Coordinate the Design and Execution Phase of a Multidisciplinary Project

Jeroen Tishauser
Sr. Specialist, Volker InfraDesign

Cristian Otter
BIM Specialist, Geonius

Introduction Jeroen Tishauser

- Jeroen is a senior specialist on road design at **Volker InfraDesign**, the In-house design and engineering firm for the Infrastructure contractor at Van Hattum en Blankevoort, part of VolkerWessels.
- With over 15 years of experience in the field of large **road and rail** construction projects, coming from a Bentley background and having taught and supported software in the design and construction phase he now uses both his engineering skills and software, programming skills to optimize **workflows** in search for **best practices**.
- Jeroen was one of the founders of the **Civil Infra Benelux User Group**, together with other power users. At present, Jeroen is Road design Advisor for different projects in both tender phase and construction phase and coordinates the use of the company's Riegl Scanner, drones and software appliances for the Autodesk portfolio.

https://nl.linkedin.com/in/jeroentishauser

Volker InfraDesign

Introduction Cristian Otter

- Cristian is a Building Information Modeling **(BIM) advisor** within the Innovation Department of **Geonius**. An interdisciplinary engineering firm for Infrastructure in the Netherlands and Belgium.

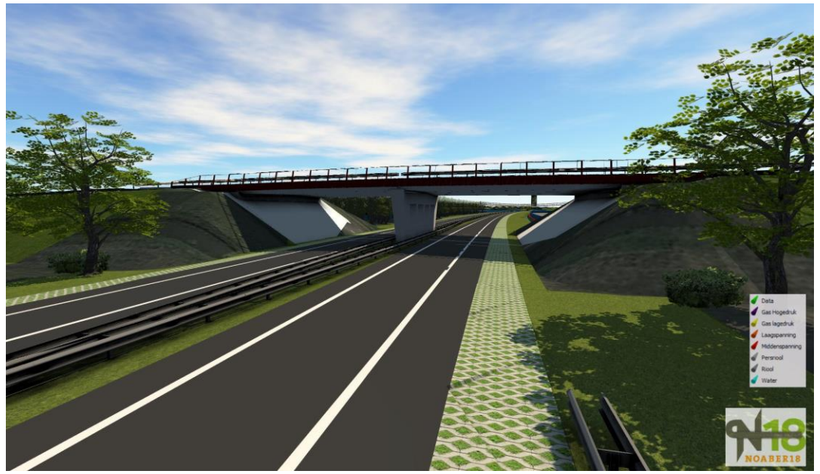
- He has 20 years of experience in the field of large infrastructural projects and worked for years as a senior designer at in-house design departments of contractors. He worked on both road designs and civil constructions. With his excellent cross-disciplinary knowledge he supports the design teams with, the implementation of **BIM**, setting up efficient **processes** and using suitable design **workflows.** The InfraWorks model in this presentation is from his hand, whereby he pushed working with InfraWorks to its limits. He is one of the early adaptors of 3D design software for Infrastructural purposes and many working methods originate from his hands.

- Same as Jeroen, Cristian is one of the co-founders of the **Civil Infra Benelux Usergroup**. He 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.

https://www.linkedin.com/in/cristian-otter-aa370a5

GEONIUS

What do we have in common?



Civil Infra Benelux

werkgroep Civil 3D

Jeroen Cristian

Holland Scherm

Volker InfraDesign

Aveco de Bondt ingenieursbedrijf

Jeroen

Iv-Infra

ZUS ZONES URBAINES SENSIBLES

VolkerWessels

GEONIUS

Cristian

Visser & Smit Hanab

DIF

Vialis

KWS

Van Hattum en Blankevoort

Jeroen Cristian

Witteveen + Bos

Movares

heijmans

Cristian

Royal HaskoningDHV Enhancing Society Together

Volker InfraDesign

GEONIUS

Iv-Infra

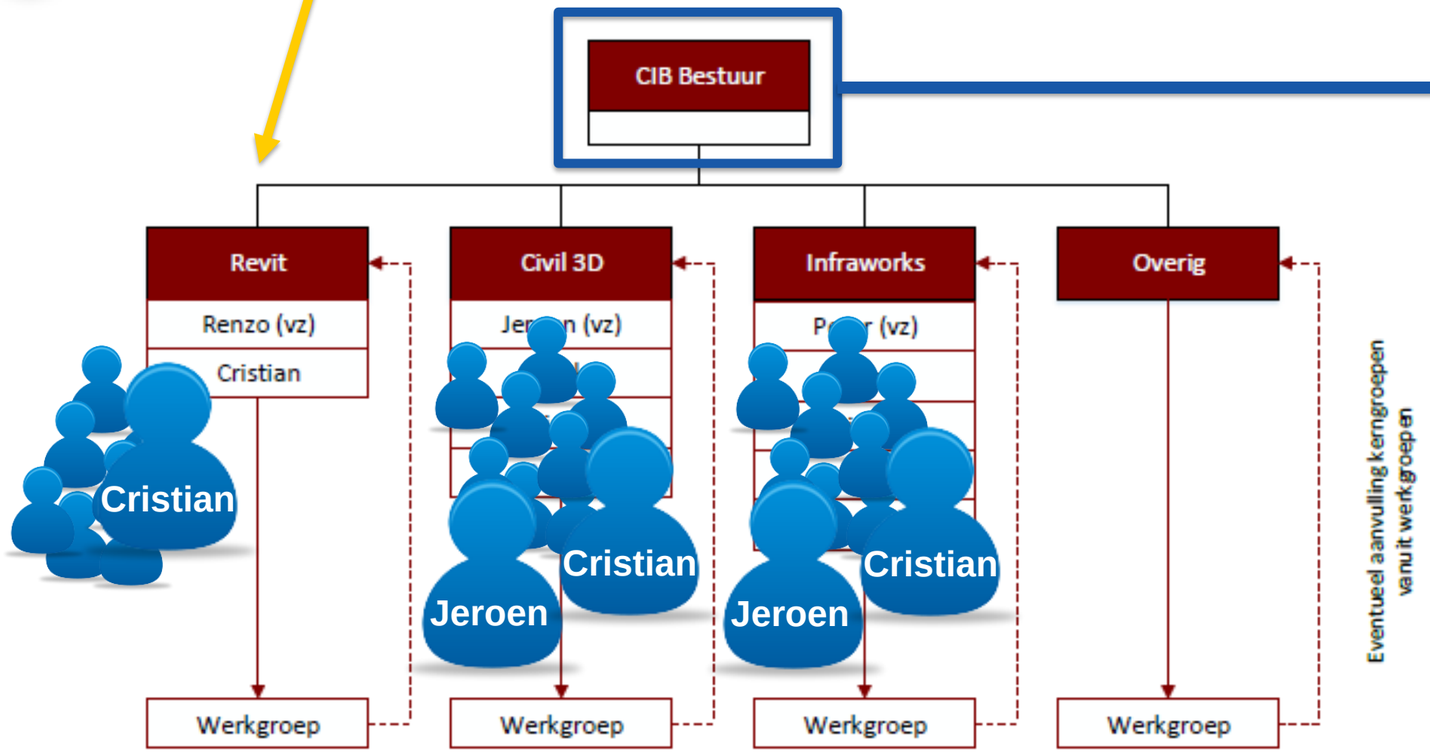
Jeroen

bam

anteagroup

Civil Infra Benelux Representation at AU

Civil Infra
Benelux
werkgroep Civil 3D



- Jordy Brouwers - Voorzitter
- Richard De Nier - Secretaris
- Remco Bastiaans - Penningmeester
- Cristian Otter
- Jeroen Tishauser - Civil 3D werkgroep
- Renzo van Rijswijk - Revit werkgroep
- Bart De Maesschalck
- Peter Ingels - Infraworks werkgroep
- Dick de Jongh

Class summary

In this class, we will guide you through the software use and setup process of an actual project: the construction of Highway N18 in The Netherlands. After a contract and project overview, we will dive into the process that makes this project succeed as a true Building Information Modeling (BIM) project. Learn where to start, what to do, and what to avoid to have your own success. Find out how to enable designers to use their favorite program, and then bring the intelligent model together in InfraWorks software for your contract management. Discover which export is used for stakeholder management. Then we will focus on what the implementation of InfraWorks software means for these types of projects. Learn how InfraWorks software can help support a large-scale project with lean sessions, sprints, and weekly stands. Combine geographic information system data with design data that together lead to better and easier decision making. This session features InfraWorks 360, A360 (Team), Civil3D and Navisworks.

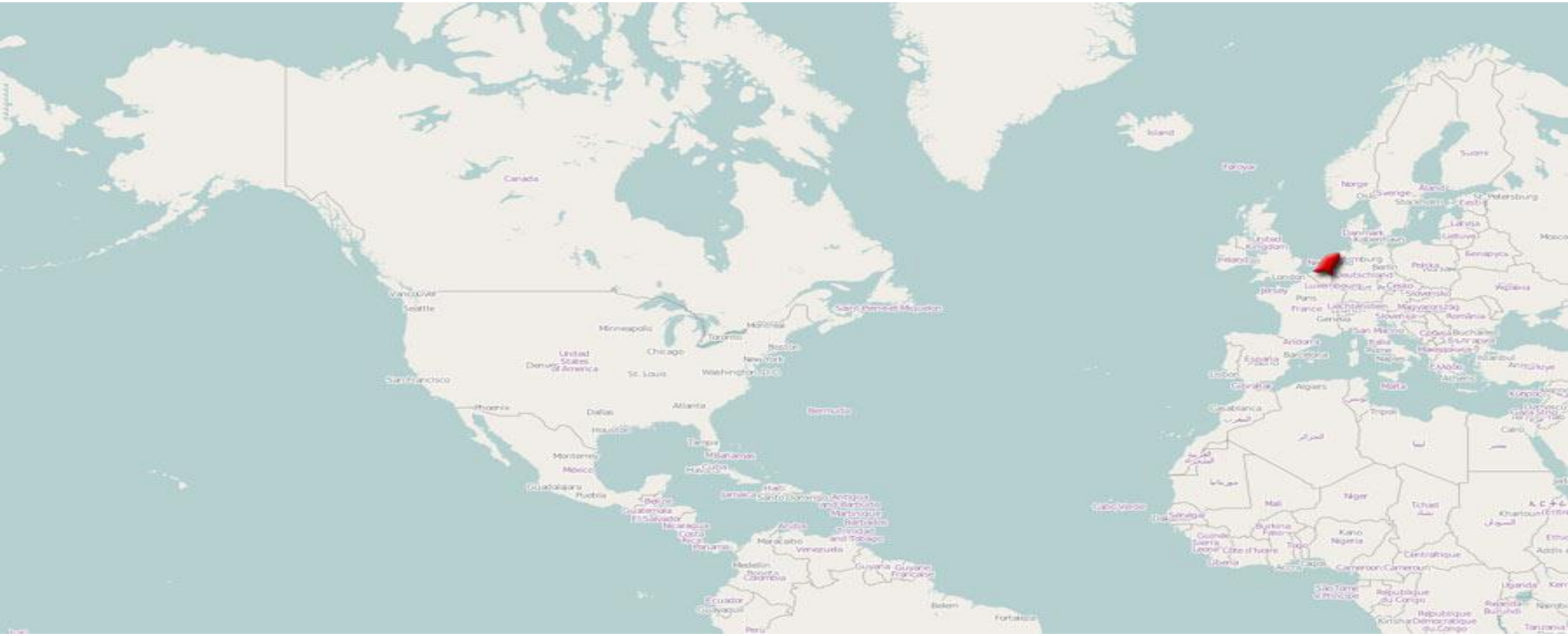
Key learning objectives

At the end of this class, you will be able to:

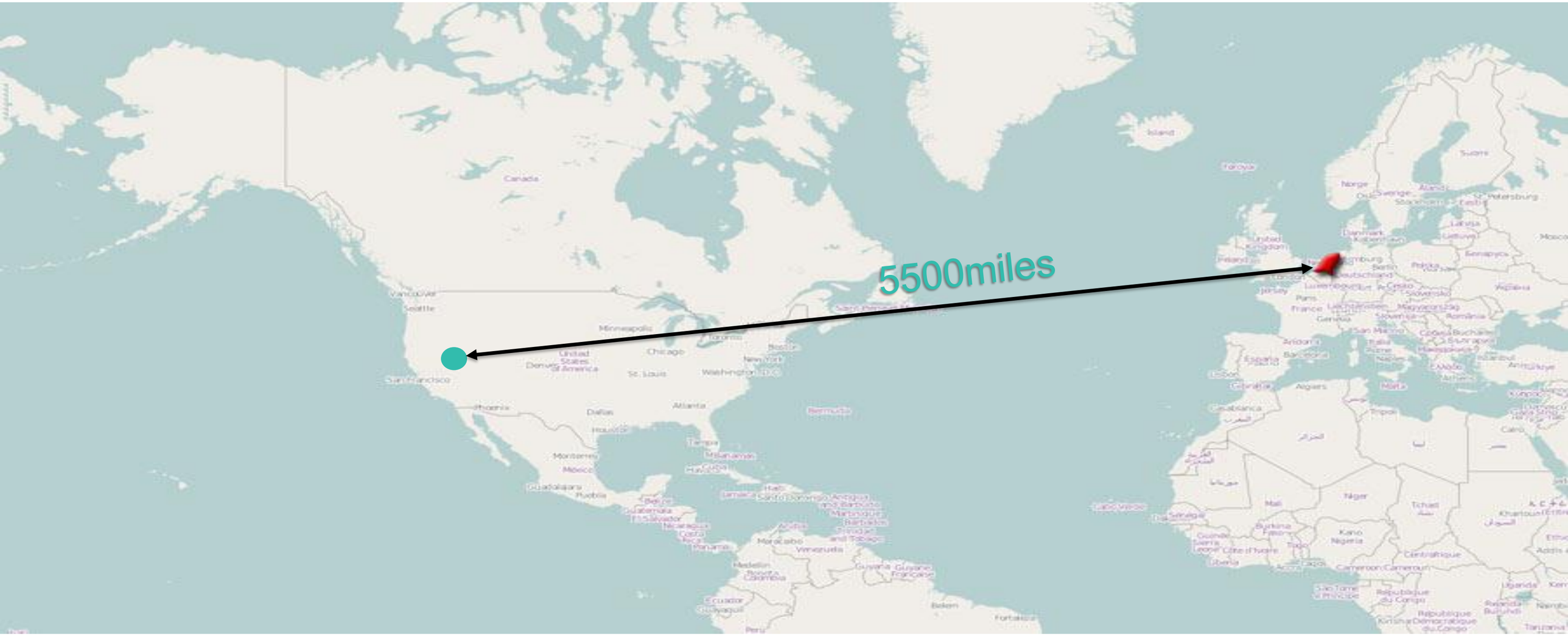
- Learn how to organize a project in execution phase
- Learn how to link your contract or design documents to ~~Navisworks~~ Infraworks
- Learn how to combine and exchange designs from multiple disciplines
- Learn how to use Infraworks to help you on an infrastructure project in different phases

