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

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Ingerop, Urban project manager

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AUTODESK. UNIVERSITY

About the speaker

Vincent Fredon, Autodesk, 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 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…).

www.linkedin.com/in/vincentduloup

Class summary

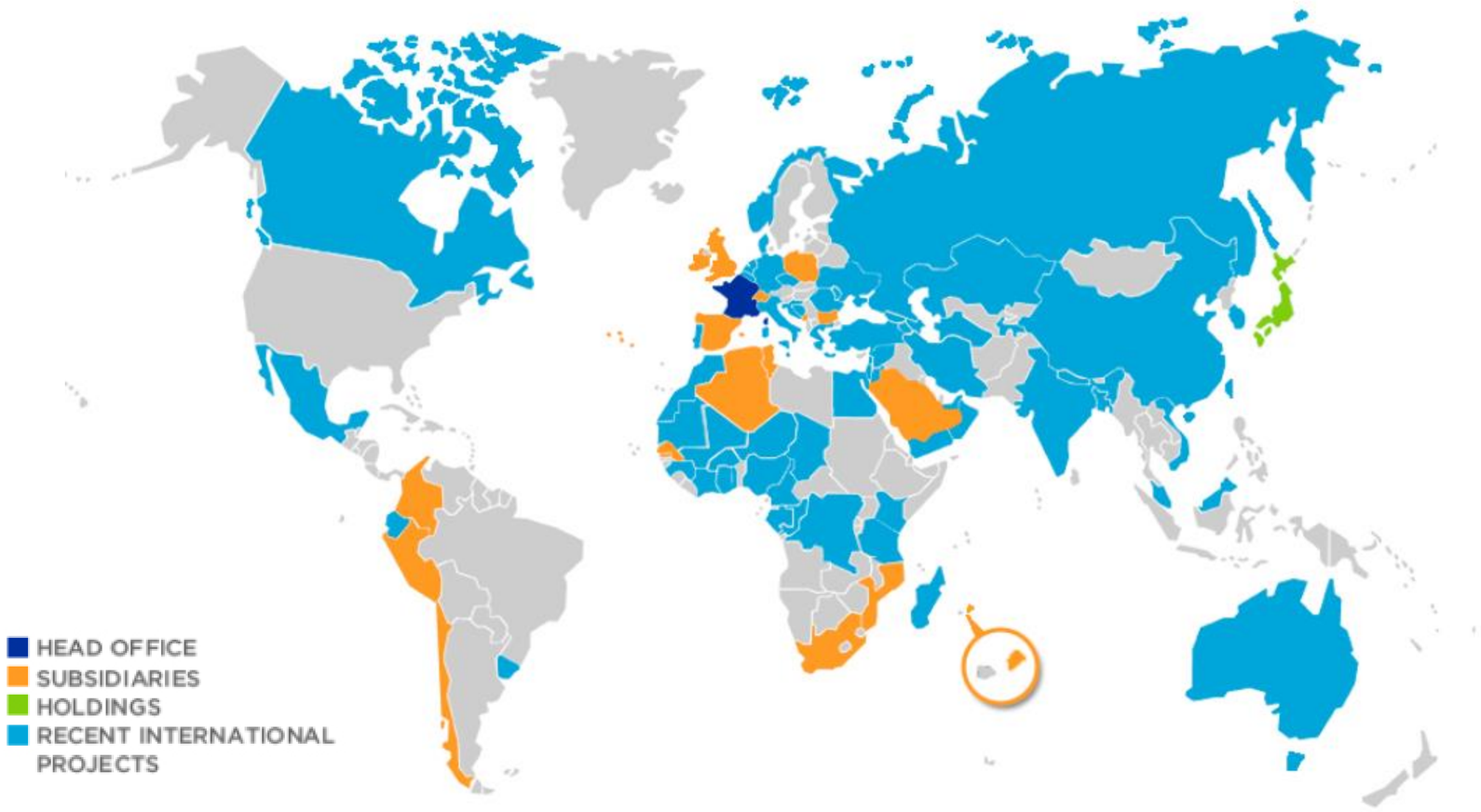
This session will cover a **case study** of BIM (Building Information Model) implementation for a complex urban project designed as a smart city.

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

All the inputs are based on real project experience

INGEROP

Inventing for tomorrow



2000
Employees
HUMAN RESOURCES

250
million Euro
THE CONSOLIDATED TURNOVER (2017)

