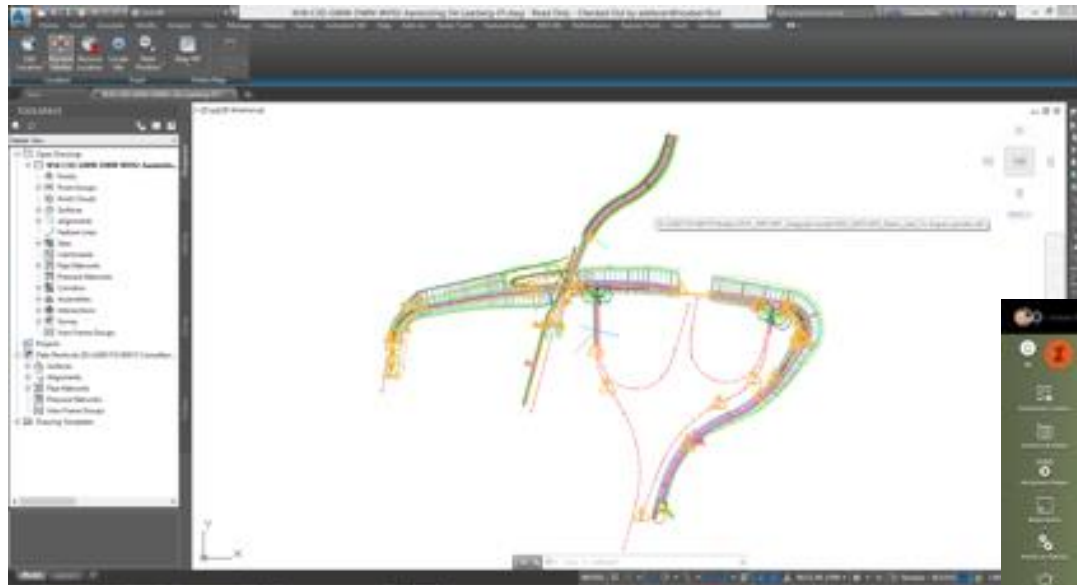
Communication with Client



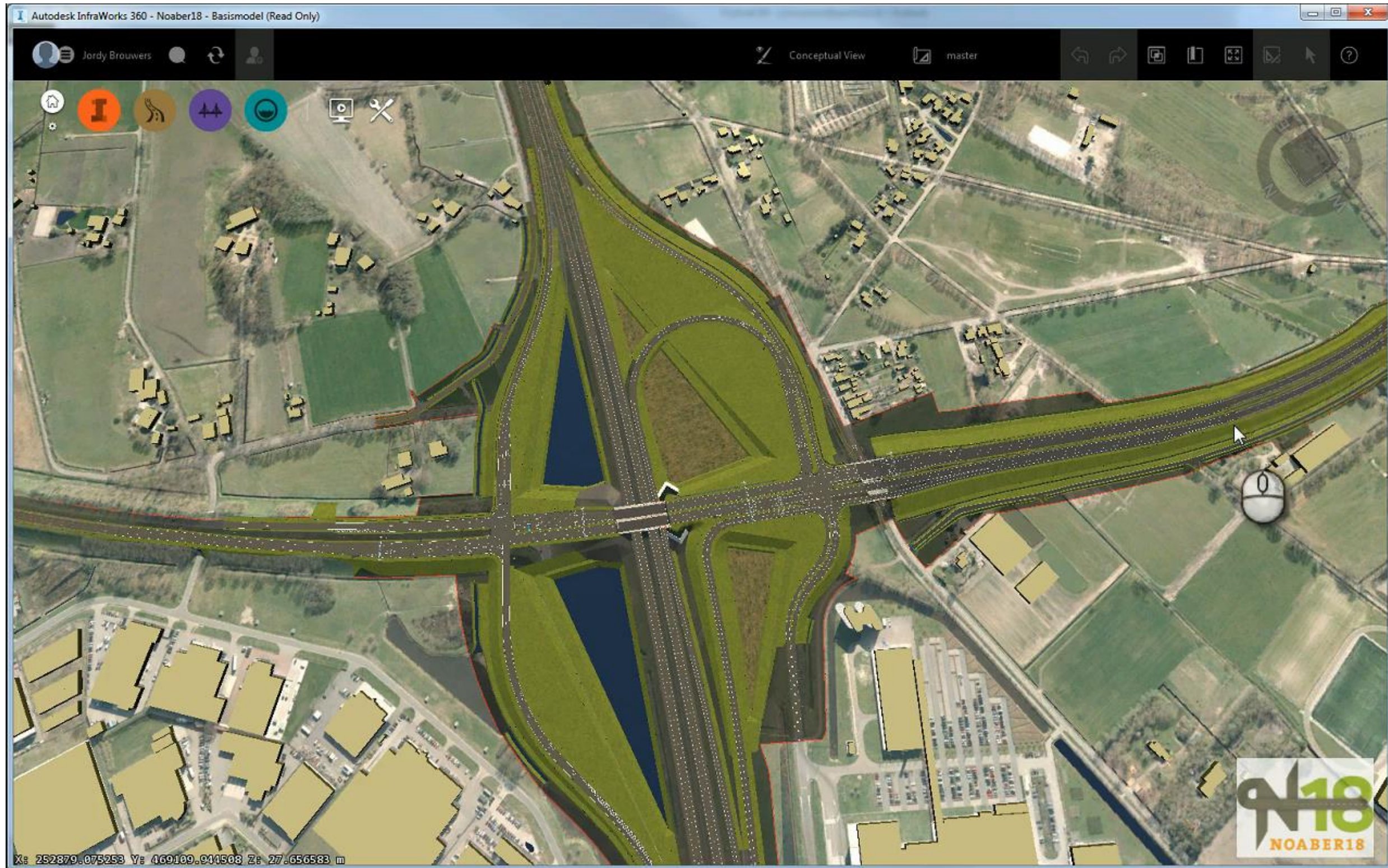
- Configuration Management Database (**CMDB**) to link geographical information from Infraworks to the