The Netherlands

The Netherlands



The Netherlands



The Netherlands

	USA	The Netherlands	
Sq. Km	9.826.675 with 2,2% water	41.543 with 18% water	0.42 %
Population	321.368.864	16.947.904	5.27 %
Density P / Sq.km.	32,7	408	

The Netherlands

The Netherlands

The Netherlands is known for …

Of Dutch origin on the DJ Mag top 100

The Netherlands is known for …

Or you can just go to California…

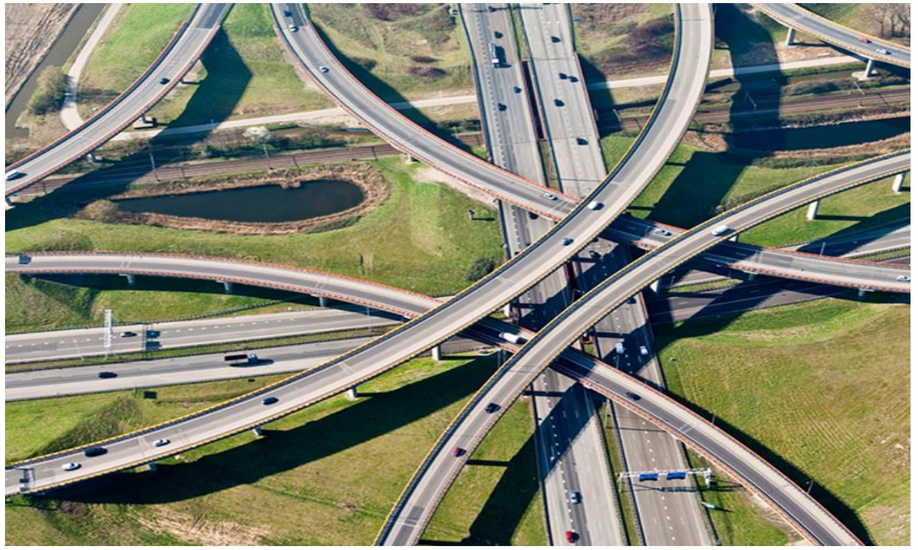
The Netherlands

29% below sea level

2/3 would flood without water protection

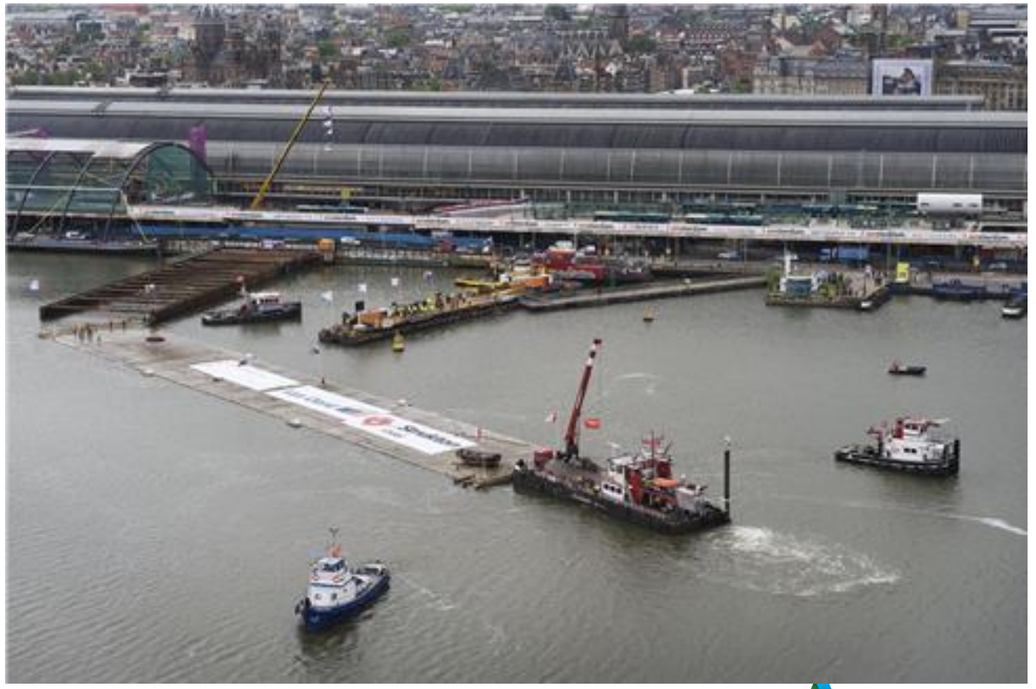
The Netherlands

The Netherlands



The Netherlands

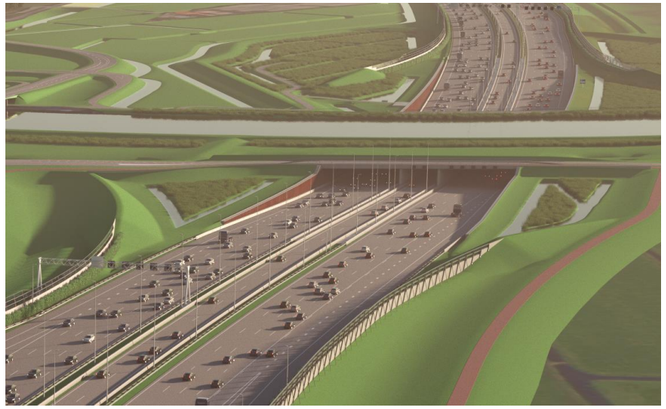
The Netherlands



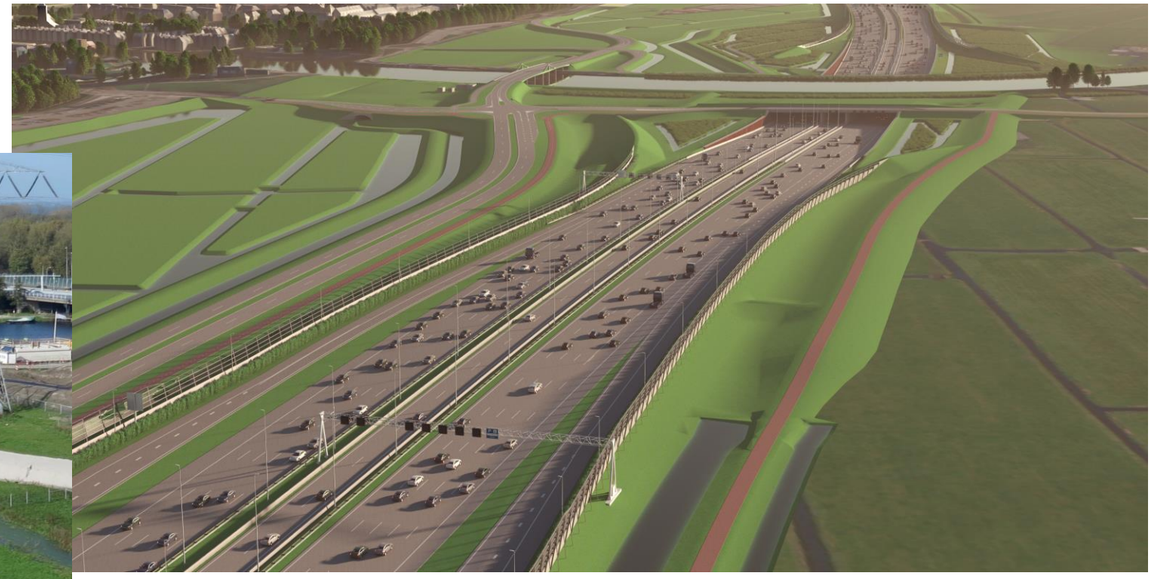
Current Projects

Challenging projects in the Netherlands

- SAAOne
  largest Aquaduct of Europe
- Sea lock IJmuiden
  largest sea lock of the world
- Reconstruction N18