65
offices
WORLDWIDE

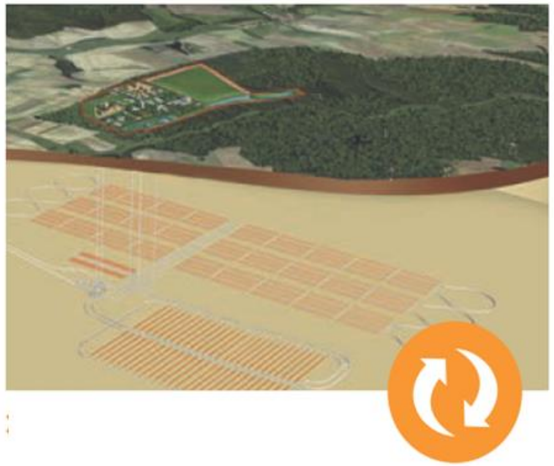
70
countries
INTERNATIONAL ACTIVITY

INGEROP is a french independant engineering company

4 business lines for all stages of the project

Building

Energy & Industry



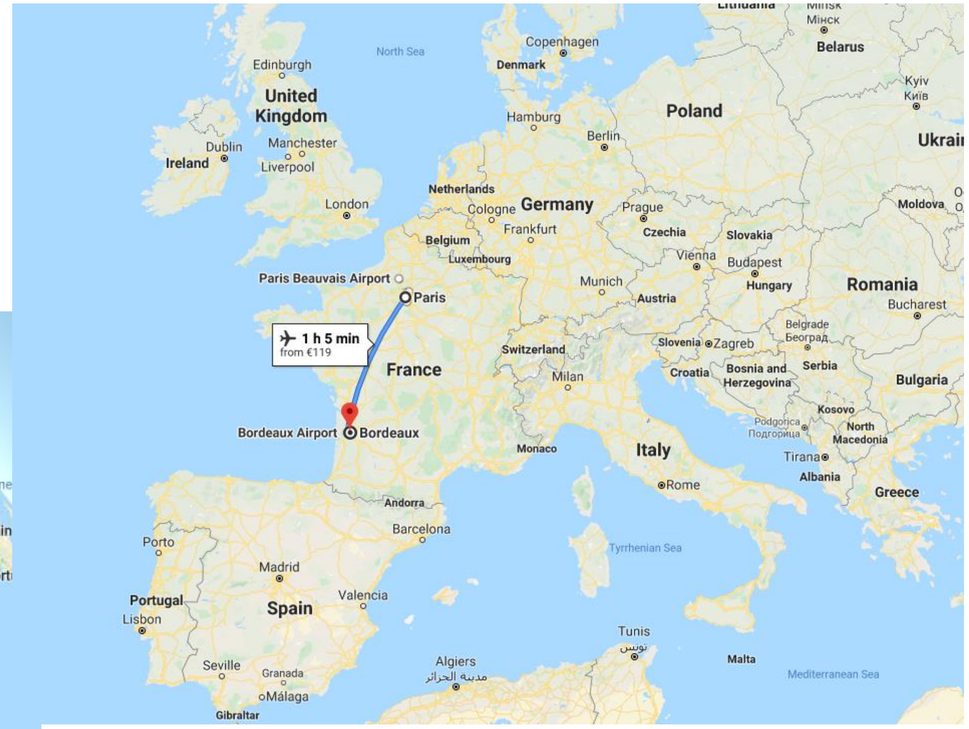
Urban development & Transportation

Water & Environment

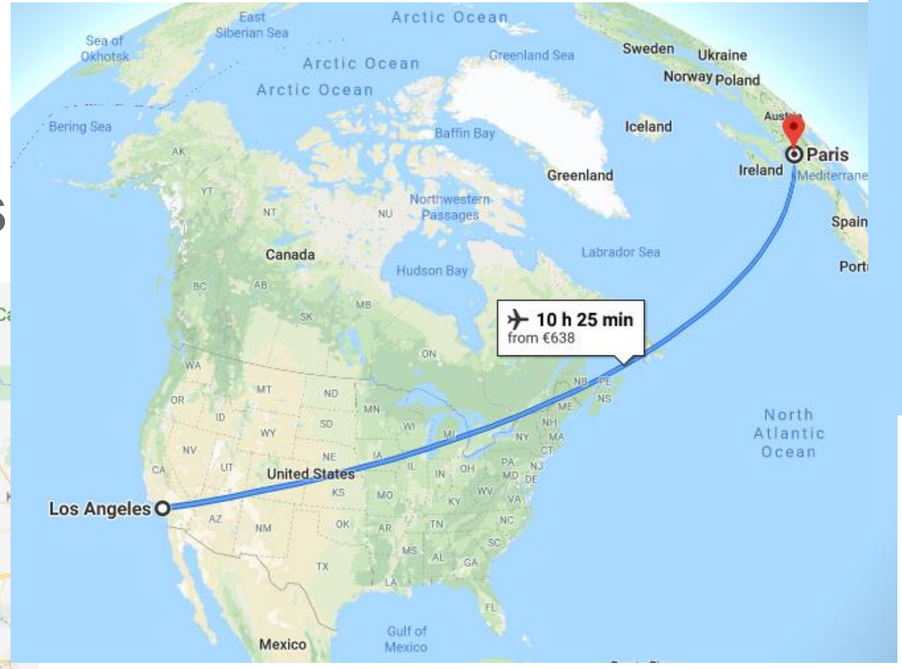
Project background

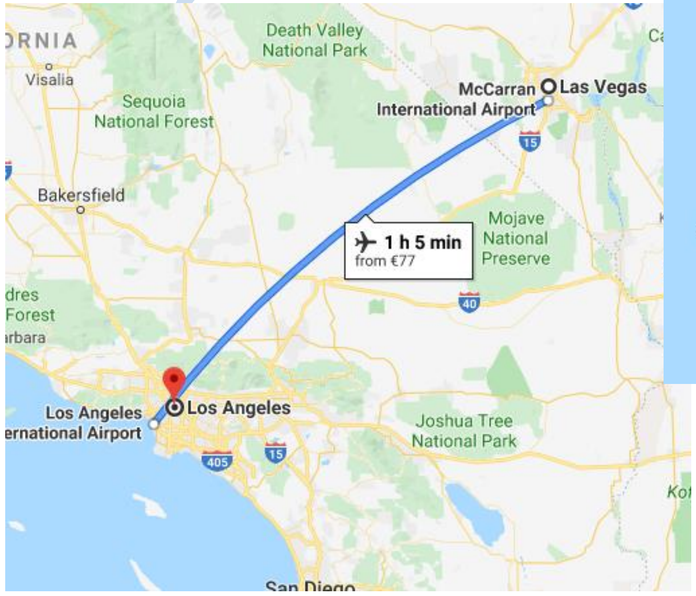
Where ?

To Bordeaux



From Vegas





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

Existing

Projects

Bordeaux in 2030

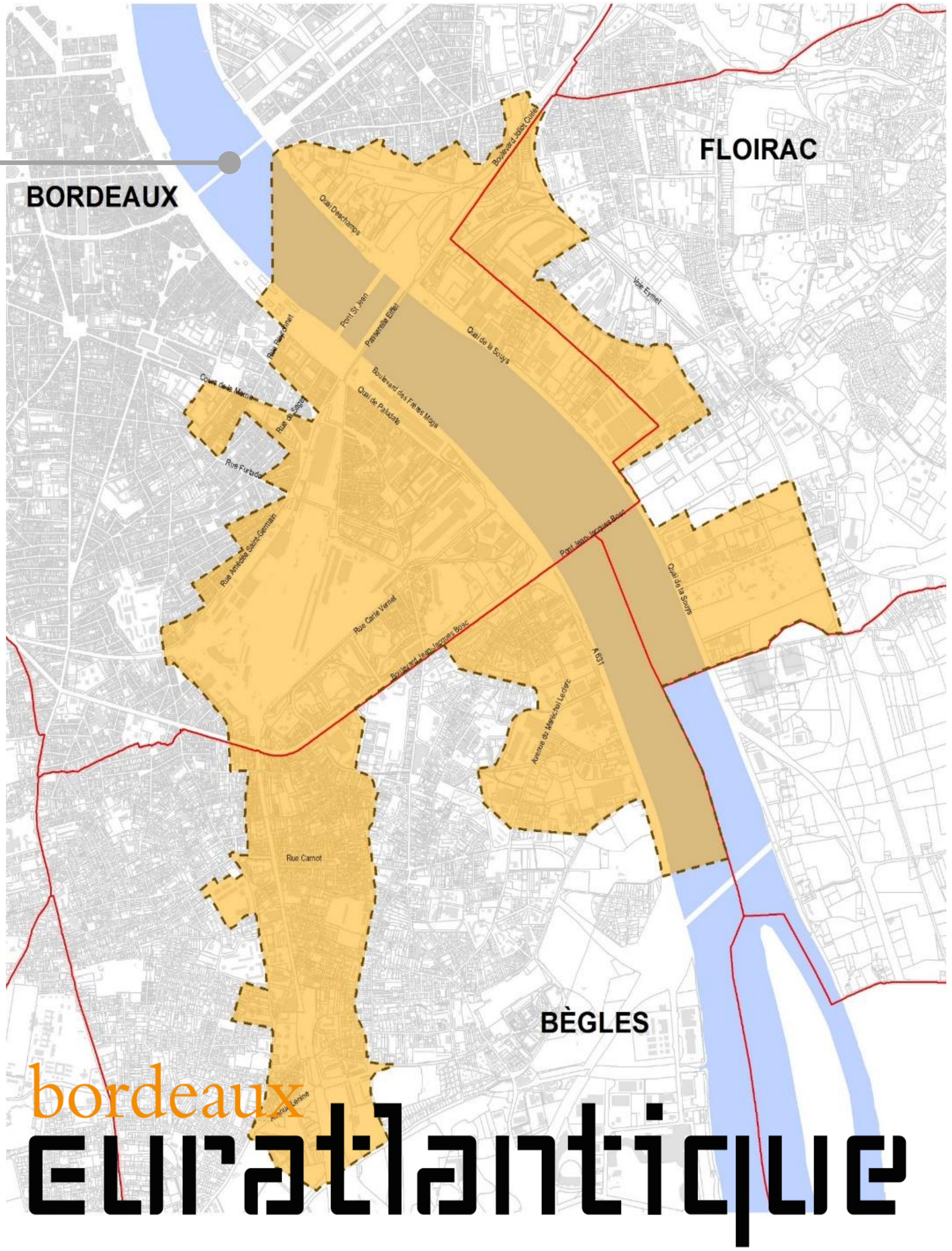
MAIN GOAL

Play a leading role at European level

Improving major infrastructure

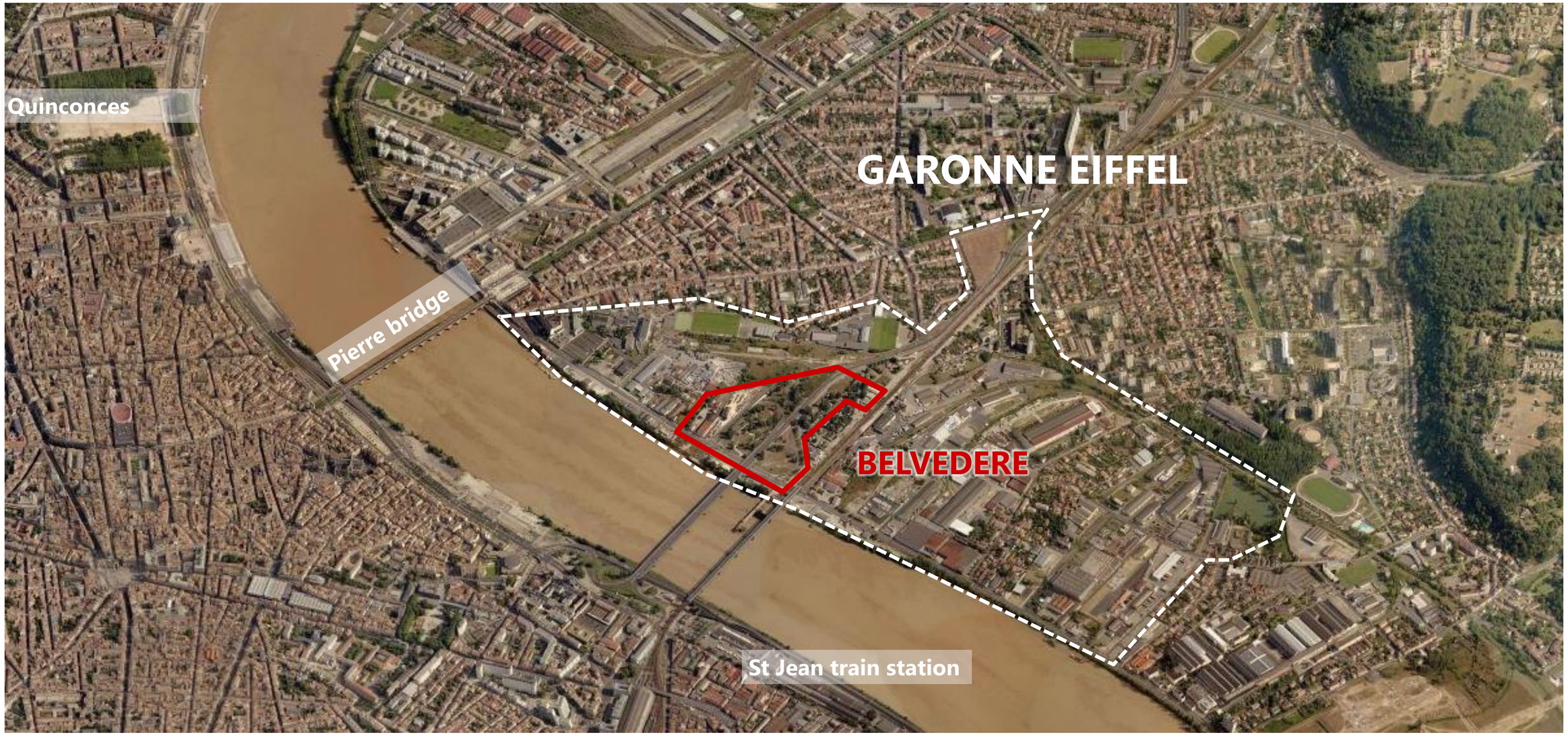
→ Achieved in 2017 : train journey from Bordeaux to Paris in 2 hours

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

INGEROP Inventing for tomorrow

TVK

URBAN FRAMEWORK AGREEMENT

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

Subdistrict Belvedere

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 ?