system engineering database and document management system.

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

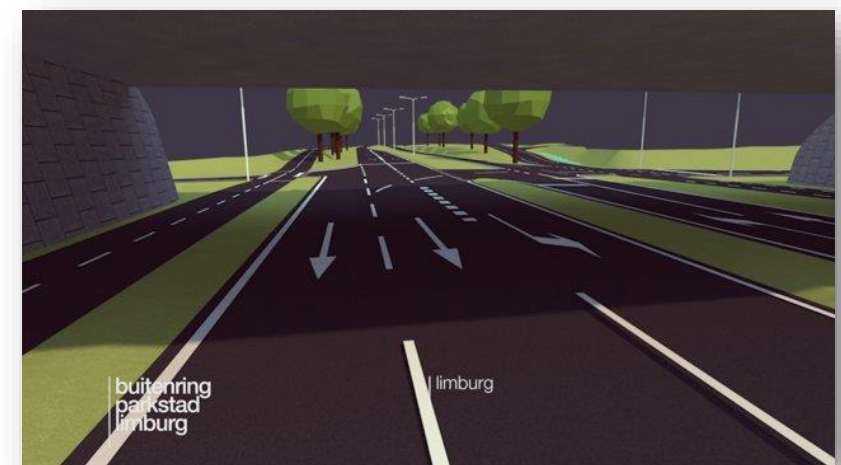
onsBIM – ourBIM, the Geonius BIM concept

‘Modulise’