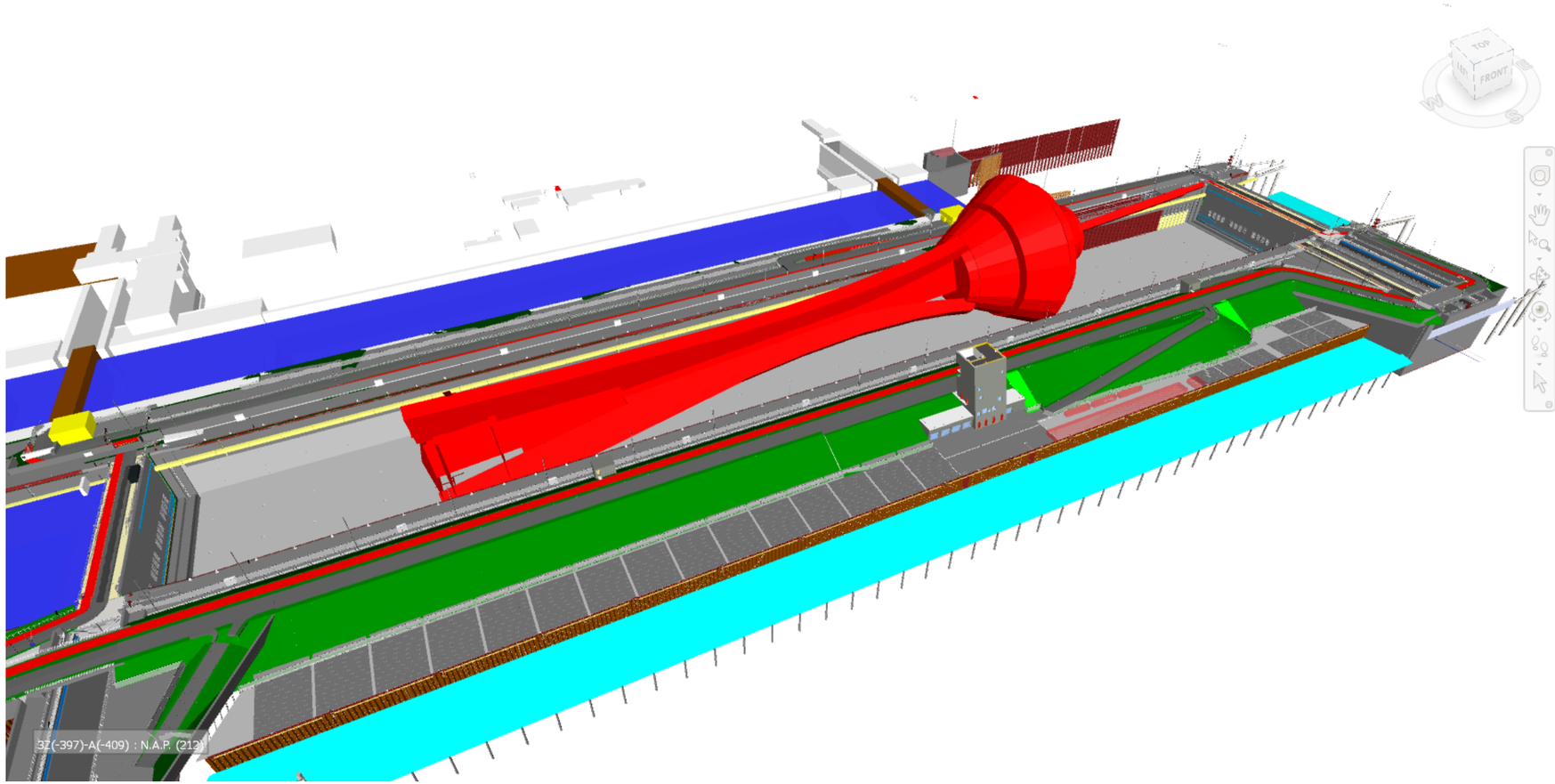


SAAOne



Sea lock IJmuiden

Stratosphere Las Vegas vs Sea Lock IJmuiden



N18 Reconstruction

N18 in numbers

27 kilometers of freeway

24 civil structures

150+ Civil3D corridors

45 kilometers of local road

25 Revit models

150+ Centre Alignements

1.100.000 m3 of sand

2 years of construction

387.000 tons subbase

412.000 tons asphalt

25 years of maintenance

57 Designers

585.000 tons secondary building material

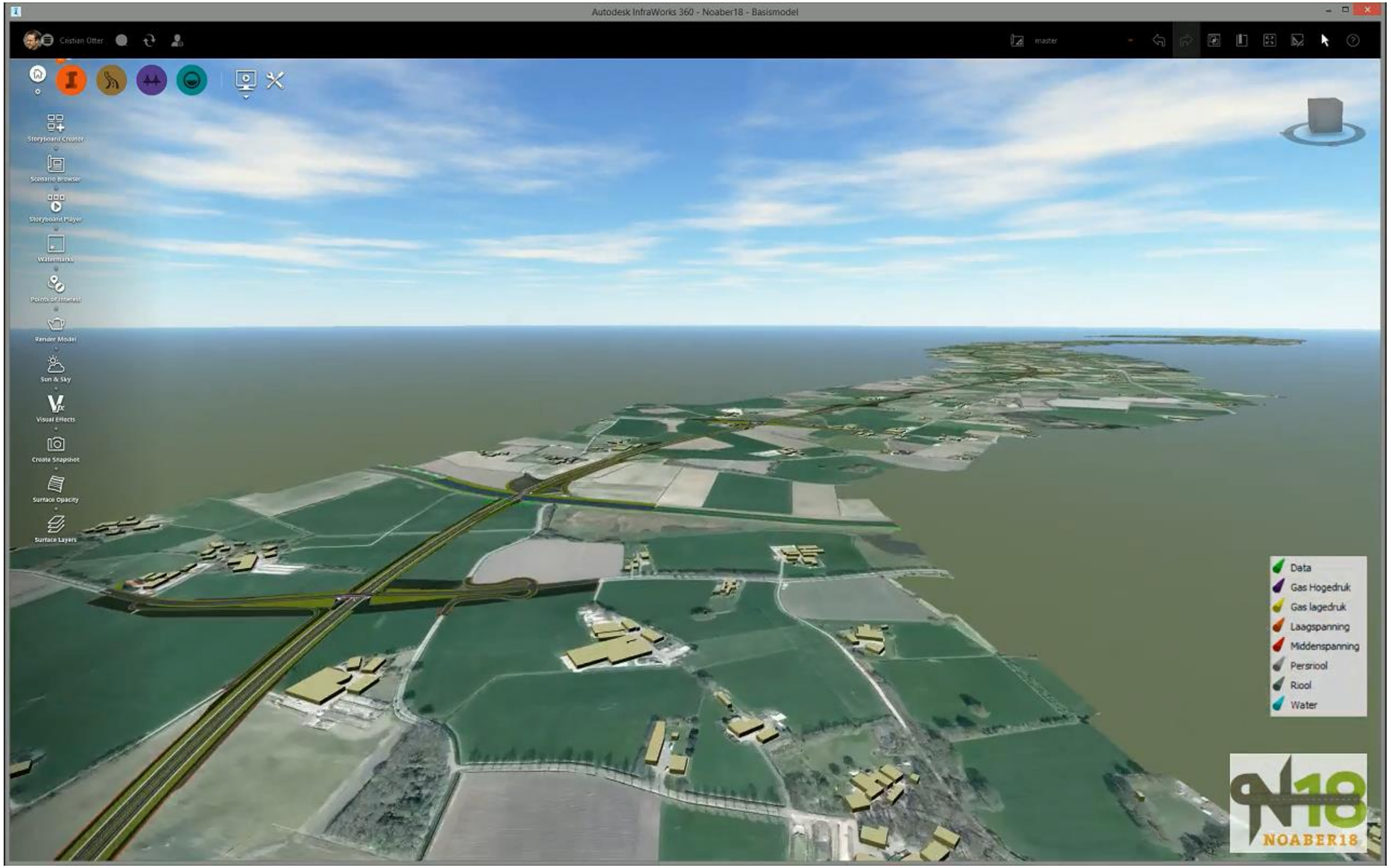
0 Printed checkprints

200+ People with data access

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

N18


Autodesk InfraWorks 360 - Noaber18 - Basismodel
Cristian Otter
master
Storyboard Creator
Scenario Browser
Storyboard Player
Watermarks
Points of Interest
Render Model
Sun & Sky
Visual Effects
Create Snapshot
Surface Opacity
Surface Layers
Data
Gas Hogedruk
Gas lagedruk
Laagspanning
Middenspanning
Persriool
Riool
Water
N18
NOABER18

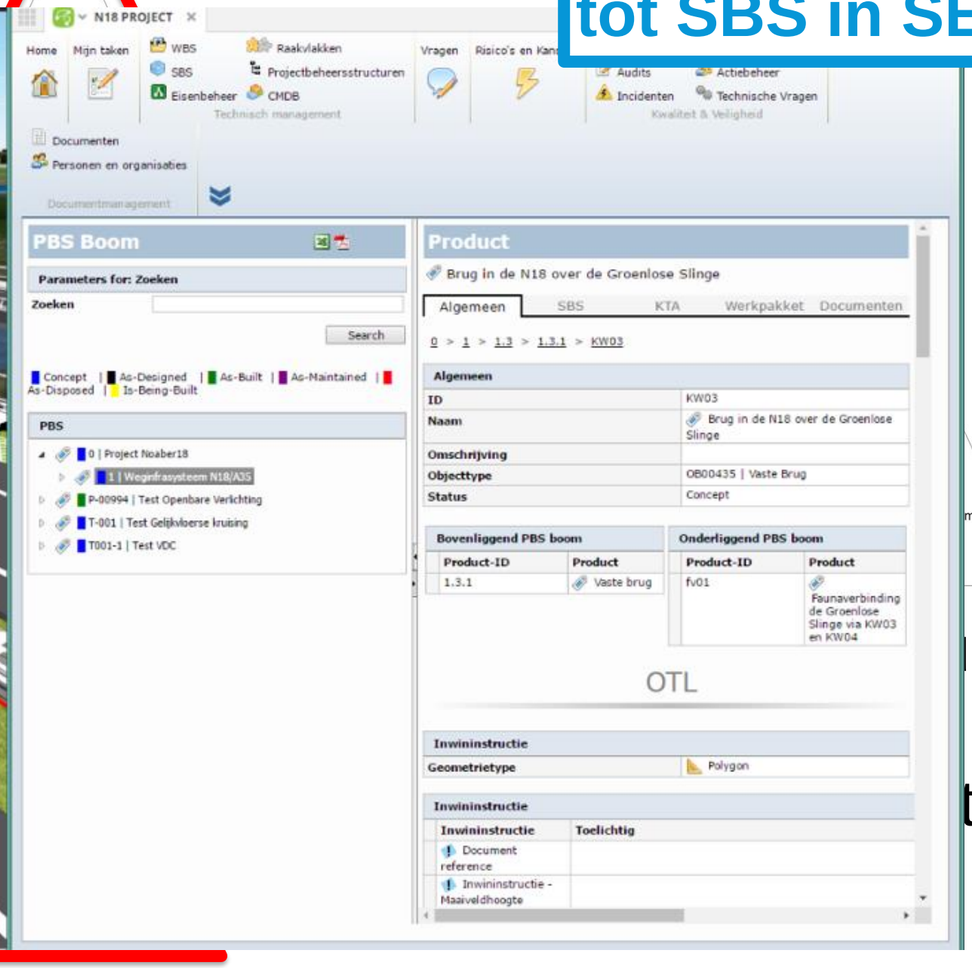
The Alliance

System Engineering

Systems Engineering (SE)

- Structu
- Workload "De

Link from Infraworks objects tot SBS in SE database



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

System Engineering

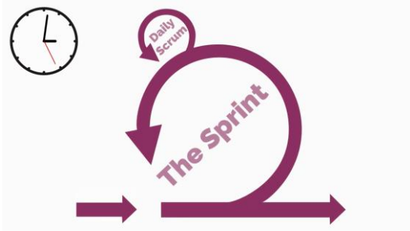
Object library

- Physical geometry, also temporary items
- The break down structure has an impact on all disciplines!
- Has big impact on deliverables at the end!

LEAN, Sprints and Scrum

Introduction

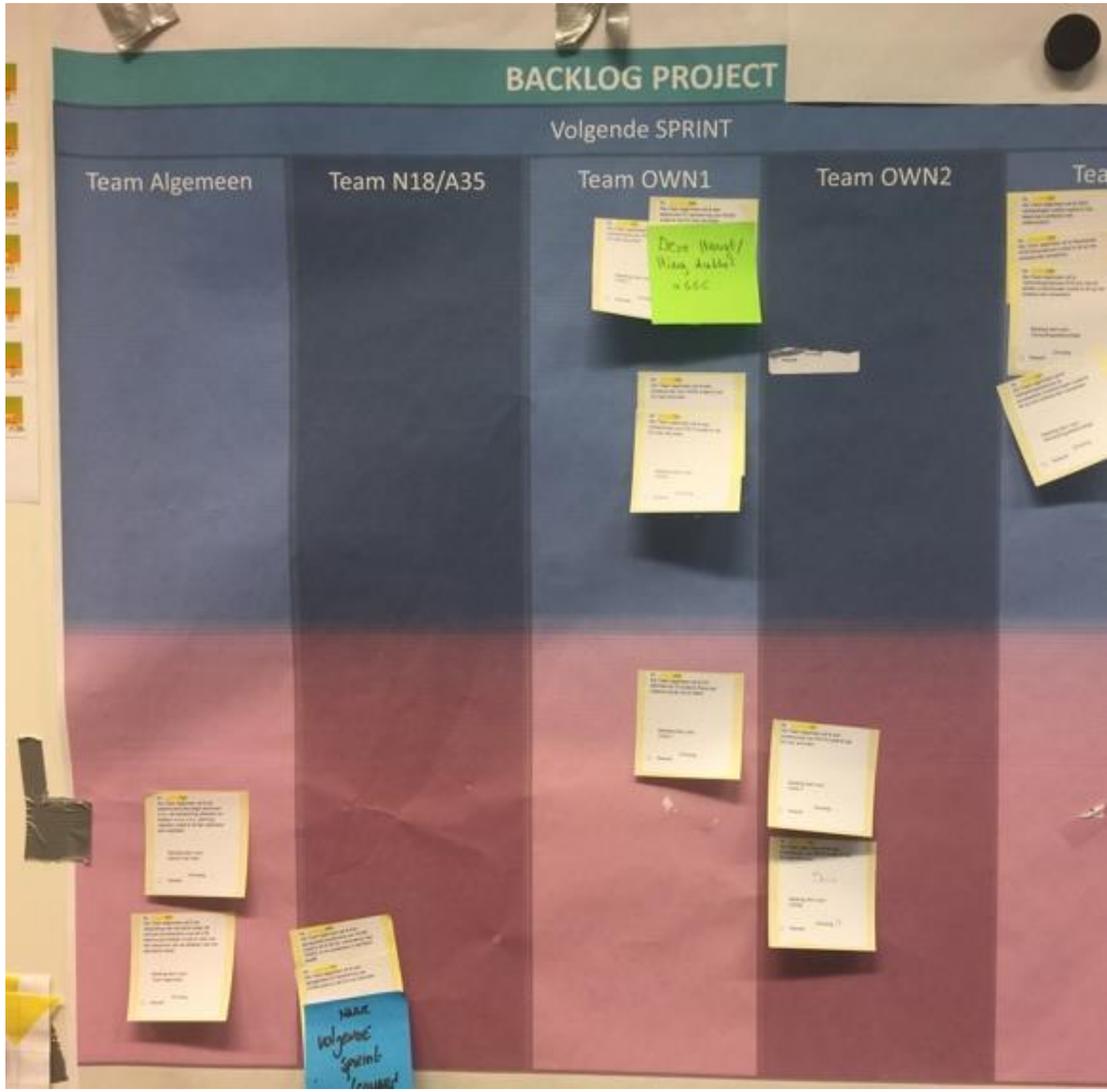
- What is scrum?



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

Backlog Items

- A backlog item is a major task as a sentence **If… I will… so I can…**
- A clear Definition of Done **(DoD)** is needed
- The Scrum-board holds all the backlog items
- Sub tasks are on the LEAN planning



LEAN Planning and Stands

- Lean planning is about **agreements** on someone
  - will start with a (sub)task,
  - will finish one or
  - needs harmonization on something.

- Stands
  - What have you done (yesterday)
  - What are you going to do (today)
  - What are you going to do (tomorrow)
  - What holds you back to work more efficient, quicker?

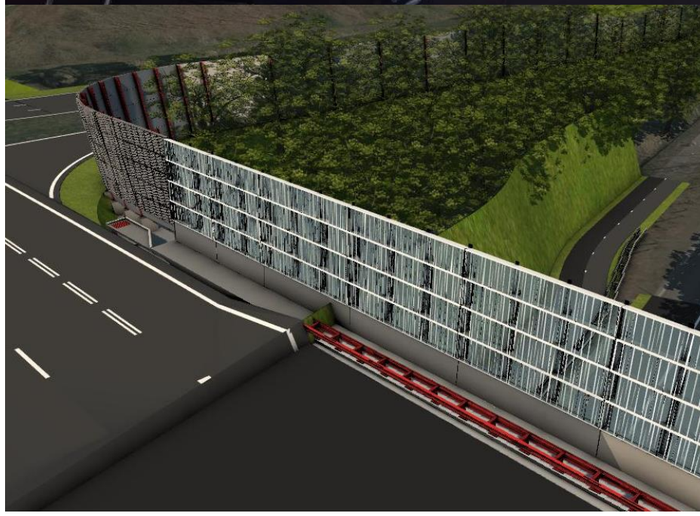
Sprint Review

- 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**

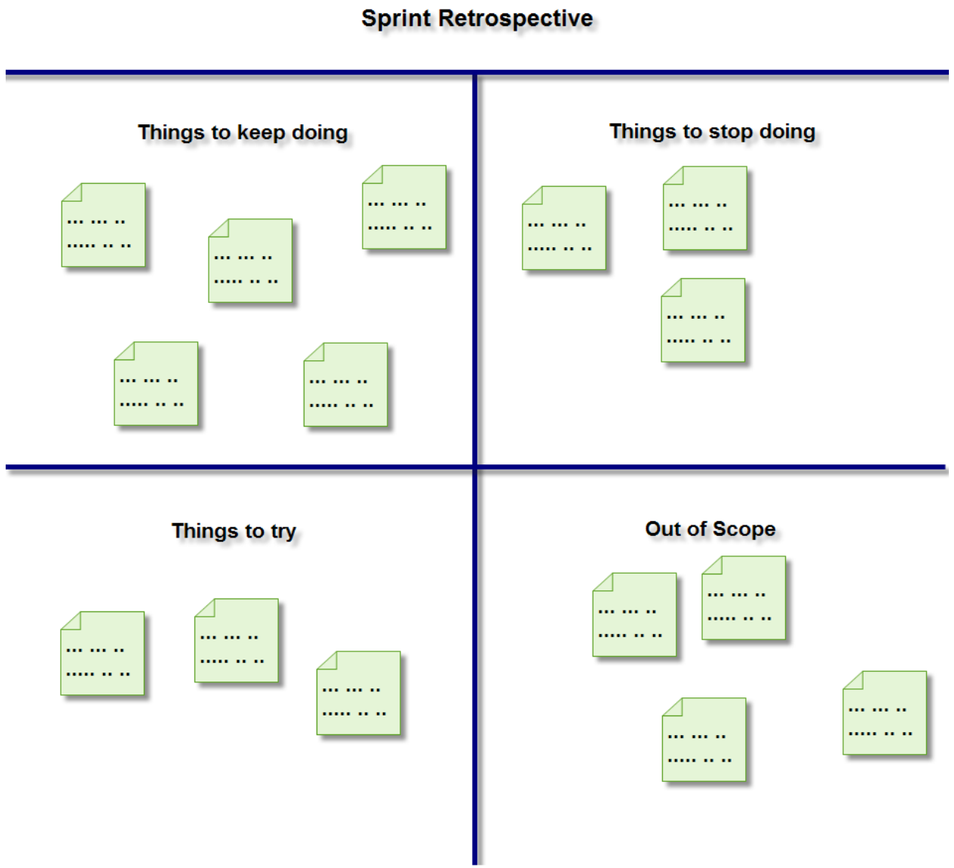
- With the client with full **transparency** so they feel part of the decision making process

- After the sprint review is finished the Infraworks 360 master is saved as an **proposal**.