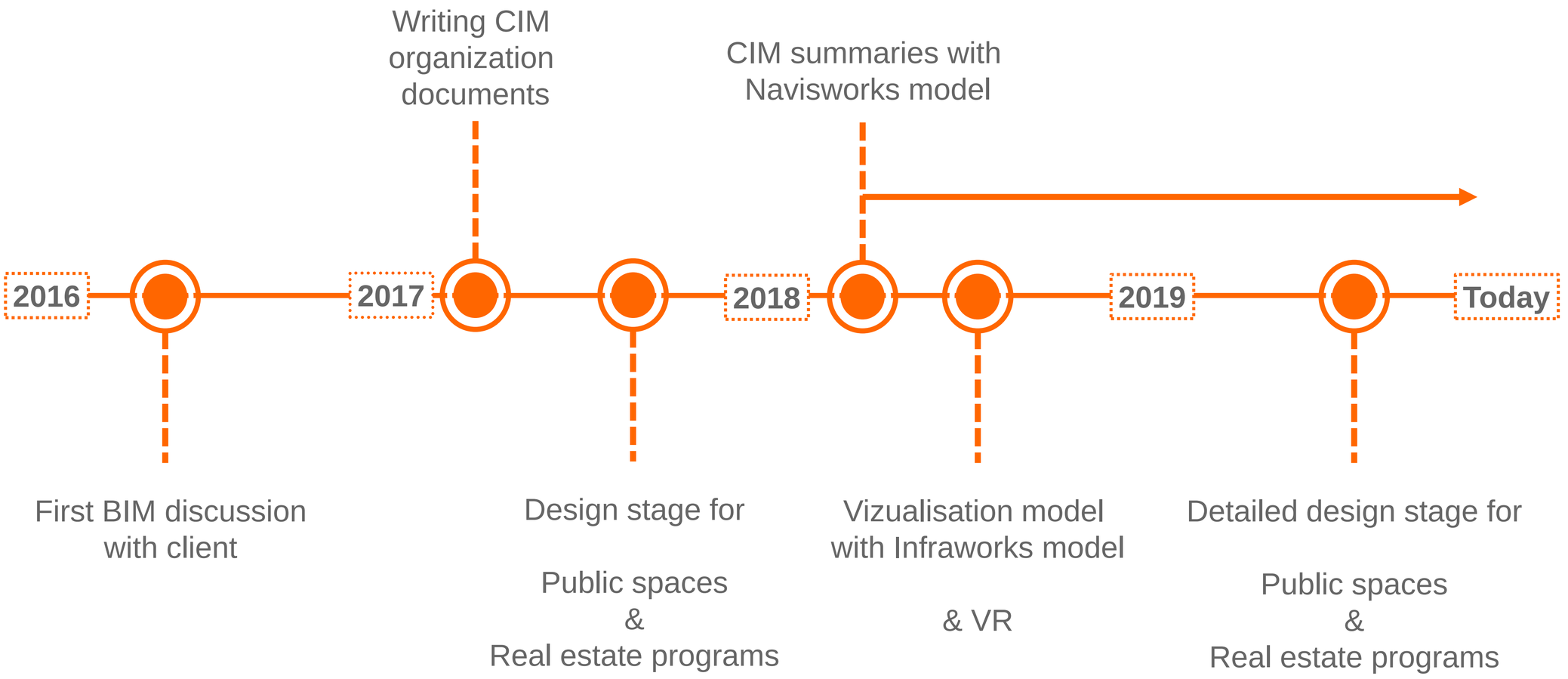
- Complex public spaces
- Upgrading infrastructure
- Grading from bridge to the shore
- Major underground networks
- 15 design teams