Vision

Protocol

Execution plan



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

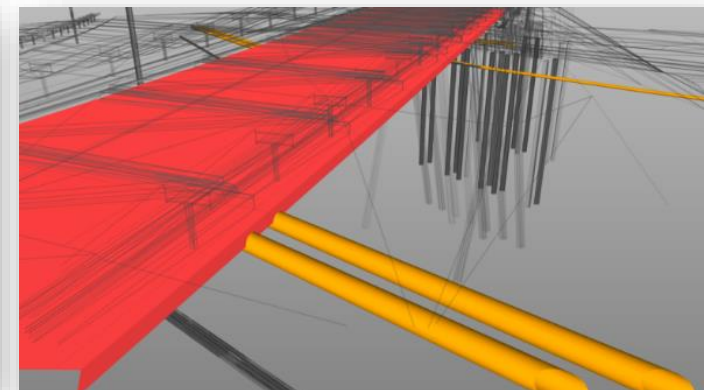
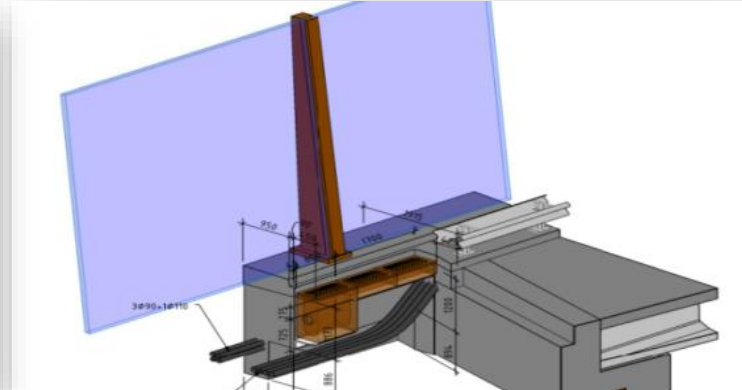
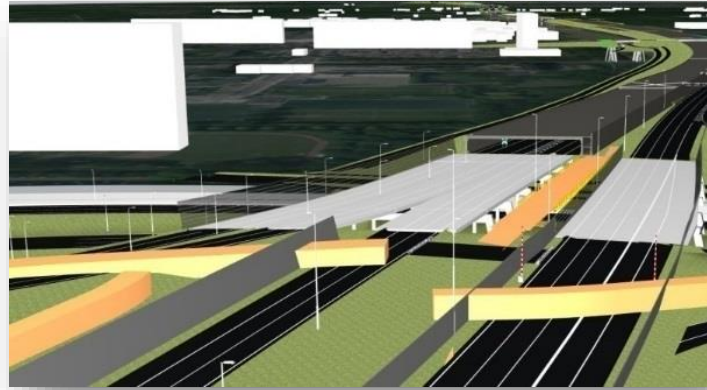
- BIM is most about **people**, not technology
- See BIM as a **integral** part of the process
- Work **together**, regardless of used software
- Bring in (external) **help** if you need it
- If possible, create **1 team on 1 location**