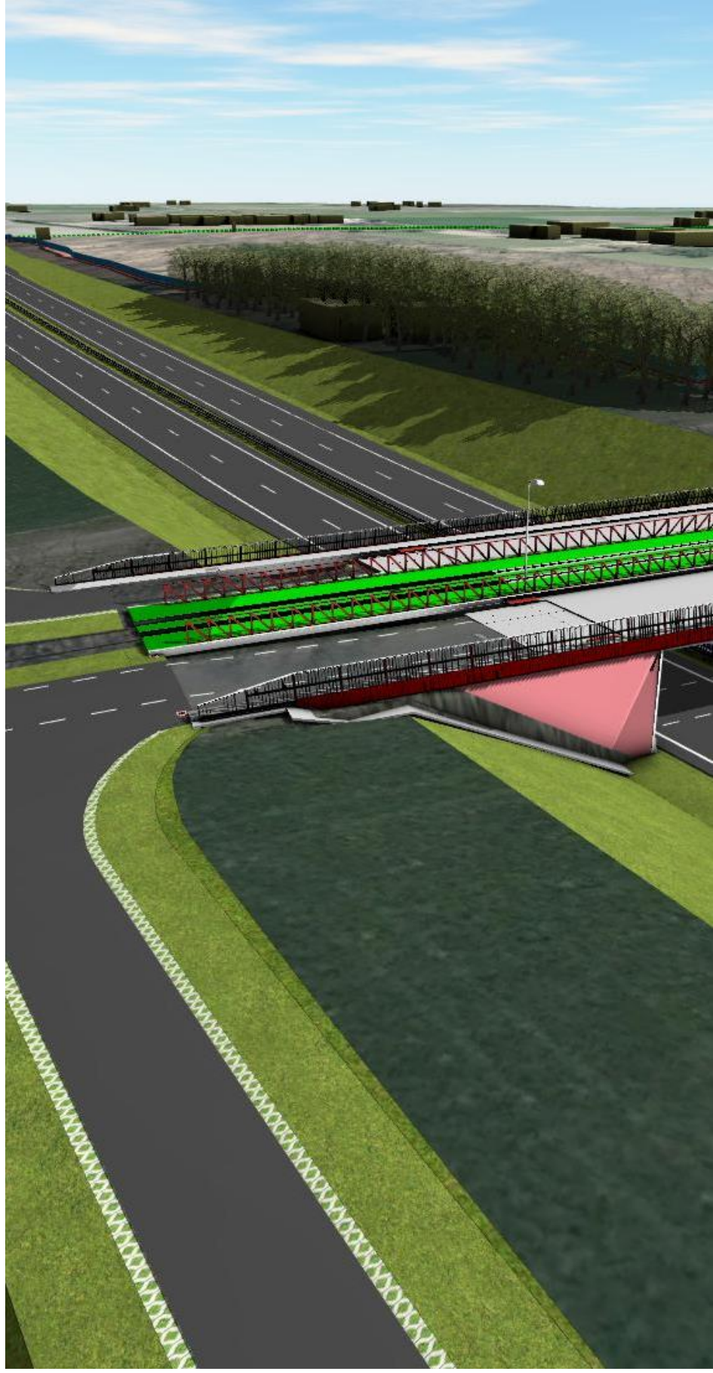


Sprint Retrospective

- **After** finishing a sprint, the chart is filled in
- Outcome
  - **Navisworks** was not used as frequently anymore so we **stopped using** that for model coordination
  - **Vault** has been on the “Things to **stop doing**” area more than once so we created a sprint to do **training** and system **optimization**
  - **Infraworks** has been on the “Things to keep doing” because it makes the design **tangible** and more **accessible**

