A Case Study of BIM Design for a Smart City with the Architecture, Engineering & Construction Collection

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About the speaker

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

Blog Civil Made in France (http://civilfrance.typepad.com/)
About the speaker

Vincent Duloup, Ingerop, Urban project manager

Based in Bordeaux, France.
Working on BIM on urban project since 2016
9 years experience with Ingerop in the urban domain
(urban planning, urban & landscape technical design...).

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This session will cover a case study of BIM (Building Information Model) implementation for a complex urban project designed as a smart city.

- BIM implementation in the project
- Use AEC collection for urban design

All the inputs are based on real project experience
INGEROP is a french independant engineering company
4 business lines for all stages of the project
Project background
Where?

From Vegas

To Bordeaux
Bordeaux !
La belle endormie  *the sleeping beauty*

1996 – 2009, first modern urban project

- Develop the quays area
- Creation of the tramway
- Promote Bordeaux heritage
After 13 years…
Bordeaux in 2030

MAIN GOAL
Play a leading role at European level

Increasing the population by 250,000 by regenerating the old industrial districts
Bordeaux in 2030

MAIN GOAL

Play a leading role at European level

Improving major infrastructure

→ Achieved in 2017: train journey from Bordeaux to Paris in 2 hours
Bordeaux Euratlantique territory

- 2 500 000 m² of new construction
- 738 ha territory size
- 50 000 new occupants
- 30 000 new jobs
Subdistrict Belvedere
Subdistrict Belvedere

URBAN FRAMEWORK AGREEMENT

- Urban design
- Environmental studies
- Public spaces design and site supervision
CASE STUDY

- 12ha subdistrict size
- 140 000 m² of new construction
- 6ha of public spaces
- 1 100 housing units
- 50 000 m² of new office space
- 16 000 m² trade and hostel
BIM implementation process
Why BIM?

- Complex public spaces
- Upgrading infrastructure
- Grading from bridge to the shore
- Major underground networks
- 15 design teams
What is CIM?

CITY INFORMATION MODEL

- A spatial scale change
- A long time period
- Taking the existing into account
- Management of building and public space BIM environments
Timeline of CIM implementation

- **2016**: First BIM discussion with client
- **2017**: Writing CIM organization documents
- **2018**: Design stage for Public spaces & Real estate programs
- **2019**: CIM summaries with Navisworks model
  - Vizualisation model with Infraworks model & VR
- **Today**: Detailed design stage for Public spaces & Real estate programs
Let’s take a deep dive into the main steps of the process
Defining the objectives

- PROVIDE DECISION SUPPORT
- IMPROVE PROBLEMS COMPREHENSION
- BETTER FINANCIAL ESTIMATIONS
- HELP COLLABORATION
- GATHER AND UTILIZE DATA
- BIM PROCESS FROM DESIGN TO OPERATE
BIM use cases for design stages

- Technical coordination of public spaces
- Production of design deliverables
- Program monitoring
- Technical coordination at public / private interfaces
- Urban visualization
BIM organization

BUILDINGS

- Architecte 1
- Architecte 2
- Architecte 3
- Architecte 4

Design
(Modelization)

- BIM Management
(Modelization)

DISTRICT

- CIM Management
Summary

PUBLIC SPACES

- Ingerop
  Inventing for tomorrow

- TVK

Design
(Modelization (Ingerop))
## Assets in the model

**Principal group of objects**
- Terrain
- Sanitation networks
- Pressurized networks
- Other networks
- Street furniture
- Green space
- Tree
- Signage

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AEC Collection
Complete workflow
Modeling public spaces
Modeling public spaces

All components of the future public spaces are modelled:

• Existing surface
• Roadways
• Squares
• Tracks/paths/footpaths
• Existing and projected underground networks
• Green spaces
• Trees
• Urban street furniture

INGEROP is the only contributor to this model
Civil 3D for modeling public spaces

- Roadways: 3D Corridors
- Squares: Feature lines & Surfaces
- Drainage networks using the Gravity networks module
- Other networks: Feature Lines & 3D Corridors
- Street Furniture, plants, signage: Multi-view blocks
Modeling ground
First approach

3D SOLIDS

• Corridor construction by homogeneous element - roadway, sidewalks
• Extraction of the Feature Lines with dynamic links
• Sidewalk baseline from extracted Feature Lines

→ Still many standard profiles due to materials variety
Optimized approach

**SURFACES**

- Still modelling road and sidewalk separately
- Without considering the material
- Get surfaces from 3D corridors
- Gather all surfaces into one

Integrate material into model
- Using "fill" slope function by material

→ Quicker, more flexible
Improving parametric
Improving parametric

- Autocad block

- Getting parameters
  - X coordinate
  - Y coordinate
  - Rotation
  - Layer
  - Block name

- Applying to Revit family
Improving non-drainage networks
Improving non-drainage networks

- Autocad 2D polylines
- Getting parameters
  - Polyline trajectory
  - Layer
- Offsetting from Revit surface
- Applying to Revit railing family
Tips

CREATING A RELIABLE SURFACE FROM CIVIL 3D TO REVIT

• Export surface from Civil 3D as Autocad file with high precision
  o Contour lines 2cm style
• Create Toposurface in Revit by importing contour data Autocad file
  o Massing & Site → Model Site panel → Toposurface
Summary model
Summary model workflow
Summary model

TECHNICAL GEOMETRICAL COORDINATION MAINLY ON PUBLIC / PRIVATE INTERFACES

- Boundaries – public/private
- Access Interfaces (position, level, function)
- Underground network connections
- The location of accesses, trees and street furniture
Vizualization model
Vizualization model workflow
How to?

FROM AUTOCAD MASTERPLAN TO INFRAWORKS 1/2

Setting coordinate system « MAPCSASSIGN »

Exporting AutoCAD objects to GIS format « MAPEXPORT »
Attribute creation = AutoCAD property (ex Layer)
How to?

FROM AUTOCAD MASTERPLAN TO INFRAWORKS 2/2

Importing GIS data in Infraworks
Assignment of the attribute to a free field (ex Tag)

Creation of a rule style
Expression: Tag = 'attribute value'
INTEGRATING PLANTED TREE AREAS FROM GIS

PROBLEM
- Assign multiple plants to one specific style leads to a uniform distribution in each zone from GIS polygon

SOLUTION
- Superimpose each plant species making up the zone
- Modify **object spacing** parameter
- Modify **object spacing variance** parameter
The cherry on top

VR
VR model workflow

AUTODESK® INFRAWORKS® → Fbx → AUTODESK 3DS MAX → DataSmith → UNREAL ENGINE → anjima → People animation
Let’s conclude!
What’s next?

2010
Bordeaux Euratlantique creation

2017 - 2020
Public spaces design of Belvedere subdistrict

2020 - 2024
Construction of Belvedere subdistrict

2035
End of Urban project Garonne Eiffel construction
Facilitate decisions
Thank you!

Q&A