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



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

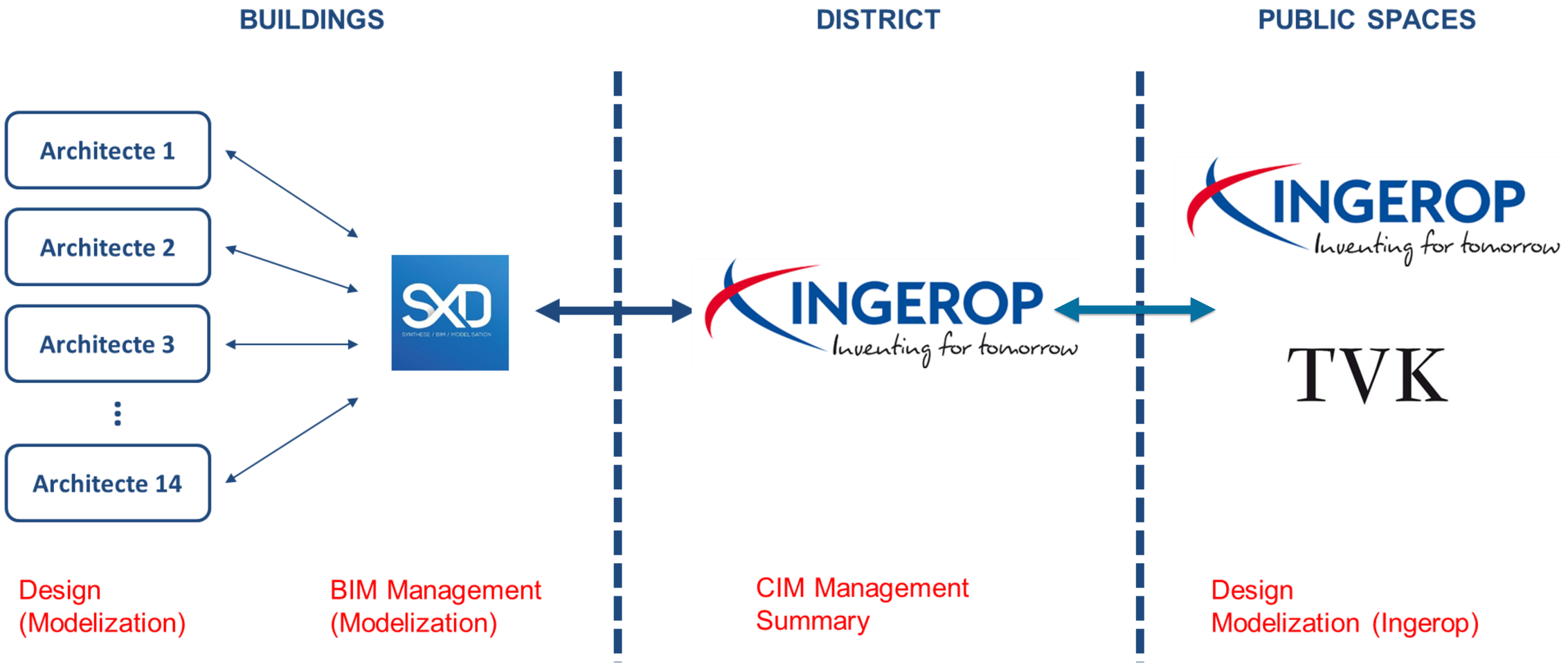
BIM use cases for design stages

- Technical coordination of public spaces
- Production of design deliverables

- Program monitoring

- Technical coordination at public / private interfaces
- Urban vizualization

BIM organization



Assets in the model

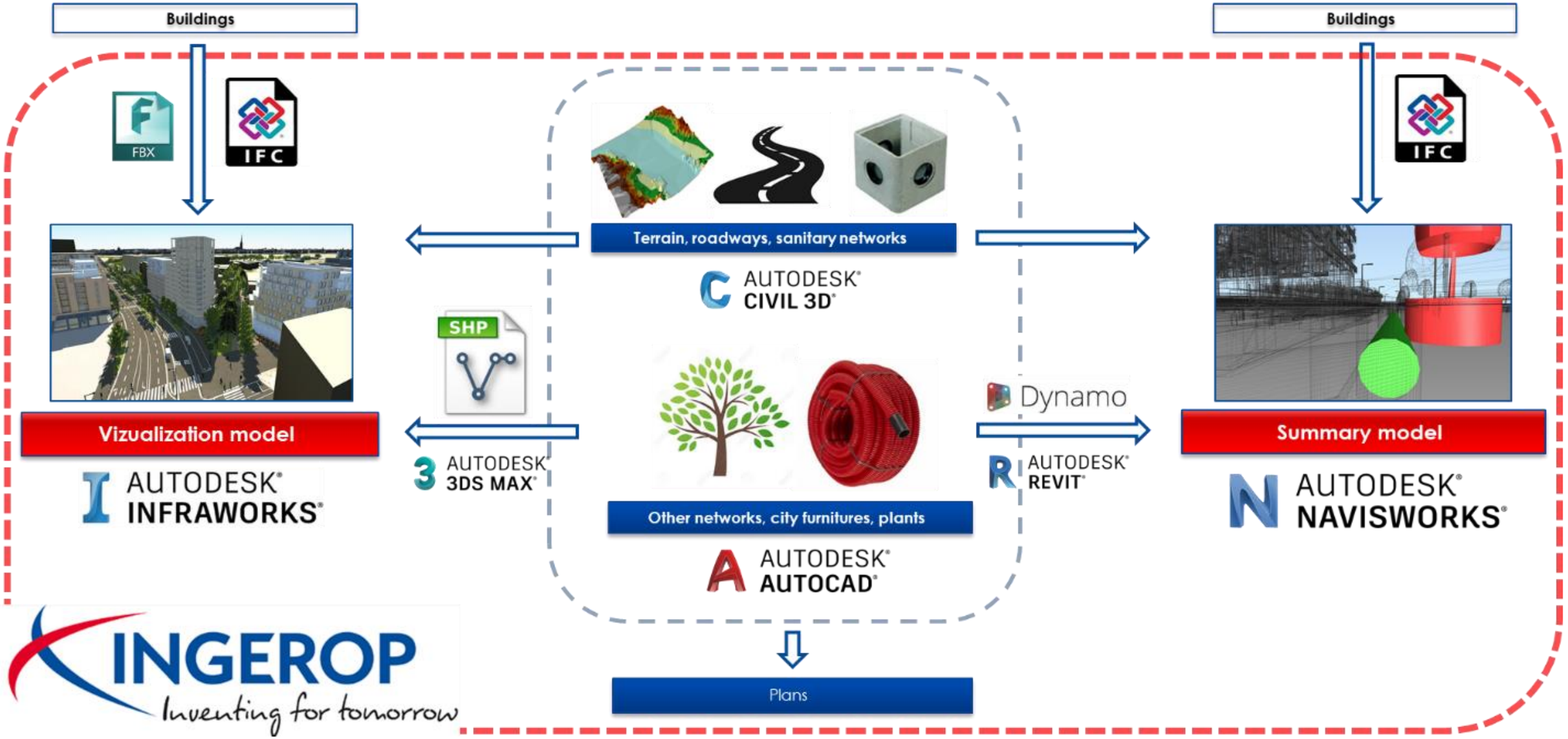
Principal group of objects

- Terrain
- Sanitation networks
- Pressurized networks
- Other networks
- Street furniture
- Green space
- Tree
- Signage

					PRO				
n° ligne	Famille d'Equipement	Type d'Objet	Code	Classe IFC	LOD		Niveau d'information (données alphanumériques)	Modélisation		Par
					Niv	Type		Outil	Spécifications	
7	Terrain	MNT	MNT		300	SURF	Dénomination Code ID_Phasage Type Etat	Civil 3D	Assemblage des surfaces unitaires (surfaces ou P3d)	ING
8		Revêtements	REV		300	SURF	Dénomination Code ID_Phasage Etat Usage Matériau	Civil 3D	Surface MNT projet redécoupée par type de revêtement suivant dwg masse DPA (projection LC)	ING
9		Structure	STR		300	SURF	Dénomination Code ID_Phasage Etat Type Matériau	Civil 3D	Décalage des surfaces revêtements	ING
10		Bordure	BOR		200	SOL	Dénomination Code ID_Phasage Etat Vue	Civil 3D	Projet 3D	ING
11		Caniveau	CAN		200	SOL	Dénomination Code ID_Phasage Etat	Civil 3D	Projet 3D	ING
12		Bande podotactile	POD		200	SURF	Dénomination Code ID_Phasage Etat	Civil 3D	Surface MNT projet redécoupée suivant dwg masse DPA	ING