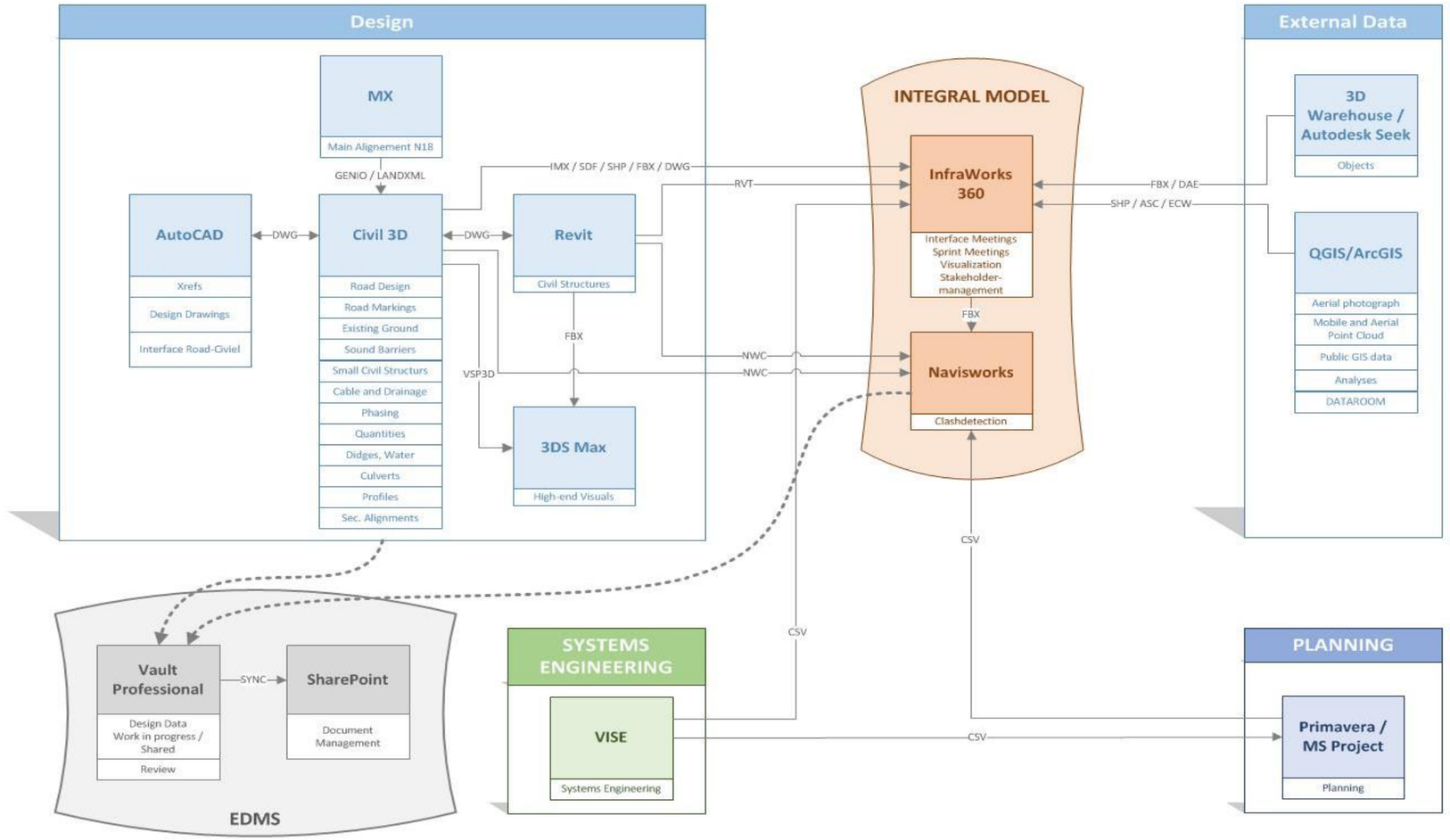


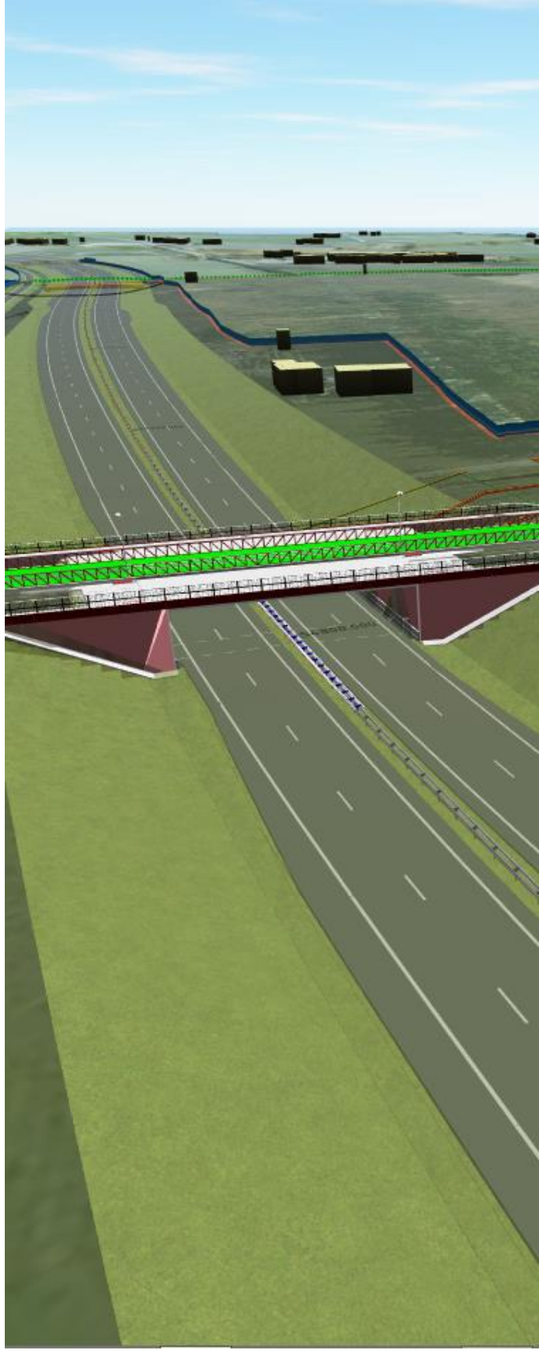
Software



Integral Model

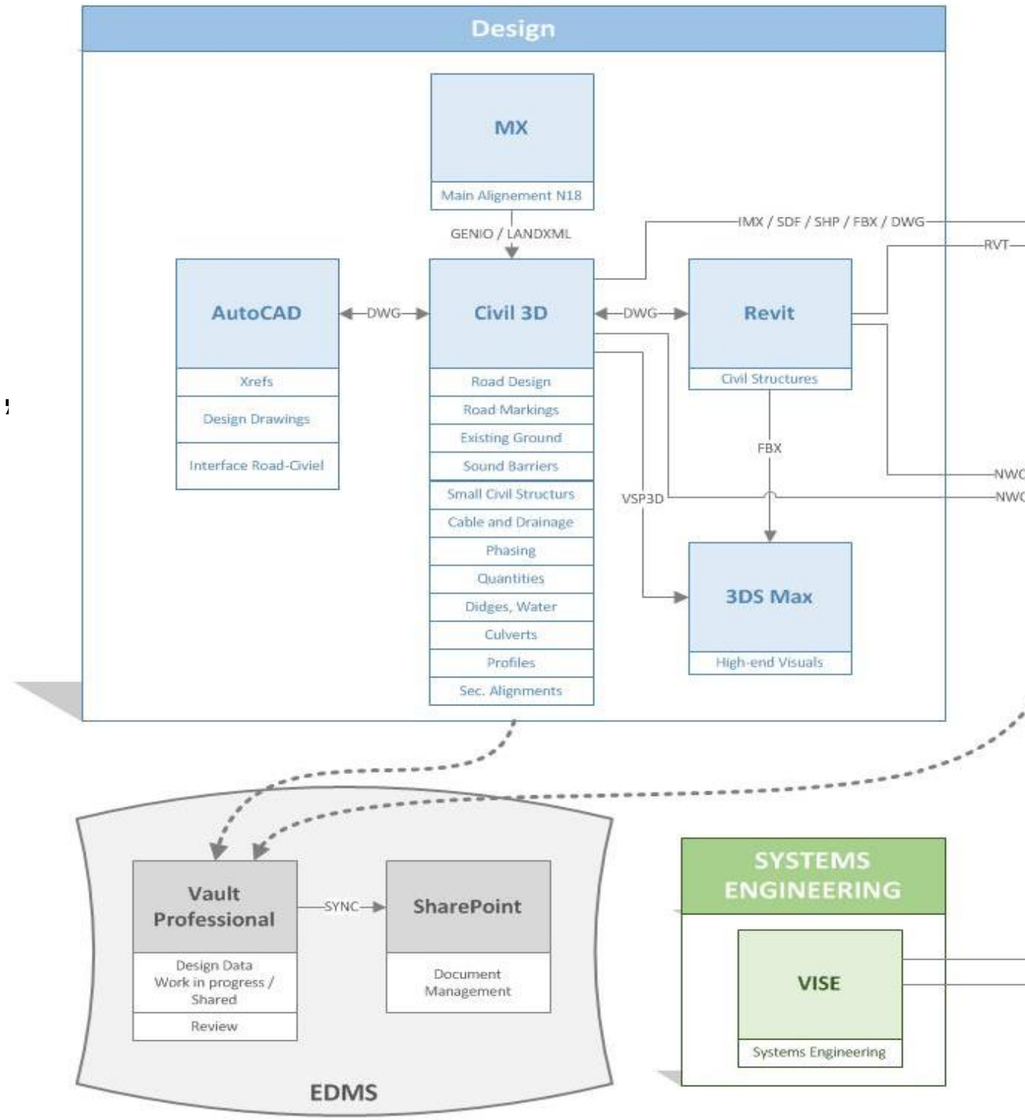
- The **current** process diagram





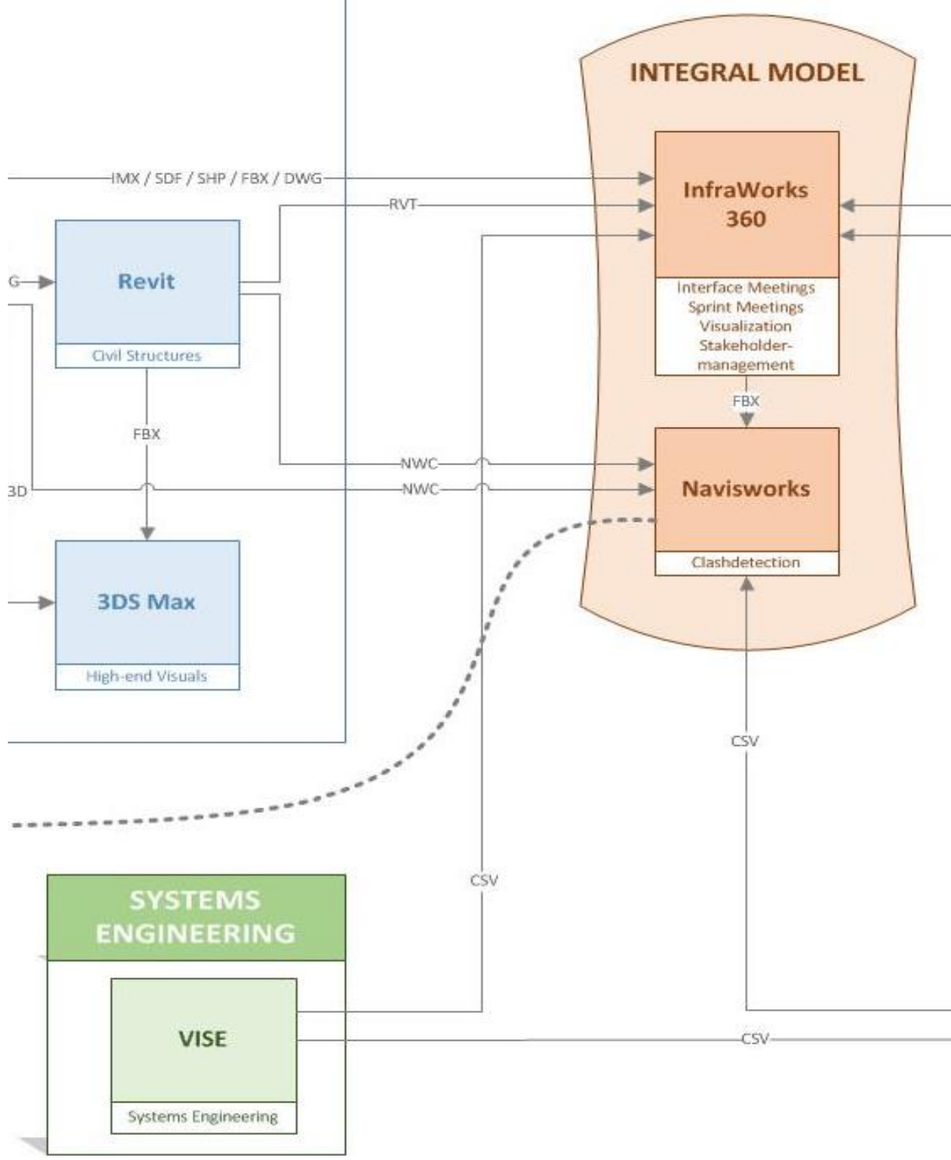
Integral Model - design

- **General** exchange and connections between the used software.
- Use of AutoCAD, **Civil3D**, **Revit**, 3DS Max, MX only for main alignment
- WIP and the published drawings stored in **Vault**
- Published drawings automatically stored in **SharePoint**



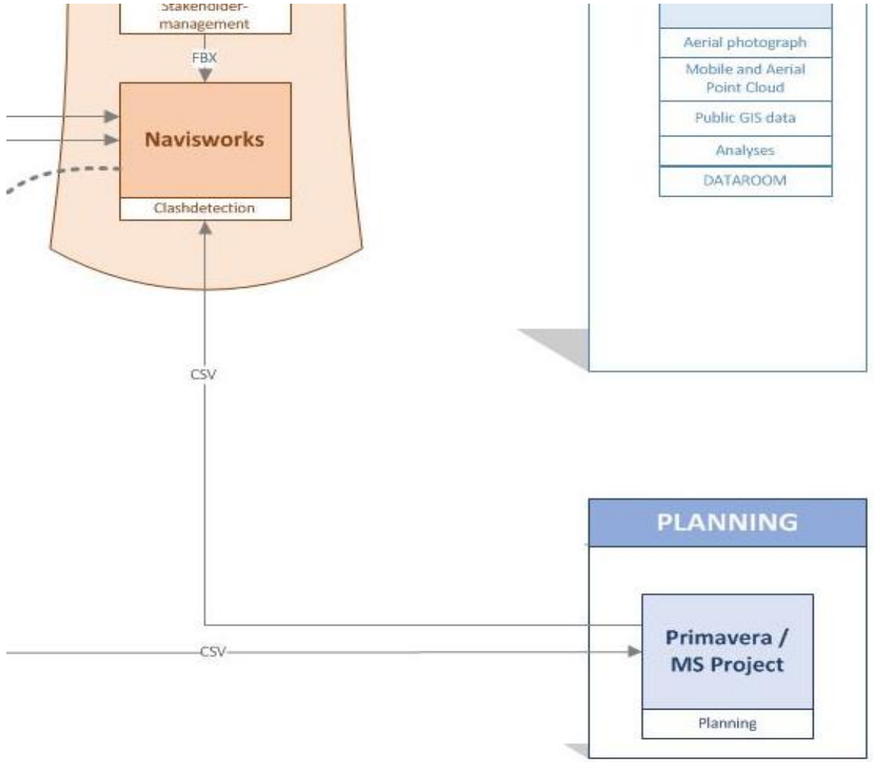
Integral Model - SE

- **System Engineering** software is Relatics
- **Deep links** from database objects exported to csv automating the link **to Infraworks object names**



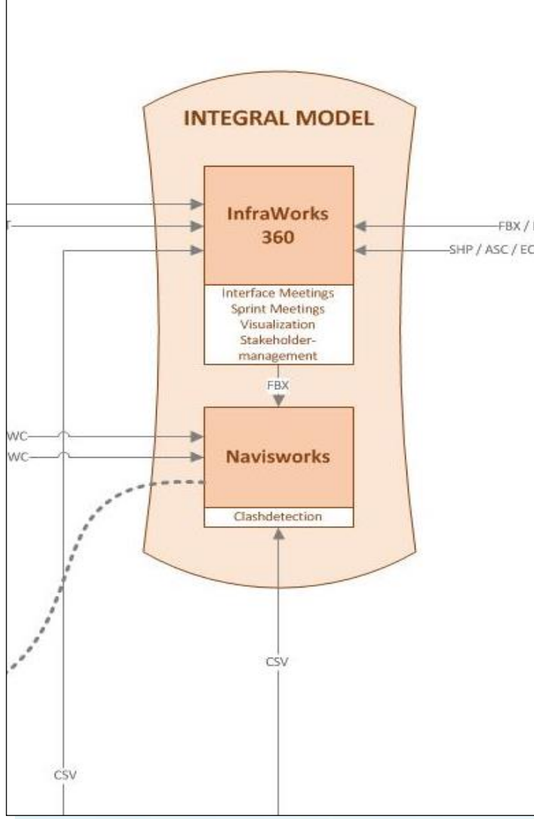
Integral Model - Navisworks

- For preparation phase link between **Primavera** planning software and Navisworks **Timeliner**.
- **Ideally** Infraworks is used for this purpose we have not found an ideal process yet and thus are **experimenting** in this field.
- Navisworks is used for **detailed** clash detection

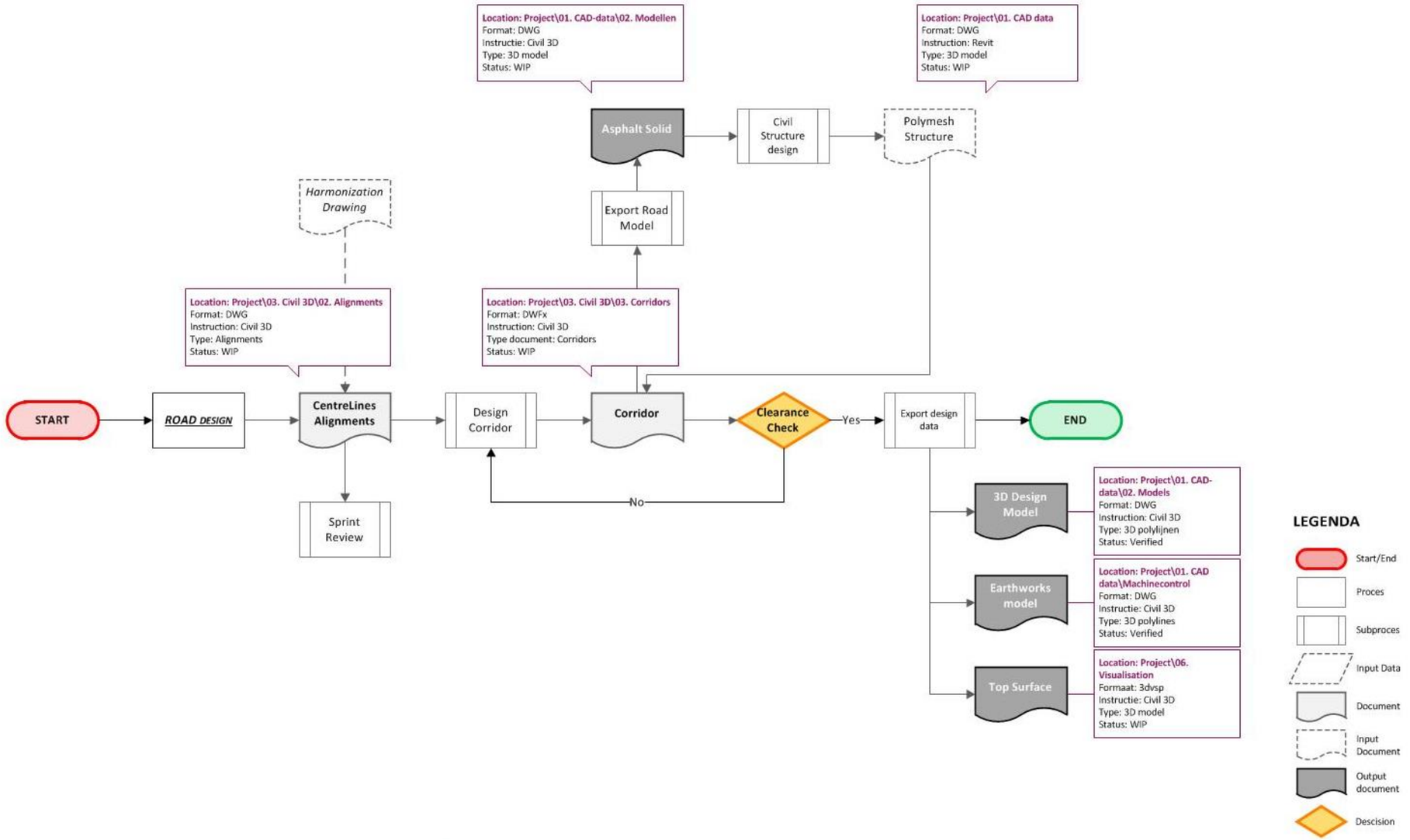


Integral Model

- **Constantly** monitoring this
  - as an **auditor** - does everyone uphold the agreed exchanges and location of files and versioning
  - as modifying the diagram due to **feedback** from the Sprint Retrospective.
  - **New insights** and constant changing possibilities in software appliances