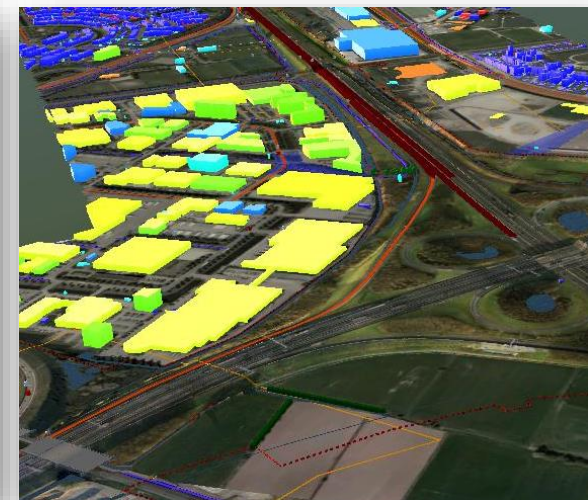
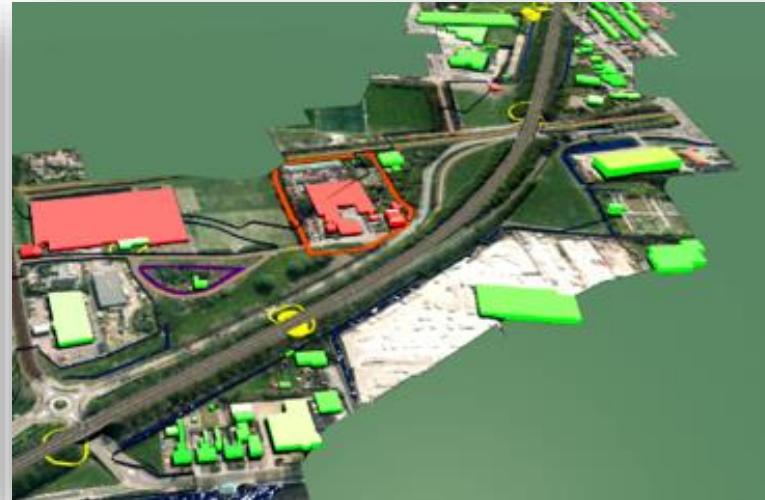
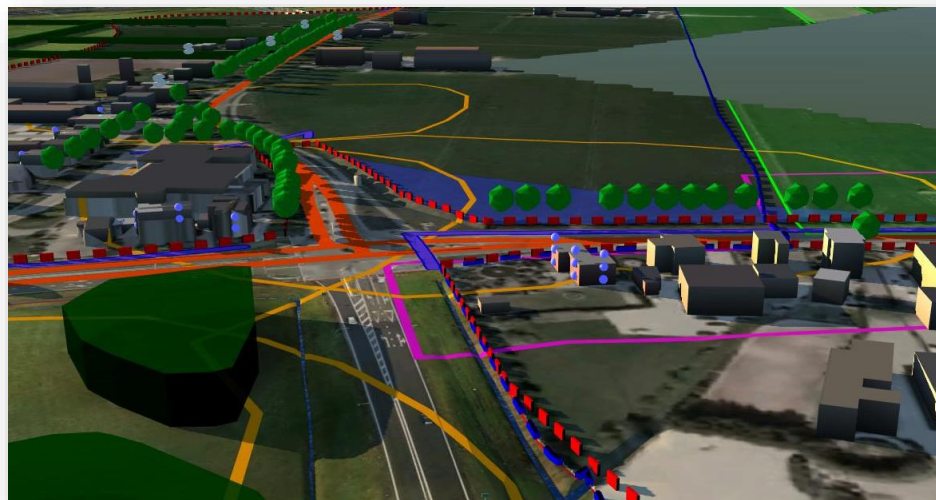
Focus