AEC Collection

Complete workflow



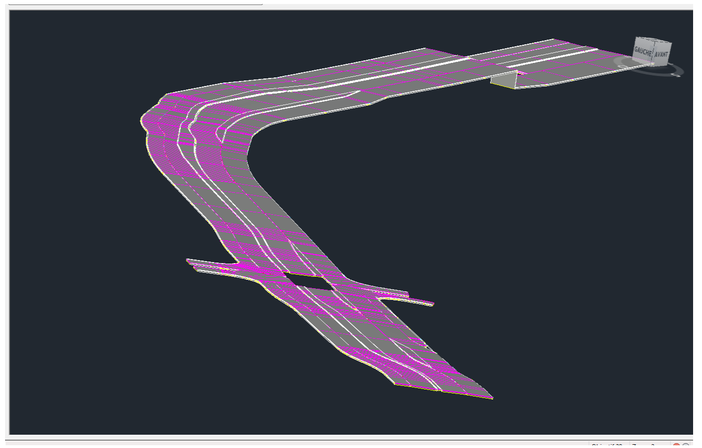
Modeling public spaces

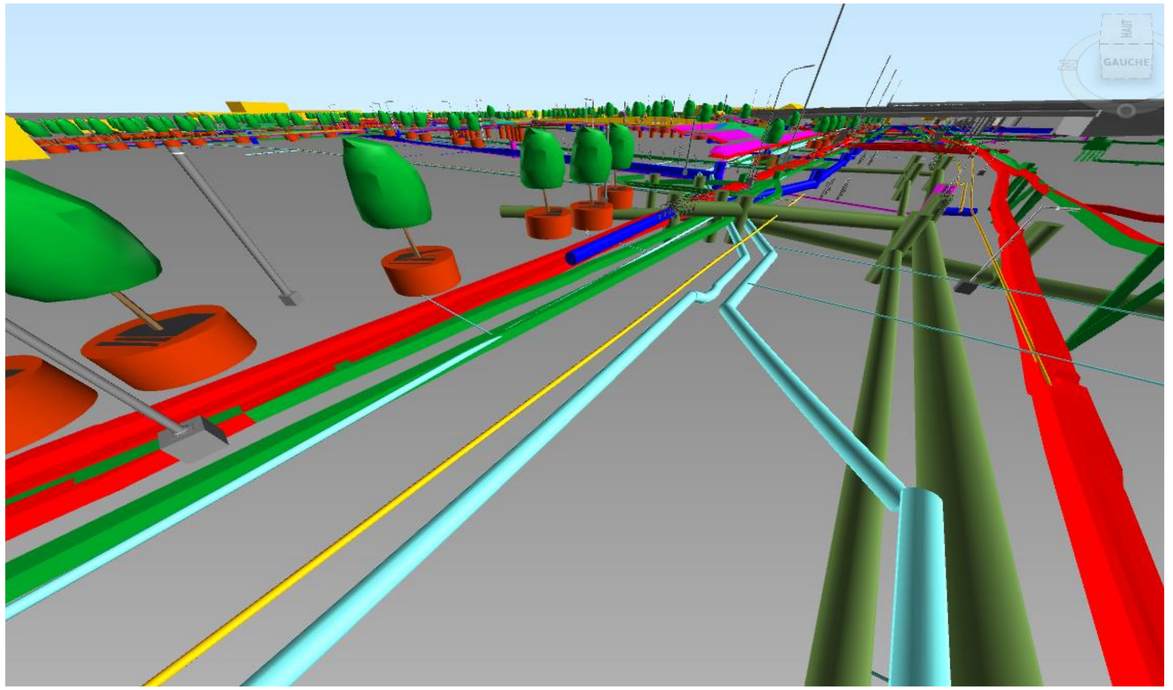
Modeling public spaces

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

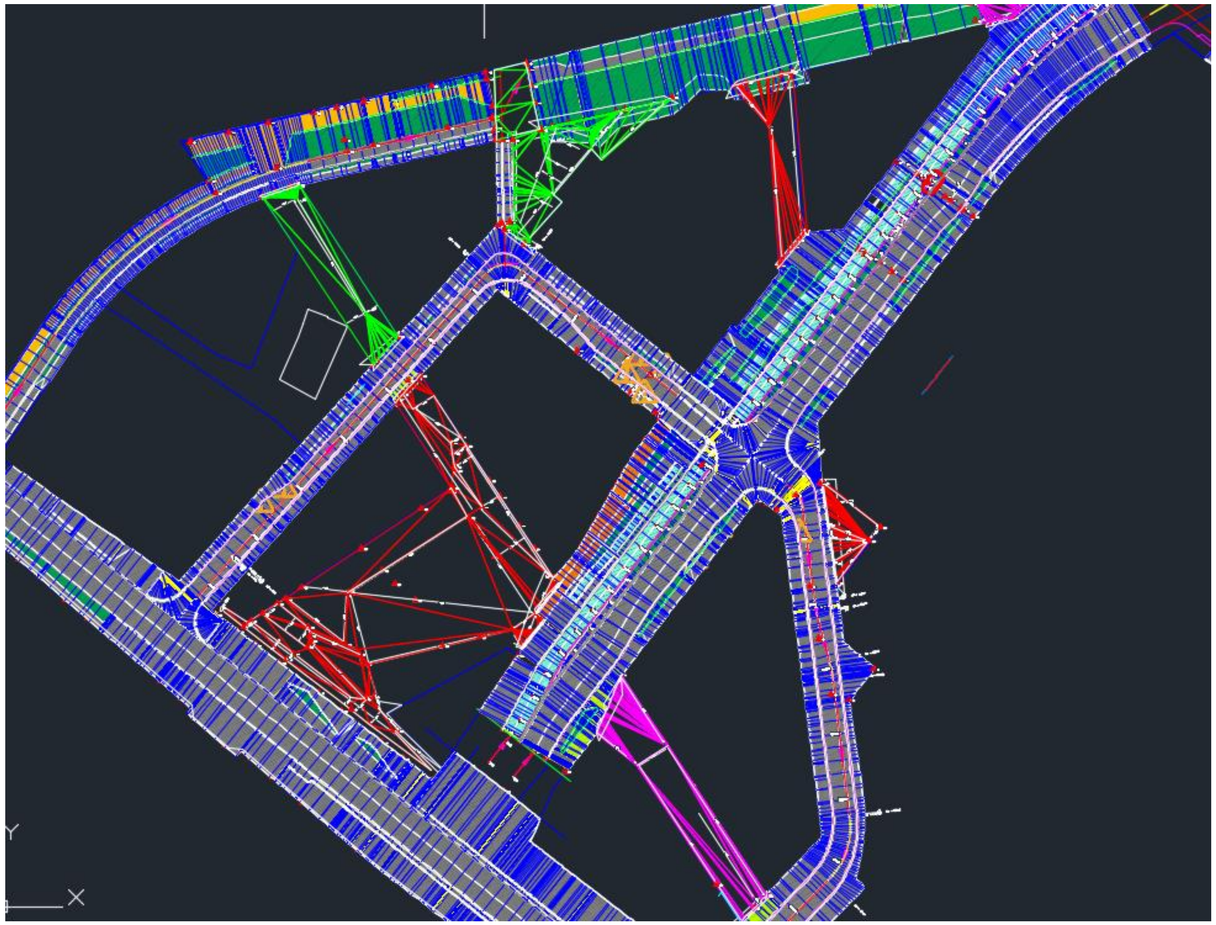
INGEROP is the only contributor to this model