Civil3D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Format: DWG
Instructie: Civil 3D
Type: 3D model
Status: WIP
Location: Project\01. CAD data
Format: DWG
Instruction: Revit
Type: 3D model
Status: WIP
Asphalt Solid
Civil Structure design
Polymesh Structure
Harmonization Drawing
Export Road Model
Location: Project\03. Civil 3D\02. Alignments
Format: DWG
Instruction: Civil 3D
Type: Alignments
Status: WIP
Location: Project\03. Civil 3D\03. Corridors
Format: DWFx
Instruction: Civil 3D
Type document: Corridors
Status: WIP
START
ROAD DESIGN
CentreLines Alignments
Design Corridor
Corridor
Clearance Check
Yes
Export design data
END
No
Sprint Review
3D Design Model
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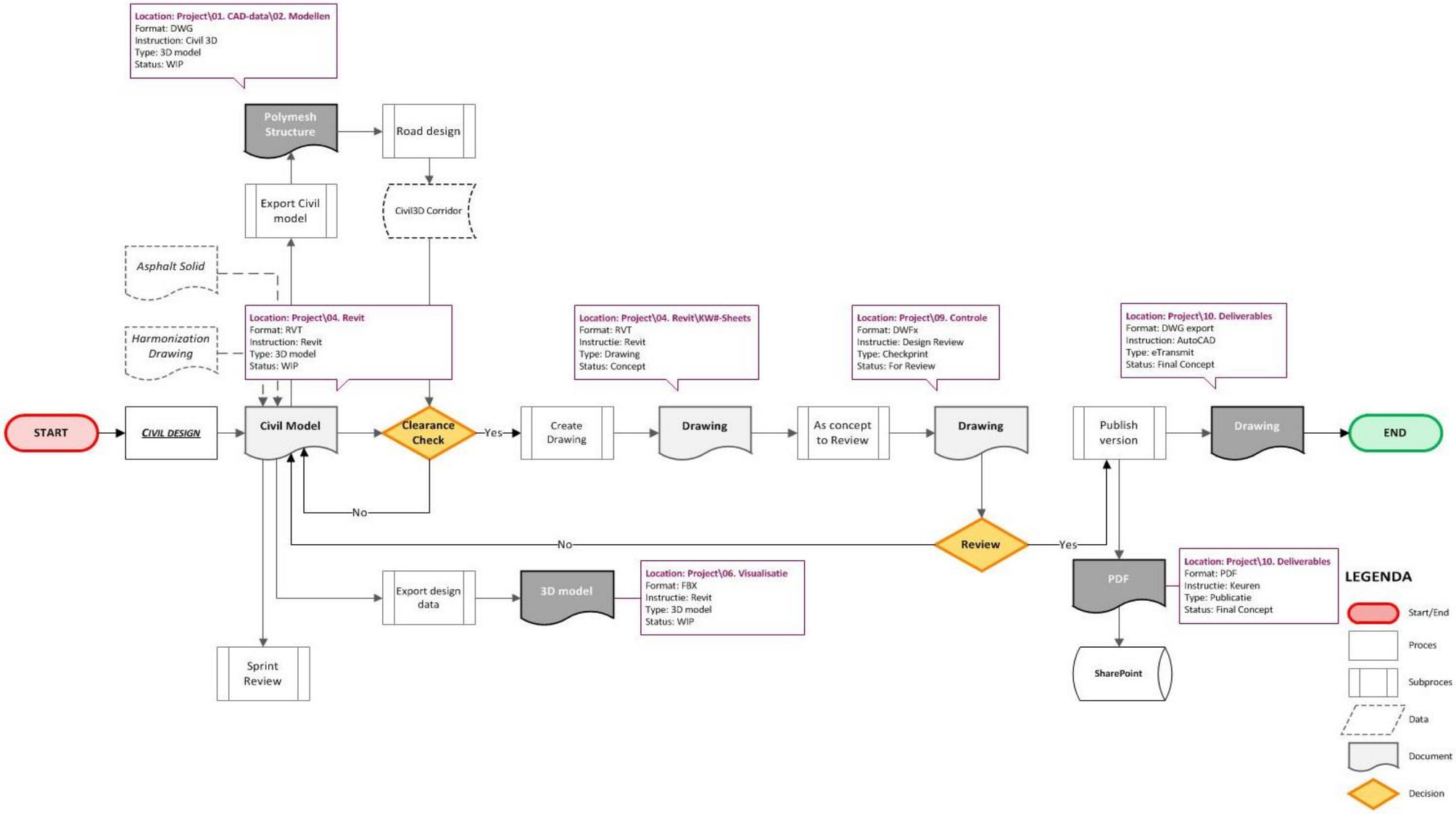
Format: DWG
Instruction: Civil 3D
Type: 3D polylijnen
Status: Verified
Earthworks model
Location: Project\01. CAD data\Machinecontrol
Format: DWG
Instructie: Civil 3D
Type: 3D polylines
Status: Verified
Top Surface
Location: Project\06. Visualisation
Formaat: 3dvsp
Instructie: Civil 3D
Type: 3D model
Status: WIP
LEGENDA
Start/End
Proces
Subproces
Input Data
Document
Input Document
Output document
Descision

Revit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Instruction: Civil 3D
Type: 3D model
Status: WIP
Polymesh Structure
Road design
Export Civil model
Civil3D Corridor
Asphalt Solid
Harmonization Drawing
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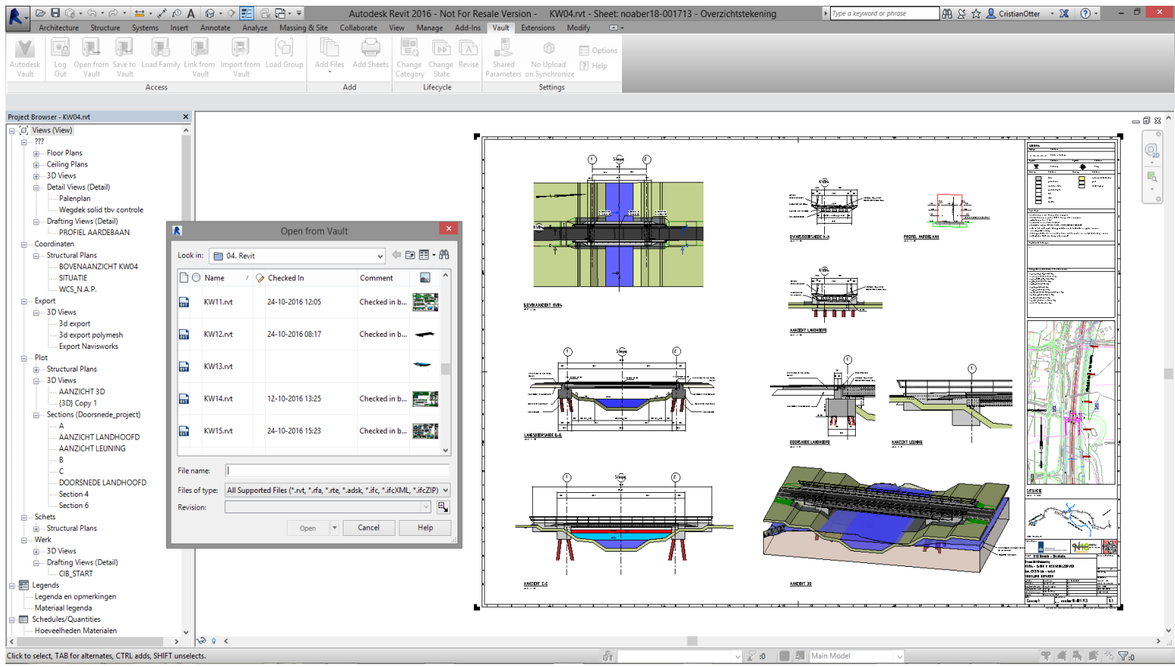
Format: RVT
Instruction: Revit
Type: 3D model
Status: WIP
Location: Project\04. Revit\KW#-Sheets
Format: RVT
Instructie: Revit
Type: Drawing
Status: Concept
Location: Project\09. Controle
Format: DWFx
Instructie: Design Review
Type: Checkprint
Status: For Review
Location: Project\10. Deliverables
Format: DWG export
Instruction: AutoCAD
Type: eTransmit
Status: Final Concept
START
CIVIL DESIGN
Civil Model
Clearance Check
Yes
Create Drawing
Drawing
As concept to Review
Drawing
Publish version
Drawing
END
No
No
Review
Yes
Export design data
3D model
Location: Project\06. Visualisatie
Format: FBX
Instructie: Revit
Type: 3D model
Status: WIP
PDF
Location: Project\10. Deliverables
Format: PDF
Instructie: Keuren
Type: Publicatie
Status: Final Concept
Sprint Review
SharePoint
LEGENDA
Start/End
Proces
Subproces
Data
Document
Decision

Vault

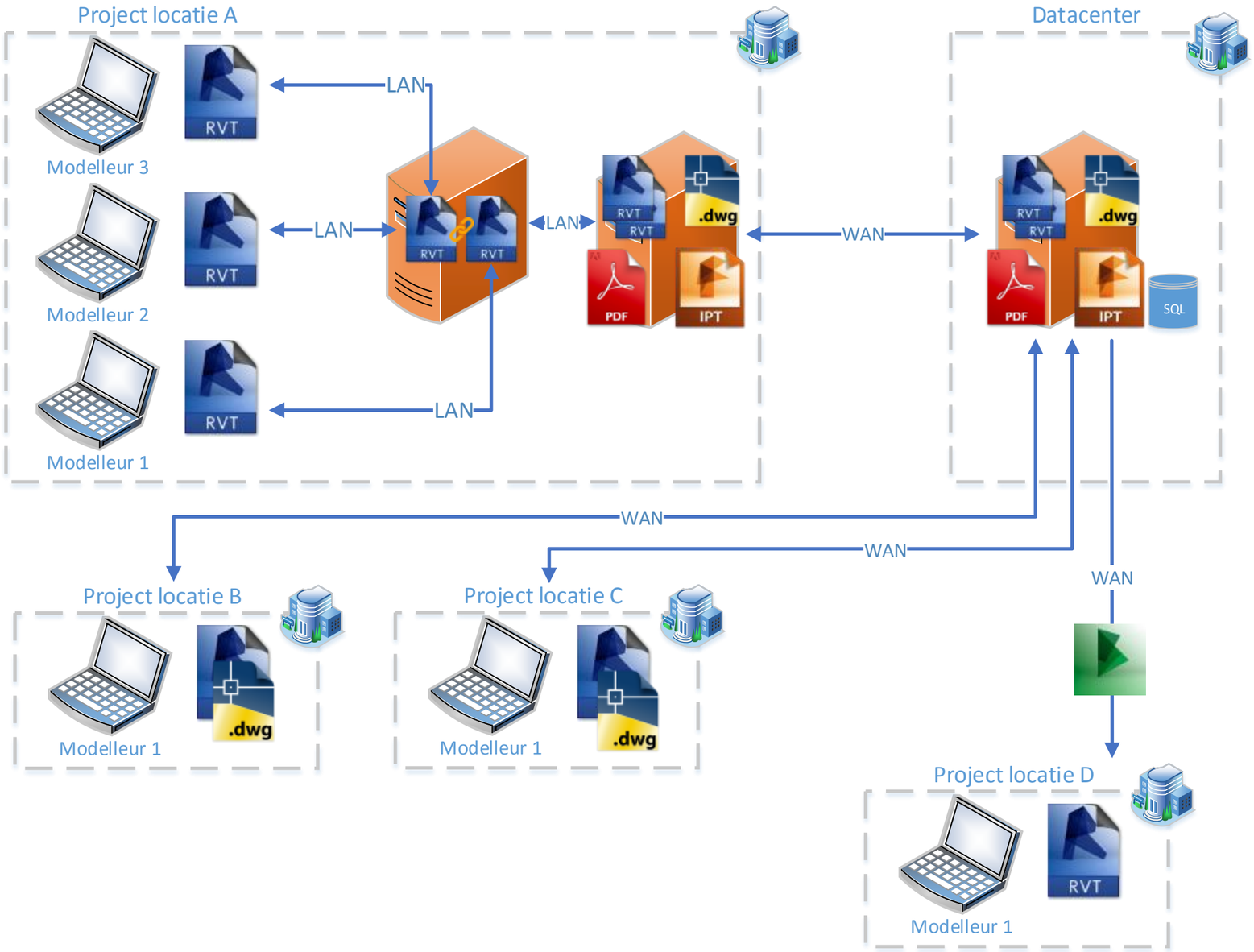
- **Minimum** use of on premises Server
- Windows Explorer is **not** a document management system
- Vault for storage and maintain of WIP data, shared data and review process.
- **Advantage** is insight of ownership, history, versions, status and where a certain alignment is used
- background and saves those to **SharePoint**.
- Looking into using **A360 Team** markup functionality, measuring and commenting tools but no versioning



Autodesk Vault

- **Challenges**:
  - Multiple companies with their **own IT**
  - Differences in **licening** on Autodesk Products
  - How to solve **worksharing**?
  - **LAN** and **WAN** acces
  - Implementing on **ongoing project** (<1 month)
  - **Acceptance** by team members

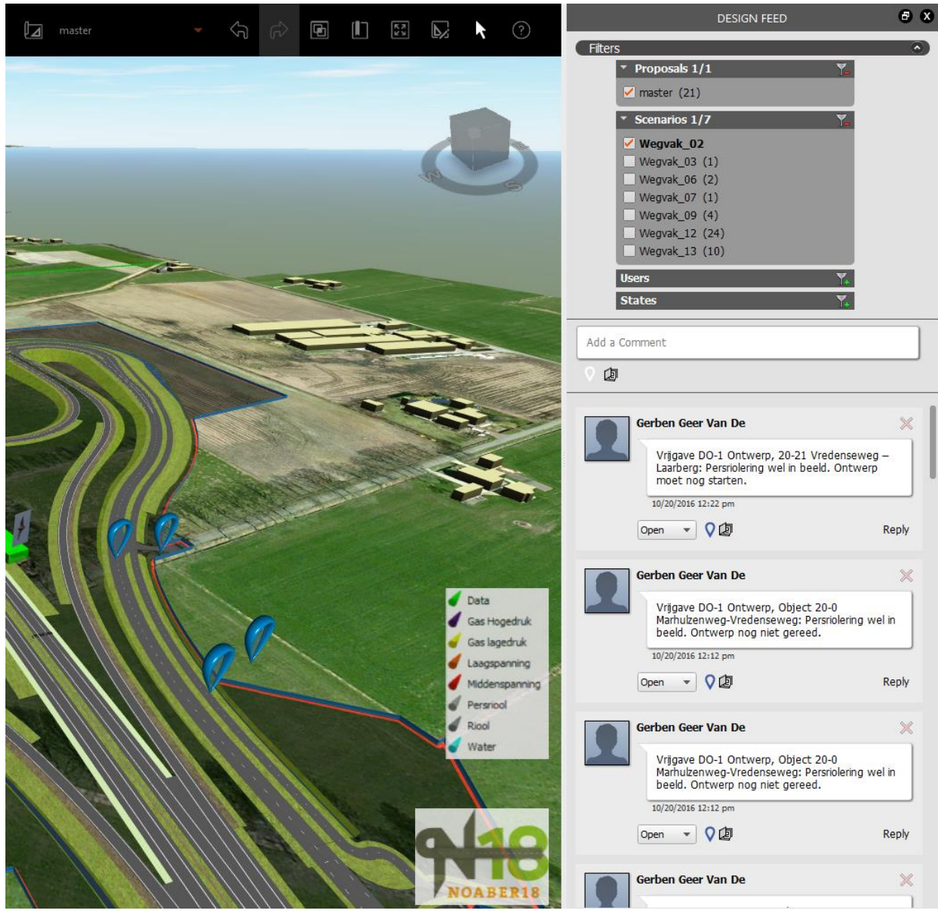
Vault infrastructure



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.