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

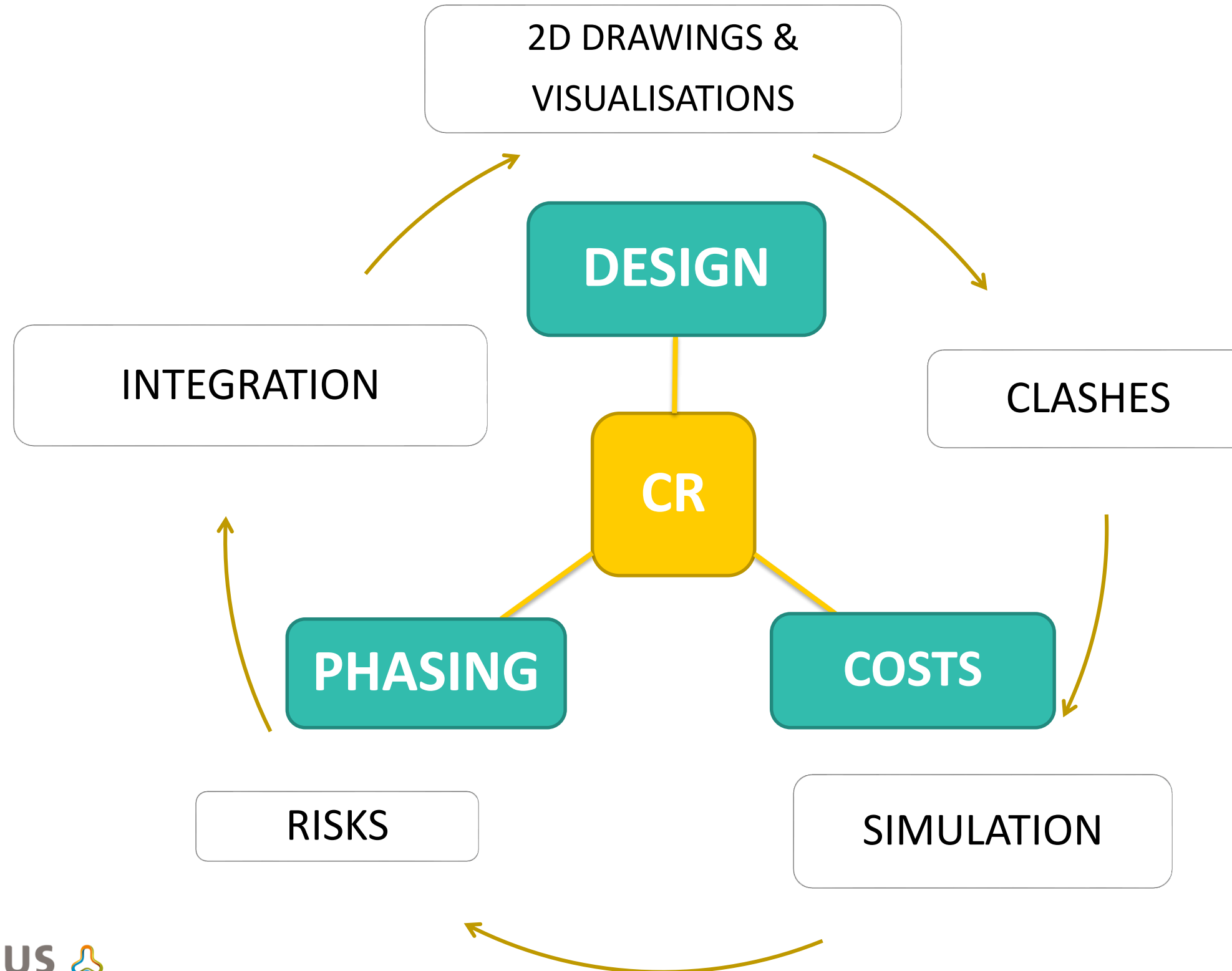
Constructability or coordination



or



Example primary and secondary BIM goals



Example - BIM Uses

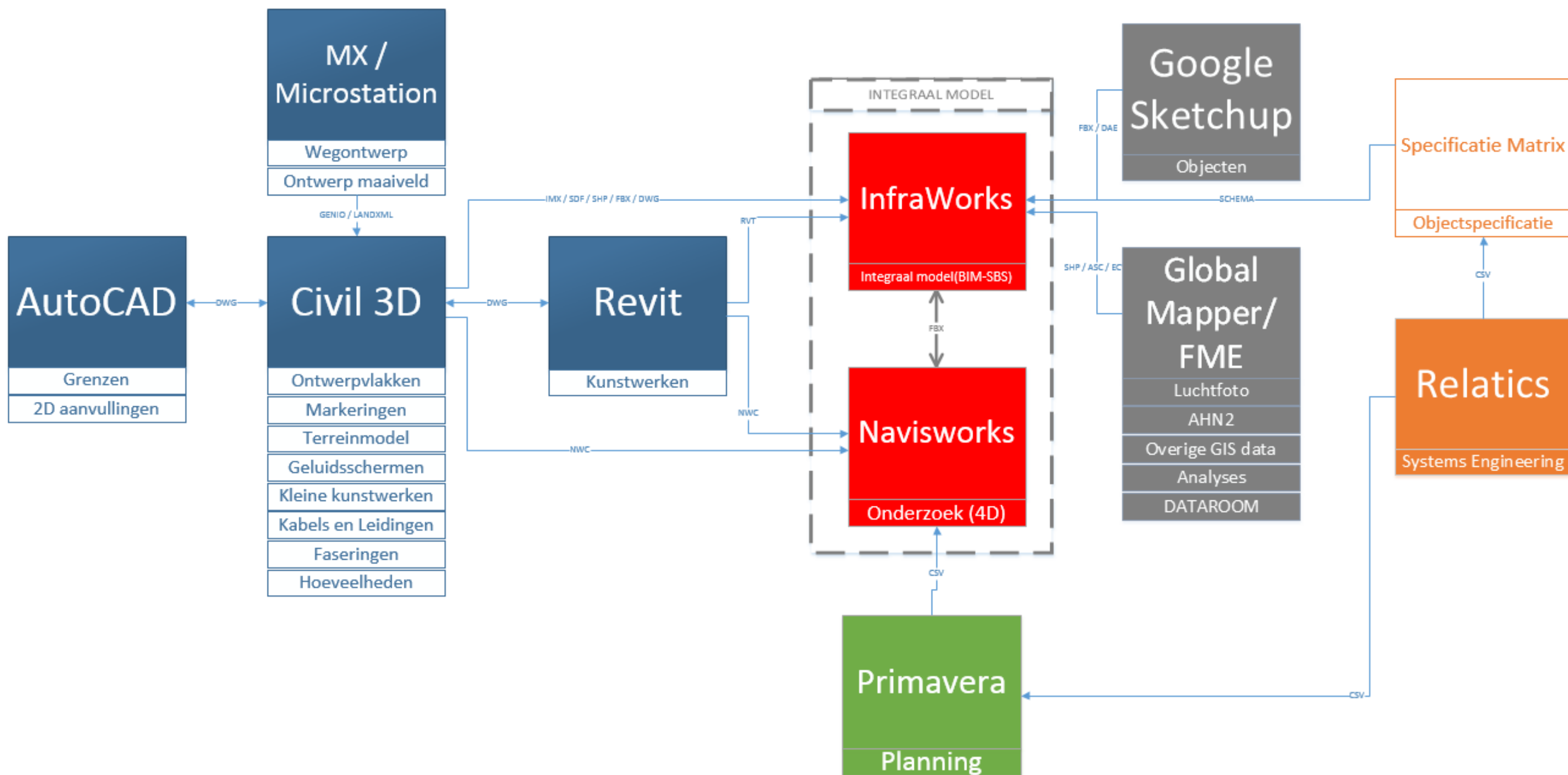
Toepassingen Matrix

Versie: 0.3

Datum: 29-4-2015

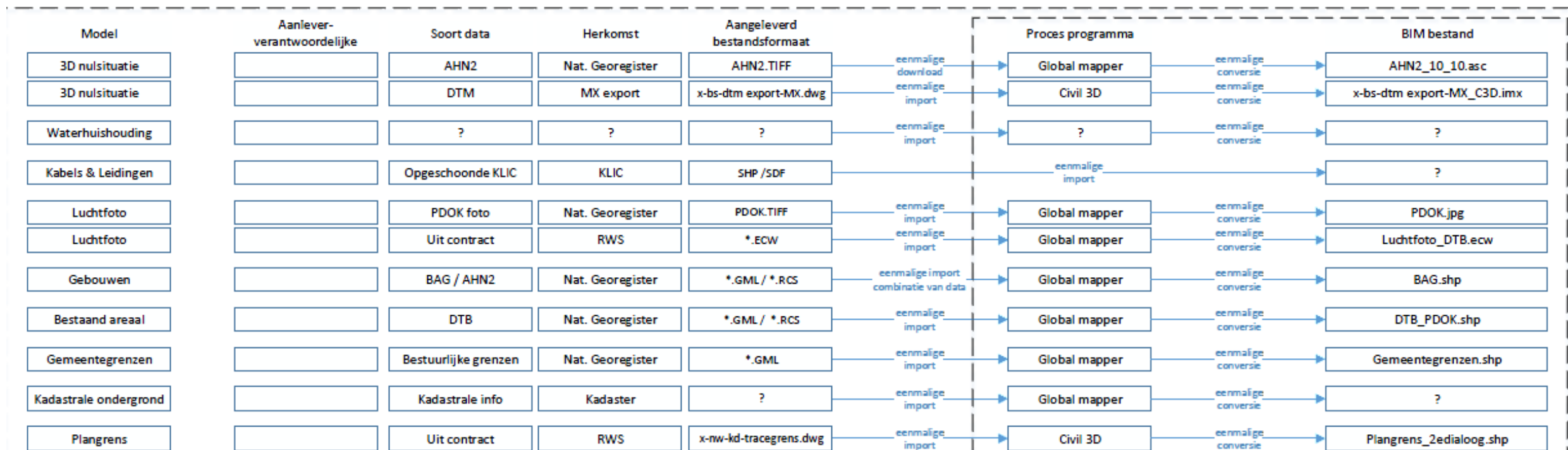
		Toepassen?		Discipline (I=Input leveren, N=Nuttig voor discipline, T=Tas)									
	Opsteller: J. Brouwers	V=JA	?=NTB	Ontwerp									
Nr.	Onderwerp	X=NEE	P=Pilot	Verkeer	Wegen	KW	DVM	Vorm-geving	WVB	geluid	Overig		
1	Raakvlakmanagement (primaair doel)												
1.1	Integraal overleg m.b.v. model	JA		N	INV	INT	IN	INT	N	IN			
1.2	Clashdetectie	JA			INV	INT	INT			INT			
2	Communicatie (primaair 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	I	N			I			
2.4	Visualisaties t.b.v. uitvoering	?											
2.5	Aanleveren BIM-Model/Visualisaties t.b.v. architect	JA			I	I		NV		I			
2.6	Visualisaties & animaties t.b.v. OG en overige stakeholders (INTERN)	JA			IV	I	I	I		I			
2.7	Visualisaties & animaties t.b.v. communicatie met externe partijen (stakeholders/omgeving etc.) (EXTERN)	JA			IV	I	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 (primaair 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							
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				
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												
6.2	Grondverzet uitgezet in tijd												
6.3	Uitvoering Kunstwerken												
6.4	Uitvoering aanleg wegen												
6.5	Uitvoering Geluid Beperkende Constructies												