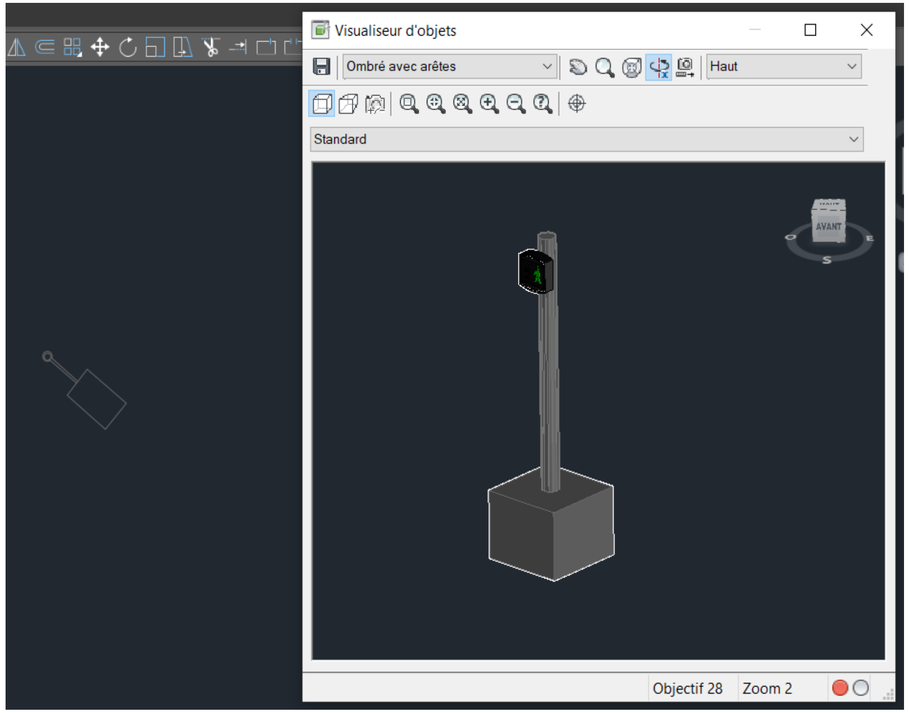




Civil 3D for modeling public spaces

- 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





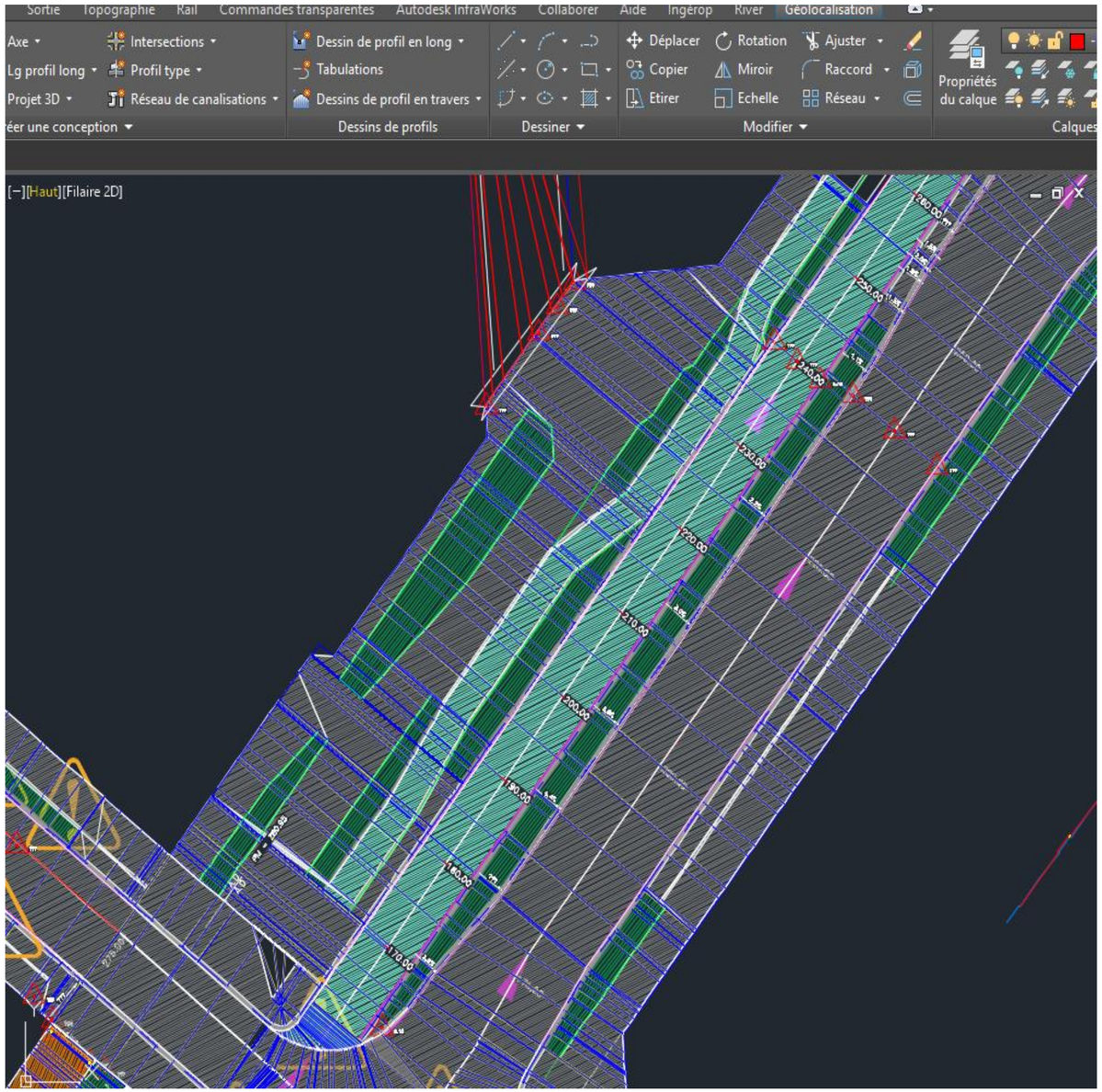
Modeling ground

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

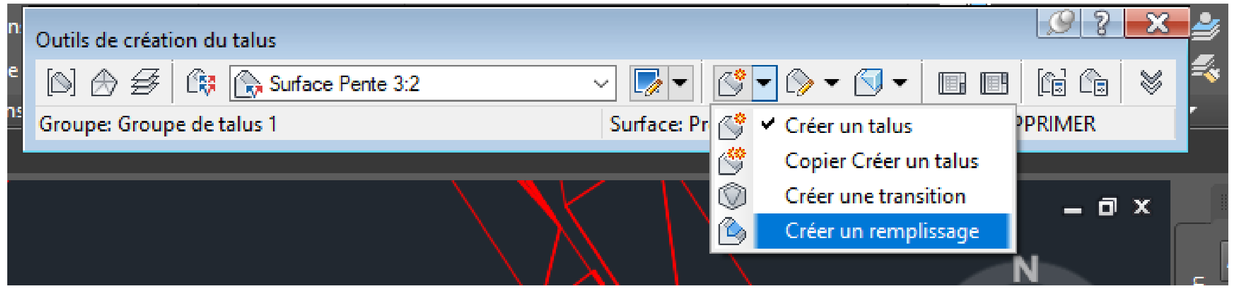
SURFACES

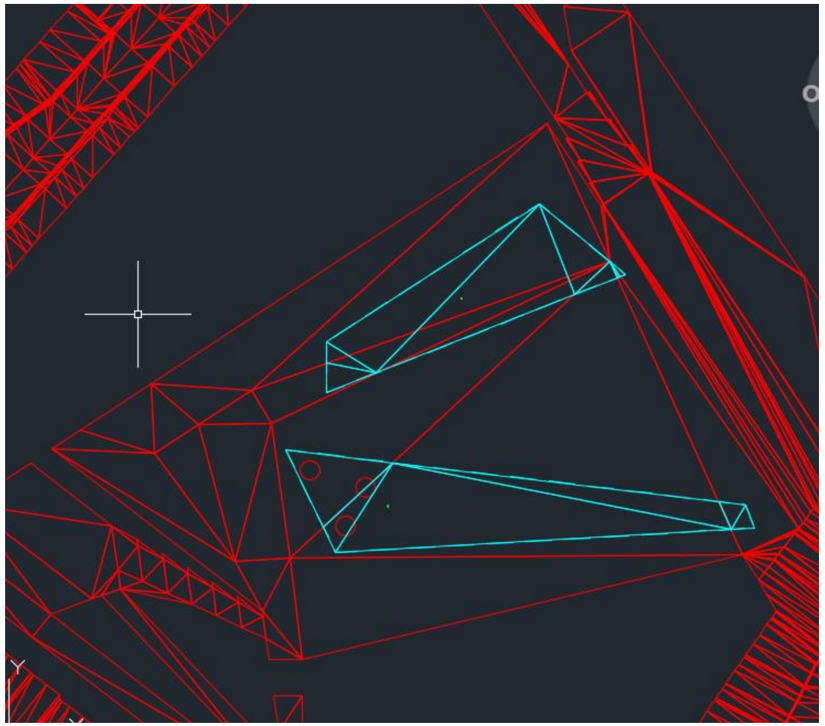
- Still modelling road and sidewalk separately
- Without considering the material
- Get surfaces from 3D corridors
- Gather all surfaces into one

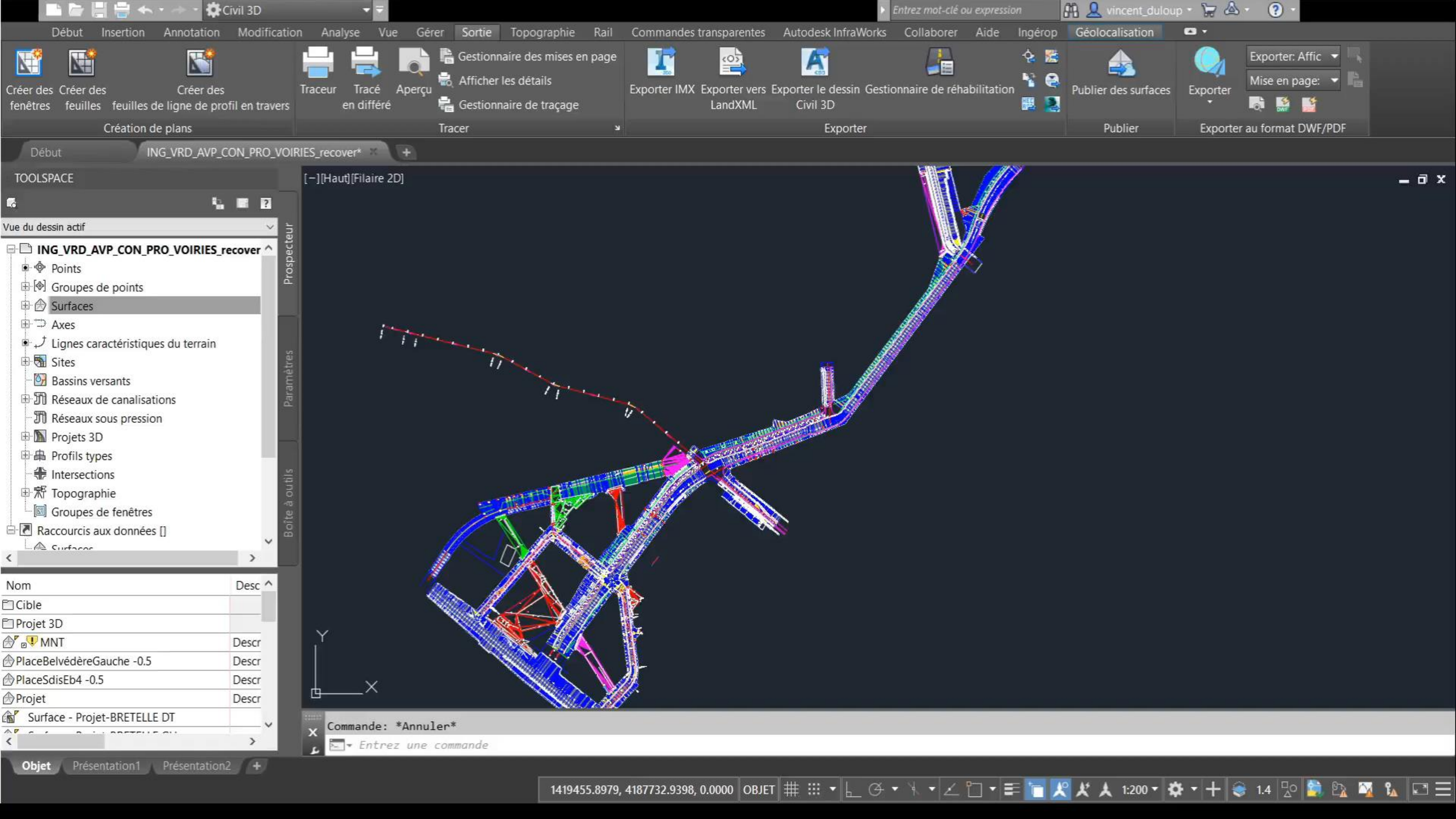
Integrate material into model

- Using "fill" slope function by material

→ Quicker, more flexible






Civil 3D
Entrez mot-clé ou expression
vincent_duloup
Début
Insertion
Annotation
Modification
Analyse
Vue
Gérer
Sortie
Topographie
Rail
Commandes transparentes
Autodesk InfraWorks
Collaborer
Aide
Ingérop
Géolocalisation
Créer des fenêtres
Créer des feuilles
Créer des feuilles de ligne de profil en travers
Création de plans
Traceur
Tracé en différé
Aperçu
Gestionnaire des mises en page
Afficher les détails
Gestionnaire de traçage
Tracer
Exporter IMX
Exporter vers LandXML
Exporter le dessin Civil 3D
Gestionnaire de réhabilitation
Exporter
Publier des surfaces
Publier
Exporter: Affic
Mise en page:
Exporter au format DWF/PDF
Début
ING_VRD_AVP_CON_PRO_VOIRIES_recover*
TOOLSPACE
Vue du dessin actif
ING_VRD_AVP_CON_PRO_VOIRIES_recover
Points
Groupes de points
Surfaces
Axes
Lignes caractéristiques du terrain
Sites
Bassins versants
Réseaux de canalisations
Réseaux sous pression
Projets 3D
Profils types
Intersections
Topographie
Groupes de fenêtres
Raccourcis aux données []
Prospecteur
Paramètres
Boîte à outils
Nom
Desc
Cible
Projet 3D
MNT
Descr
PlaceBelvédèreGauche -0.5
PlaceSdisEb4 -0.5
Projet
Surface - Projet-BRETELLE DT
[−][Haut][Filaire 2D]
Y
X
Commande: *Annuler*
Entrez une commande
Objet
Présentation1
Présentation2
1419455.8979, 4187732.9398, 0.0000
OBJET
1:200
1.4