Infraworks 360

- Clash detection
  - The detail clash detection remains in Navisworks
  - If needed an IFC export is created from Infraworks
  - No need for maintaining two systems

- A360 Drive
  - We use both an A360 Team site and A360 Drive.
  - Infraworks source data is on the A360 Drive
  - Source data is always available to everyone

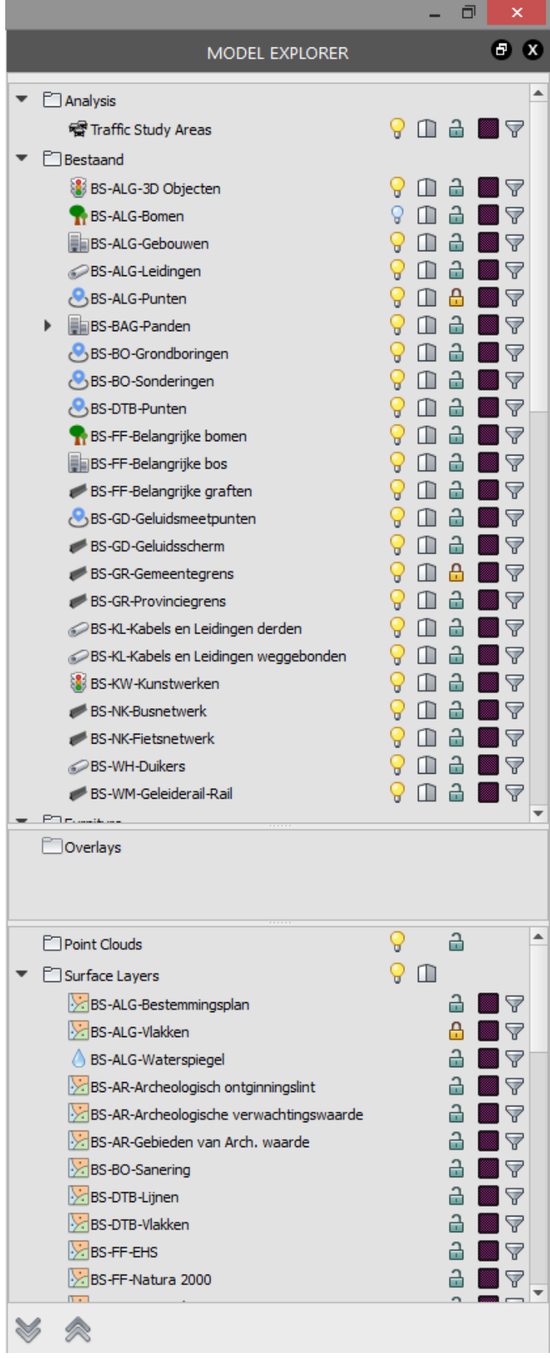
Model Explorer

- Changed the model explorer **definition**
- We can **filter**, set LOD and turn on or off sub types

  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**".

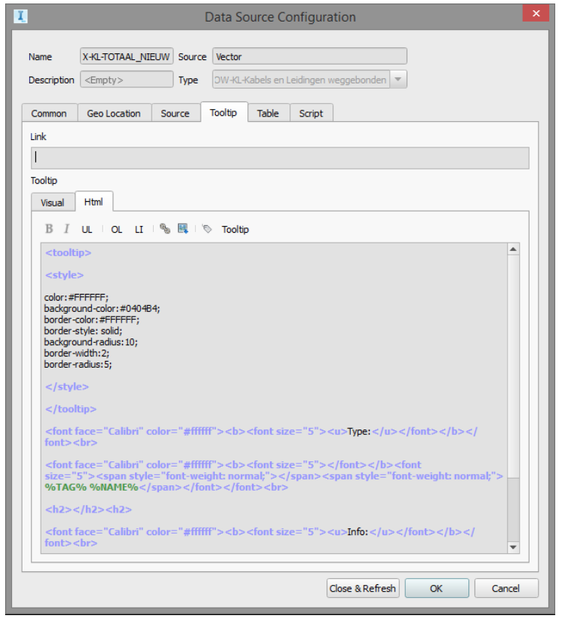
More information

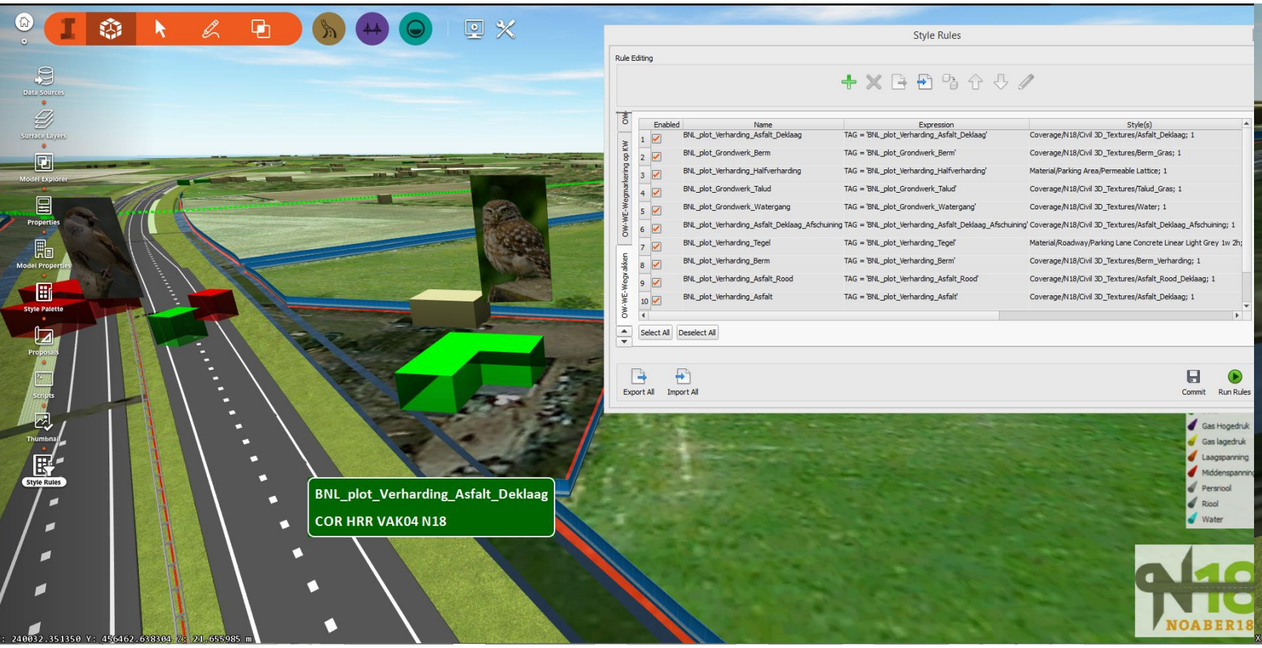
- http://autodesk.typepad.com/bimagination/
  search for *json* (im.schema.json)



HTML Tooltips

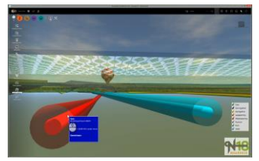
- HTML tools tips is quite **common**
- Different **coloring** to these tooltips depending on the **object type** is useful
- Working well to **identify** object origin/type or source.

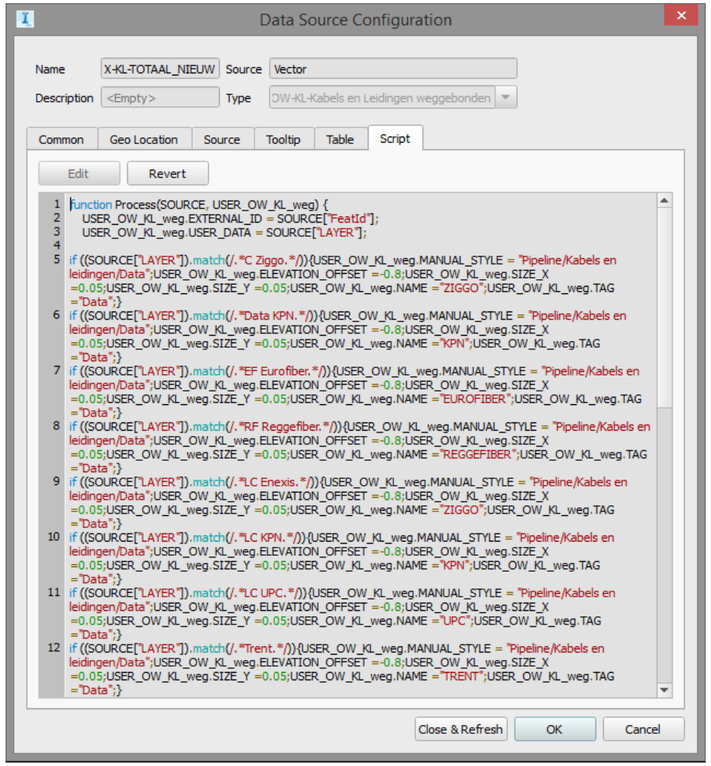


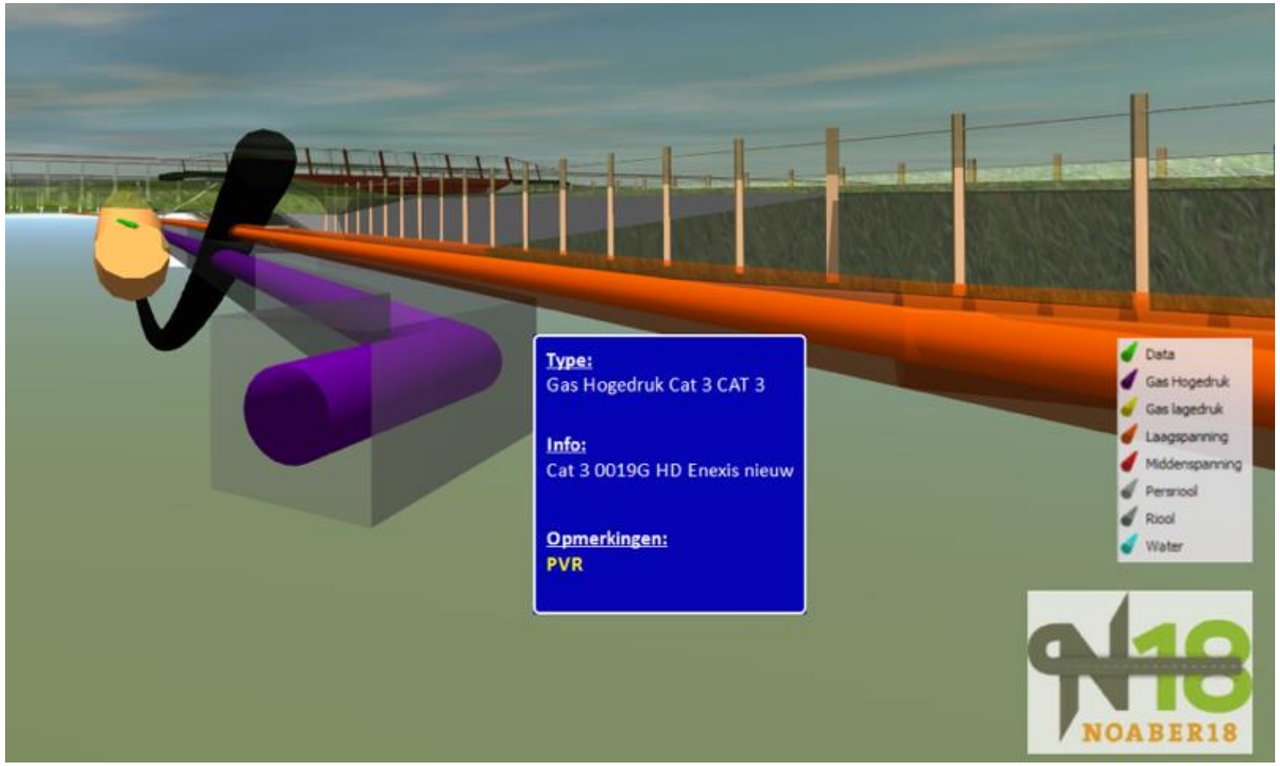


Scripting

- 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.