Example - software use

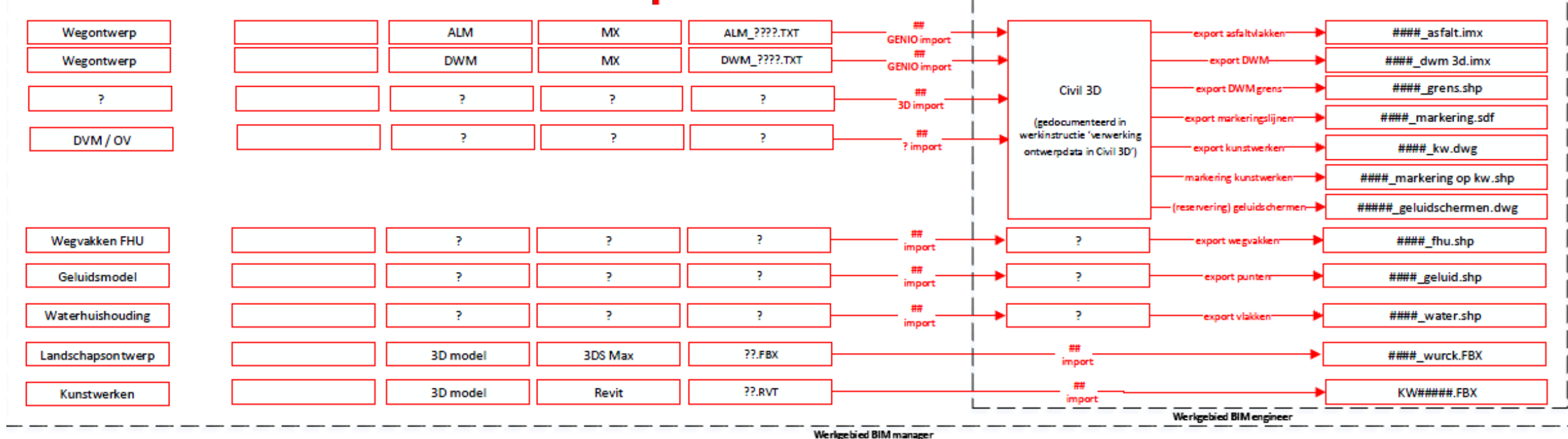


Example - data exchange chart

Datastroom bestaande toestand



Datastroom ontwerp



Werkegebied BIM manager

Werkegebied BIM engineer

2017 – What's next ?

INTO THE INTERNET OF THINGS

THEME

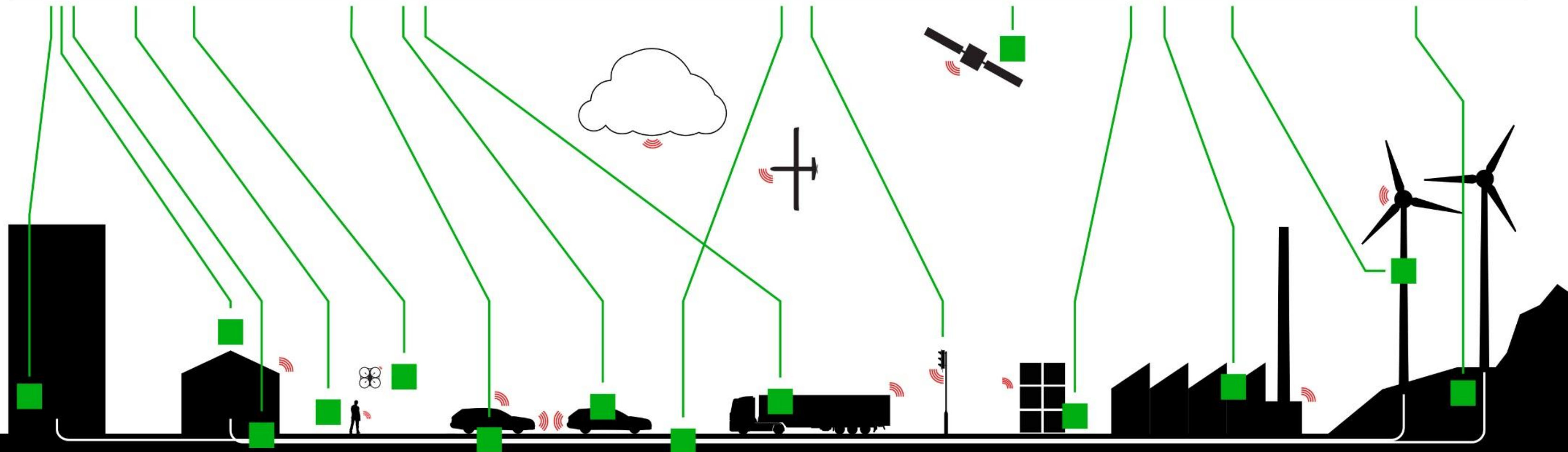
DIGITAL LIFE

FUTURE MOBILITY

SMART CITY

INDUSTRY 4.0

FIELDS



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



Tips – DO's

Geonius adopted & invested in BIM in an early stage.

As a result, we are very competitive 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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Tips – DO's

Ask questions

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