Improving parametric

Improving parametric

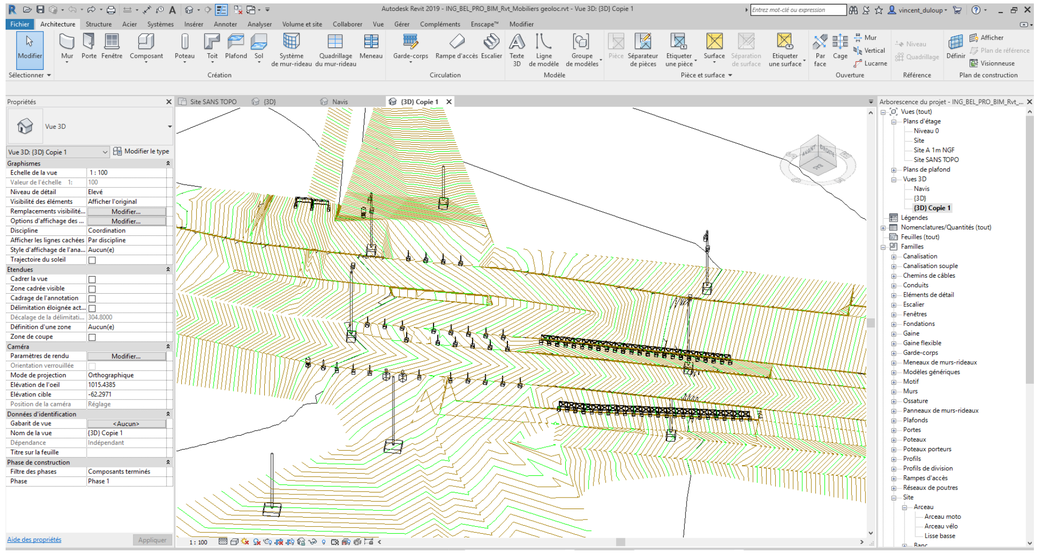
REPLACE MULTI-VIEWBLOCKS

AUTODESK® AUTOCAD® → Dynamo → AUTODESK® REVIT®

- Autocad block

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

- Appliying to Revit family



Improving
non-drainage networks

Improving non-drainage networks

REPLACE FEATURE LINES & 3D CORRIDOR

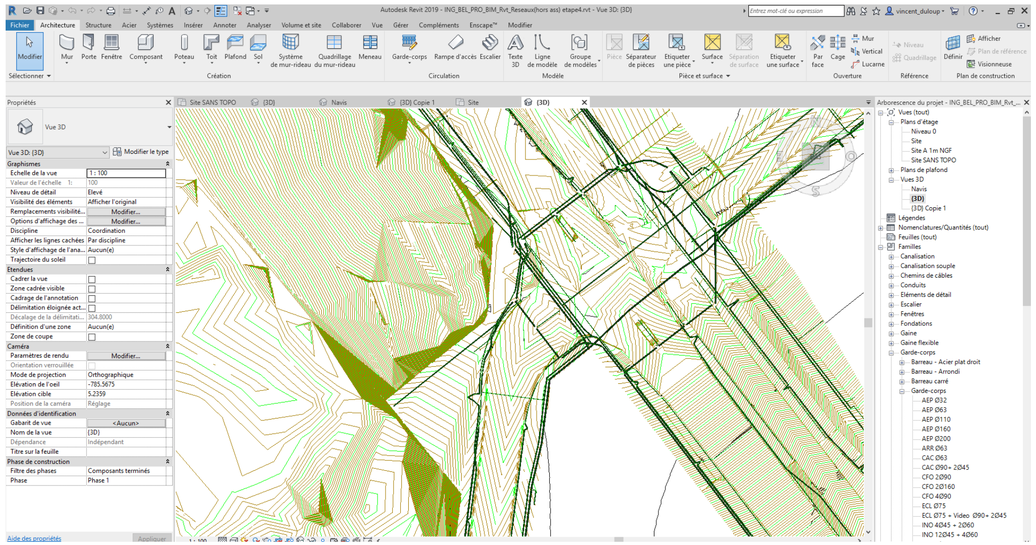
AUTODESK® AUTOCAD® → Dynamo → AUTODESK® REVIT®