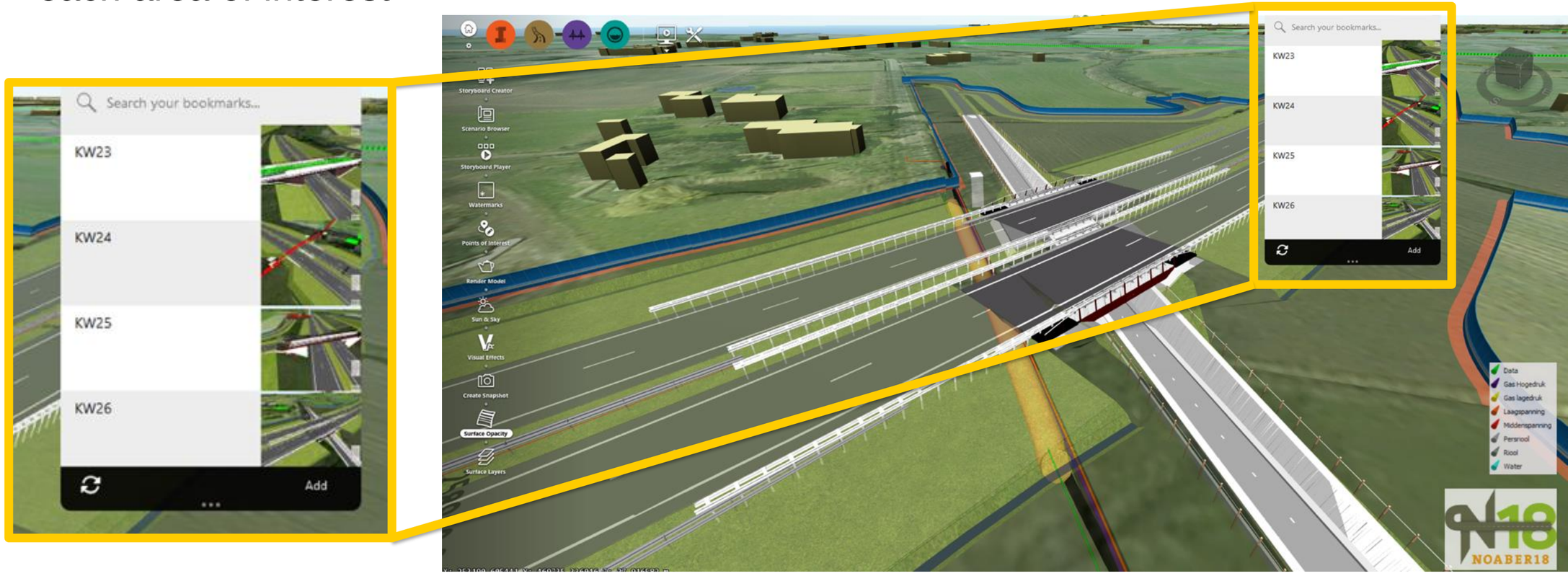






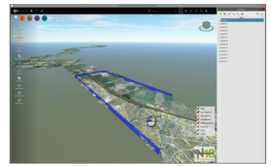
Bookmarks for Navigation

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



Scenarios and Proposals

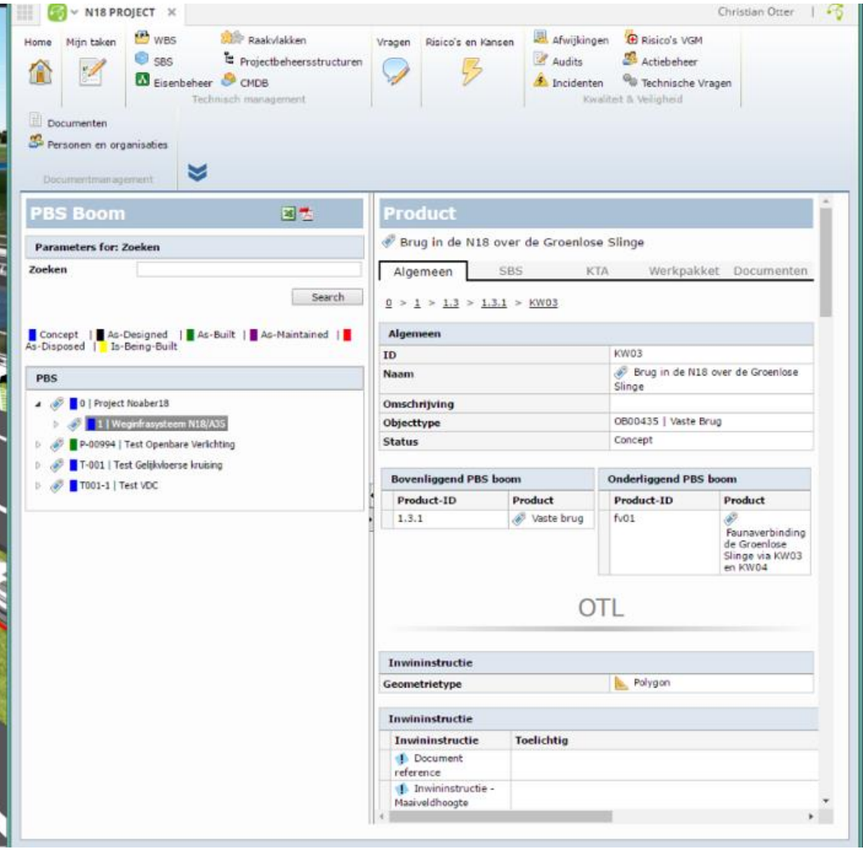
- Scenarios used as **project areas**. You are able to quickly select or show only a certain project area.
  - remember you can filter design feeds as well



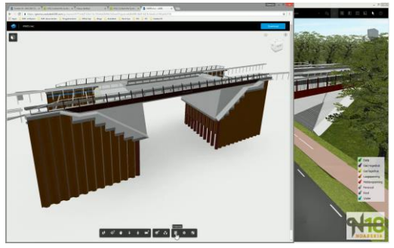
- Proposals used as Sprint Review **milestones**
- Each proposals represents a **version** of the model which has been subject to the client's approval.
- Able to go back to a **previous state**
- Show **progress** of design or **change** by switching proposals.

Requirements, Documents and 3D models

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

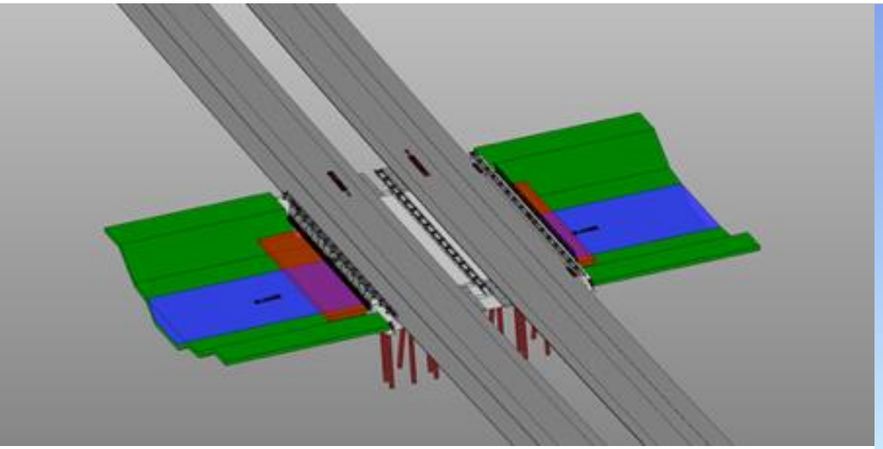
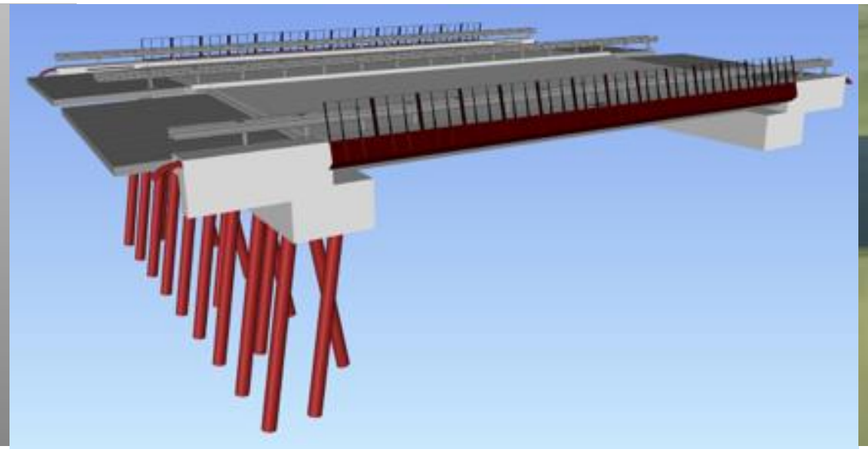
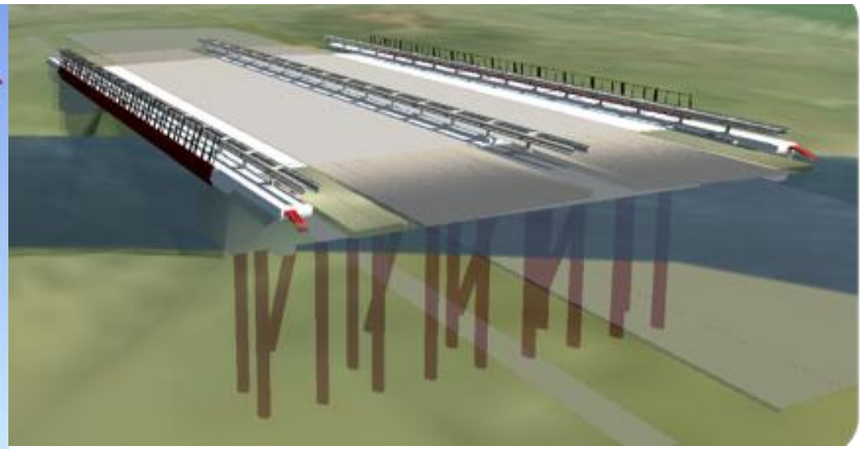


demo



Revit import

- Use IFC export from Revit and import **FBX** in Infraworks. **Advantage**:
  - Create selection sets or cleanup the model
  - Get the render materials across to Infraworks
- Export the 3D view in Revit to IFC
- Open IFC file in Navisworks and create a selection or cleanup. Export this model to FBX
- Add this FBX model to Infraworks

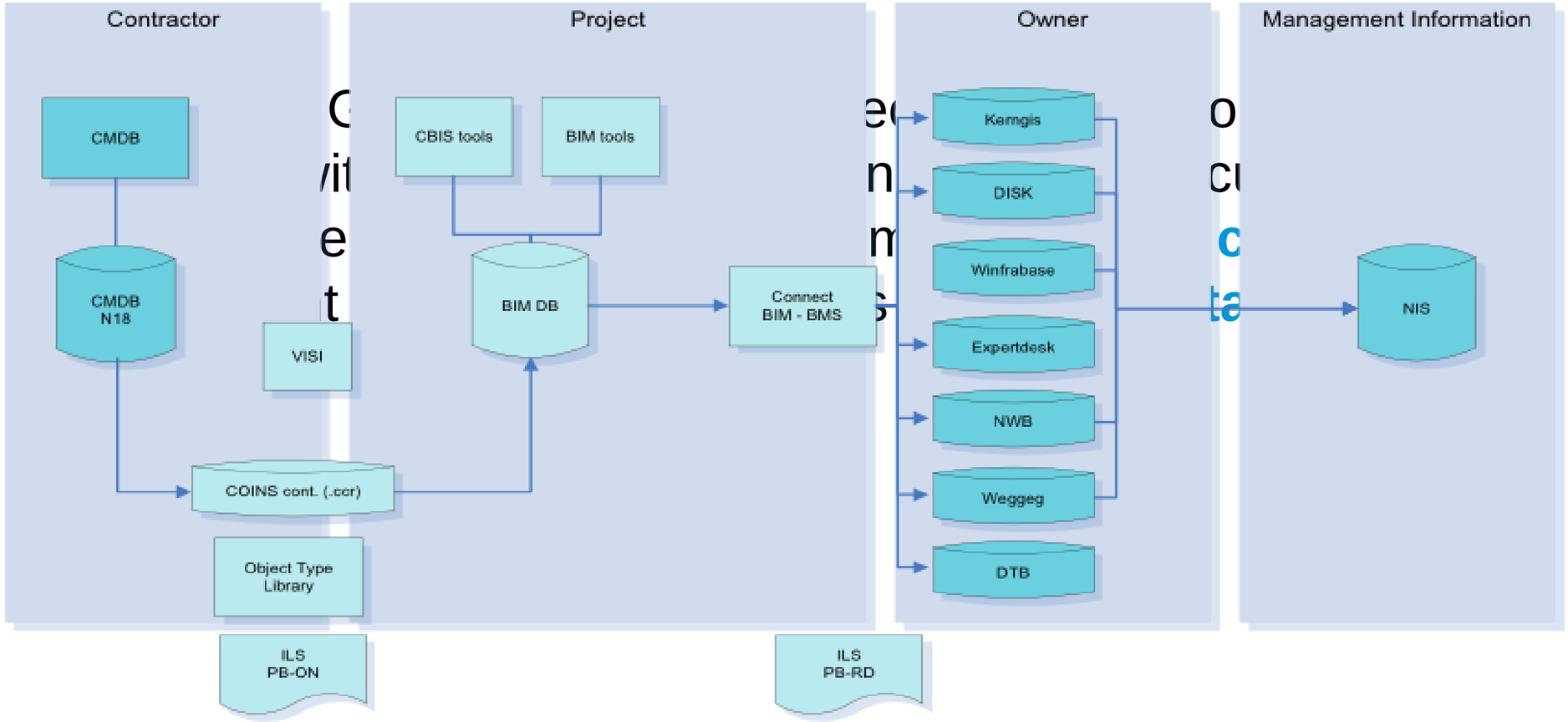




A360 Drive and Team together

- A360 Team for Published models and **exports** for Sprints.
- Non-technical and/or management has **access** to this data
- Data is **linked** from the Infraworks model as 3Dmodel-link.
- A360 drive for WIP data and as a **source** of Infraworks **models**.
- Tip: create a **shortcut** to the **A360 local** folder
  you cannot select the A360 drive folder shown under windows explorer favorites from within Infraworks.

GIS and Configuration Management Database

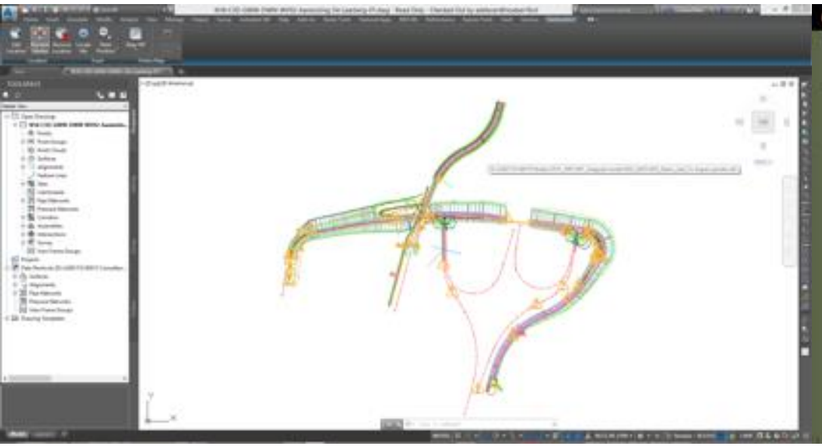
Communication with Client



- 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
  - Export Infraworks to **Shape** with Civil3D properties
  - Import the Civil3D **corridors** into Infraworks
  - Connect to the Infraworks **SQLite** file from AutoCAD MAP
  - Select the categories (**coverages**) to import
  - Export this layer as a **SQLite**



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