The new workflow for bridge design with InfraWorks, Inventor, Civil 3D and Revit - CI223945

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Technical Sales Specialist AEC South Europe
Class summary

• This session is about the new Autodesk workflow for bridge design.

• All the manipulations are based on real bridge data.

• We will show how to use hero products in the AEC Collection for bridge process: pre-design, design, structure analysis, visualisation, documentation, rebar…
This session is about the new Autodesk workflow for bridge design.

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We will show how to use hero products in the AEC Collection for bridge process: pre-design, design, structure analysis, visualisation, documentation, rebar…
Key learning objectives

• Learn how to use InfraWorks, Inventor, Civil 3D, Revit and Autodesk Structural Bridge Design together

• Discover the new bridge design workflow

• Learn how to apply some tips and tricks to be more productive

• Learn how to better communicate with an in-context visualization of the bridge project
About the speaker

Stéphane Balmain, Technical Sales Specialist AEC South Europe

Structural Engineer based in Grenoble, France

Specialist for BIM structural workflows (Revit, InfraWorks, Navisworks, BIM 360, Robot…) since 2008.

Product Manager of RSA for Concrete in 2006/2009


Blog VillageBIM (http://villageBIM.typepad.com/)
About the speaker

Vincent Fredon, Technical Sales Specialist AEC South Europe

Based in Paris, France.
Specialist for BIM infrastructure workflows (Autodesk Civil 3D, InfraWorks, Navisworks, BIM 360) since 2015.
Geotechnical Engineer.
13 years in engineering companies in infrastructure domain (road design, drainage design, urban planning…).
5 years as Application Engineer for an Autodesk partner.

Blog Civil Made in France (http://civilfrance.typepad.com/)
The data

The bridge is part of a road project around Vichy (center of France). The road bypass has been open in the beginning of 2016.

The project is described in the document “Declaration of Public Utility” available on the web.
The data

Documentation from LB7, Rector Lesage Group (girders precast manufacturer).
The data

Other pictures of the bridge.
Bridge workflow synthesis
InfraWorks: BIM infrastructure platform

AUTODESK® AUTOCAD® CIVIL 3D®
VEHICLE TRACKING
Detailed design
Swept path analysis
Detailed quantities
Documentation

AUTODESK® REVIT®
Architecture – MEP
Structure – Construction & Documentation

AUTODESK® ISRANWORKS®
Preliminary design
Visualization
Analysis / Simulation
Quantity

AUTODESK® INVENTOR®
Parametric model

AUTODESK® 3DS MAX® INTERACTIVE
AR / VR

Bridge & Tunnel

Civil view

Coordination model

LandXML, DWG
Share surface (BIM 360)

= direct import

DWG, ADSK

FBX

Project review
Why InfraWorks for bridge design?

Contextual & parametric model
- Support large projects
- Many roads/rails, interchanges and bridges
- Customization
- Collaborative process

Proposals based on rules and analytics to generate optimal designs
Reliable quantities and cost
Visualization public and technic
Documentation efficient & dynamic
Construction staging
The Bridge design workflow

Bridge Design module
- Default components
- Customized components

Send bridge to Revit
- Dynamic update

Open in Civil 3D

Bridge model

Context

Documentation + Rebar

Share BIM360

Export FBX

Send to Revit

Drop DWG

Autodesk Invenor

Autodesk Navisworks

Autodesk InfraWorks

Autodesk Civil 3D

Autodesk Revit
Part 1
Context creation
BIM 360 Docs project

Stéphane lives in Grenoble and Vincent lives in Paris (about 600 km). To collaborate on this production, we have used BIM 360 Docs.

- InfraWorks collaboration
- InfraWorks data shared (Autodesk Desktop Connector)
- Civil 3D surface published for Revit
Model Builder

Create a 3D context anywhere
Topography enhancement 1

Free IGN data base (BD Alti 75) + Civil 3D: terrain elevation more accurate than Model Builder data for Europe.
Topography enhancement 2

Plan view of the bridge + Raster Design in Civil 3D: extraction of the survey points around the bridge
Topography enhancement 3

Import the enhanced terrain in InfraWorks
Manual enhancement

Basic roads → components roads
Rail style
Alignment & profile, gradings
Basic bridges
Culverts…
Step 2
Bridge pre-design
Plan view superimposed on the default bridge proposition

TIF picture is used as terrain overlay in InfraWorks
Fine-tune using the plan view

- Start & End Station – total length
- Numbers of piers
- Each Span length
- Size and number of column of the piers
- Size and number of piles & cape of the foundation
Fine-tune using the plan view
Fine-tune using the plan view

- Start & End Station – total length
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Road components edition

Detailed edition of the road components according to the final bridge position and geometry.
Step 3
Bridge customization
Specific girders from Inventor
Specific girders from Inventor
Specific cornices from Inventor

Cornices are 3D parametric models created in Inventor and imported into InfraWorks with the Infrastructure Part Shape Utilities tool.
Step 4
Structural analysis
Bridge structural analysis

Autodesk Structural Bridge Design (ASBD)

1. Line girder analysis
2. Display key results
3. Download PDF report
4. Fine-tuned Analysis (Add military convoy...)
Infraworks Cloud analysis

Cloud Structural Analysis in InfraWorks powered by Structural Bridge Design
Infraworks Cloud analysis

AASHTO Type VI
H = 1.83 m

AASHTO Type II
H = 0.91 m

AASHTO Type I
H = 0.71 m

Design standard | Eurocode FR | Shear: g1b-5 | 1.020
Shear: g1a | 0.910
Live Bending: ULS: +ve: g1a | 0.760
Prestress Transfer | 0.740
Live Bending: ULS: +ve: g1b-5 | 0.730
Live Bending: SLS: +ve: g1a | 0.520
Erection Stage | 0.500
Live Bending: SLS: -ve: g1b-5 | 0.500
Live Bending: SLS: -ve: g1a | 0.500

Get Full Report

Unsatisfactory tendon layout
From InfraWorks to Local Structural Bridge Design analysis

Local Autodesk Structural Bridge Design – Fine tune analysis
From InfraWorks to Local Structural Bridge Design analysis

Local Autodesk Structural Bridge Design – Fine tune analysis

- Fatigue Model 3
- Military Load MC120
Step 5
Communication model
InfraWorks for communication
InfraWorks for communication
Step 6
Documentation & Rebar with Revit
Civil 3D terrain for Revit

Publish surface for Revit on BIM 360
Open bridge in Revit

- Send the 3 bridges to Revit
- Add the terrain from BIM360
- Link the Bridge together
Documentation in Revit
Rebar in Revit
Rebar Clash in Navisworks
Step 7
Excavation
Excavation in InfraWorks

Excavation creation for foundations in InfraWorks
Excavation in InfraWorks

Excavation optimization for foundations in InfraWorks
Excavation in InfraWorks

Excavation simulation in InfraWorks
Excavation in Civil 3D – Step 1

Getting the InfraWorks context in Civil 3D is easy.
Excavation in Civil 3D – Step 2

Create a detailed excavation with Civil 3D tools.
Excavation in Civil 3D – Step 3

Volume and 3D solids slicing
Step 8
Construction planning
Navisworks Timeliner