- Autocad 2D polylines

- Getting parameters
  - Polyline trajectory
  - Layer

- Offseting from Revit surface

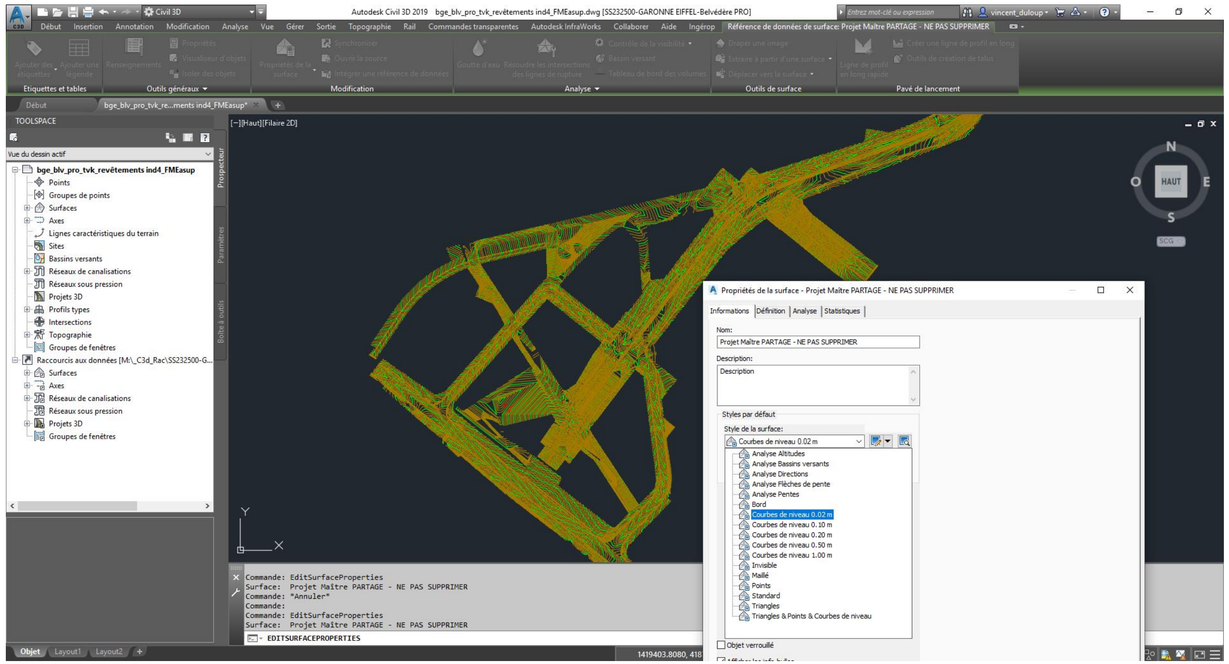
- Appliying to Revit railing family

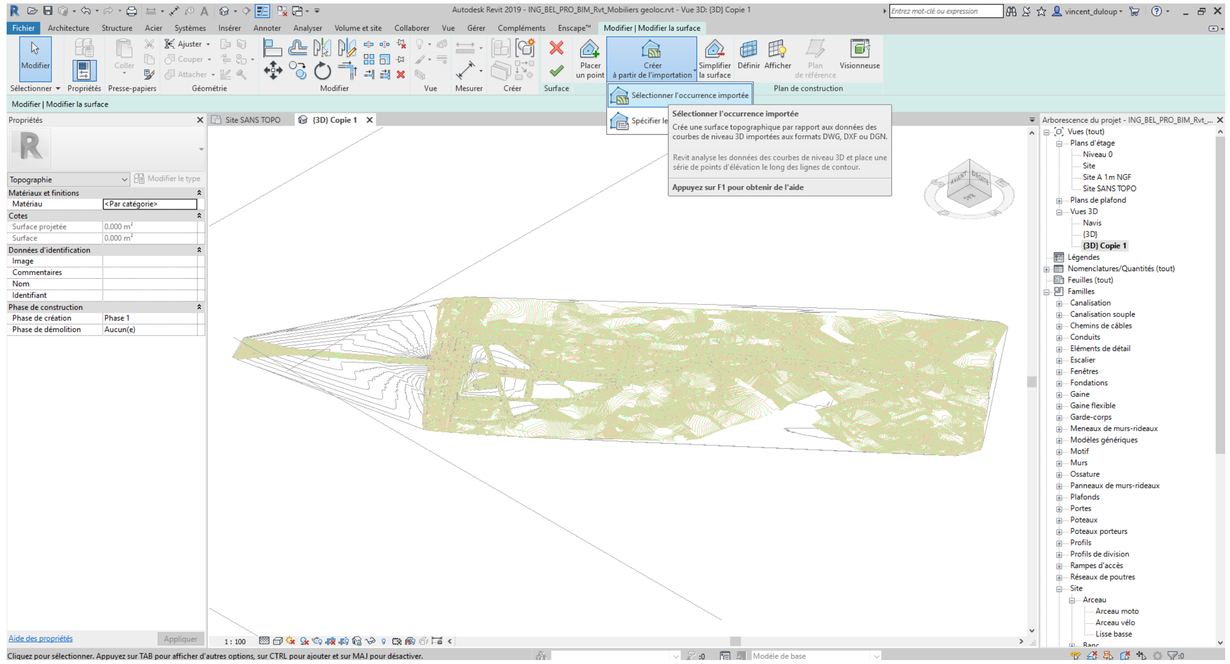


Tips

CREATING A RELIABLE SURFACE FROM CIVIL 3D TO REVIT

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





Summary model

AUTODESK®
NAVISWORKS®

Summary model workflow

Public spaces

AUTODESK® CIVIL 3D®

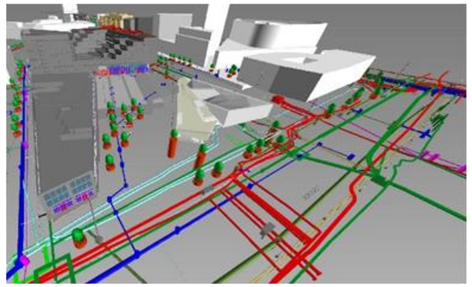
Terrain, roadways, networks, furnitures…

AUTODESK® REVIT®

DWG™

District

AUTODESK® NAVISWORKS®



Summary model

Word + Excel

IFC

Buildings

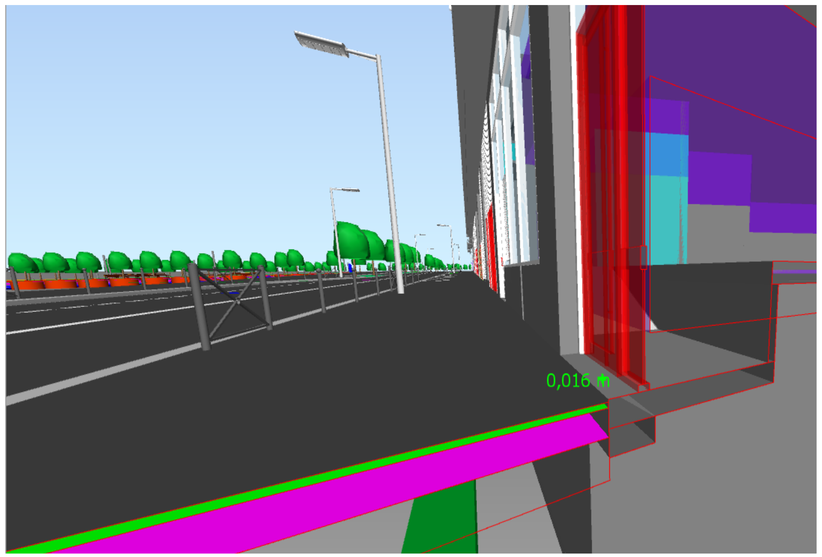
AUTODESK® REVIT®

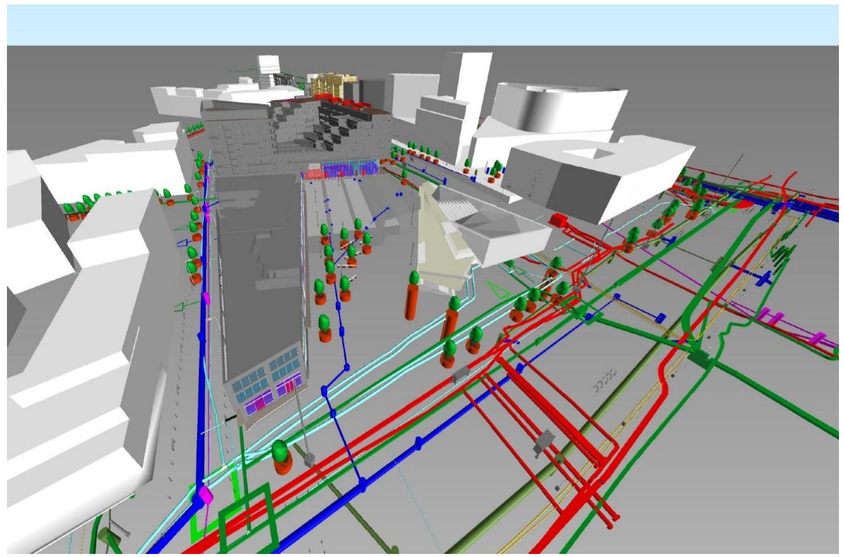
Slabs, walls, connection networks…

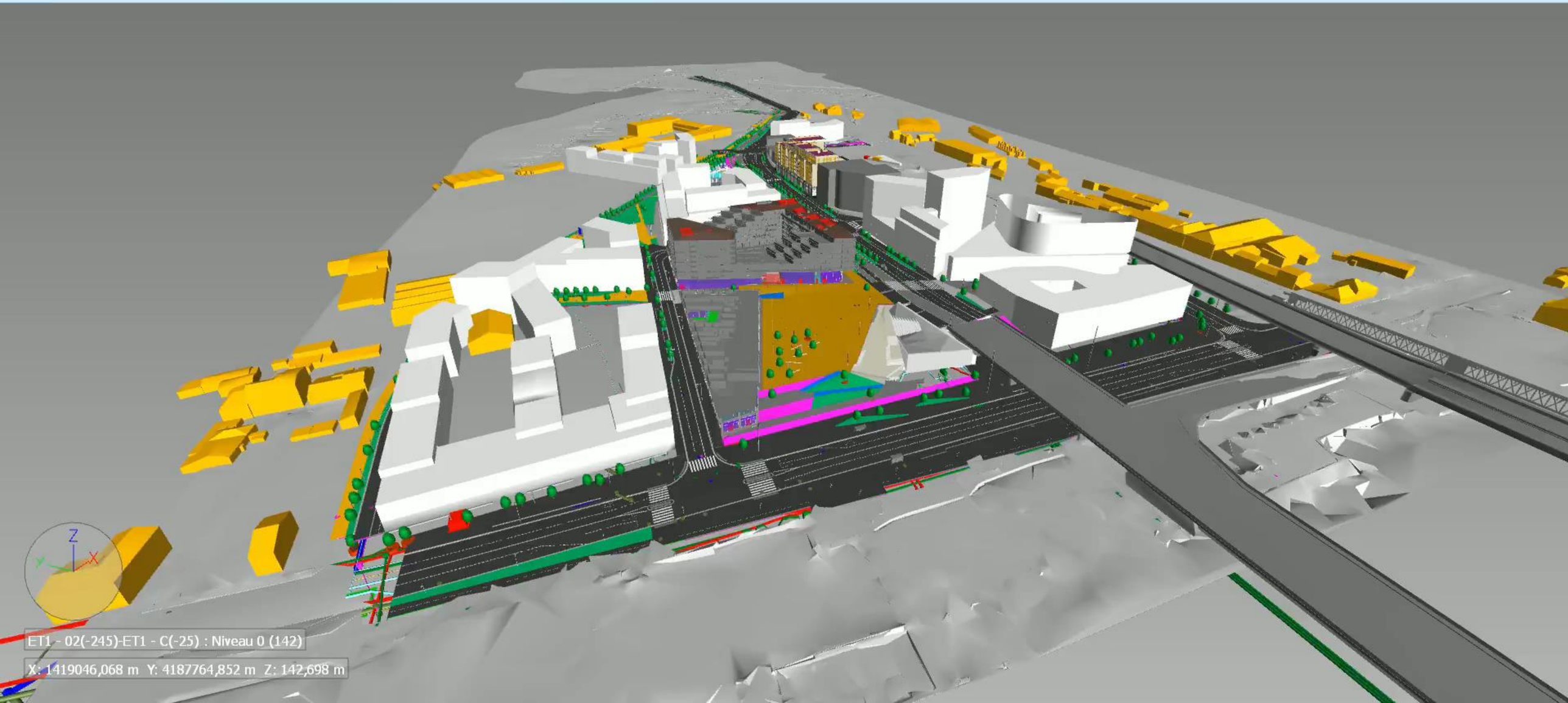
Summary model

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

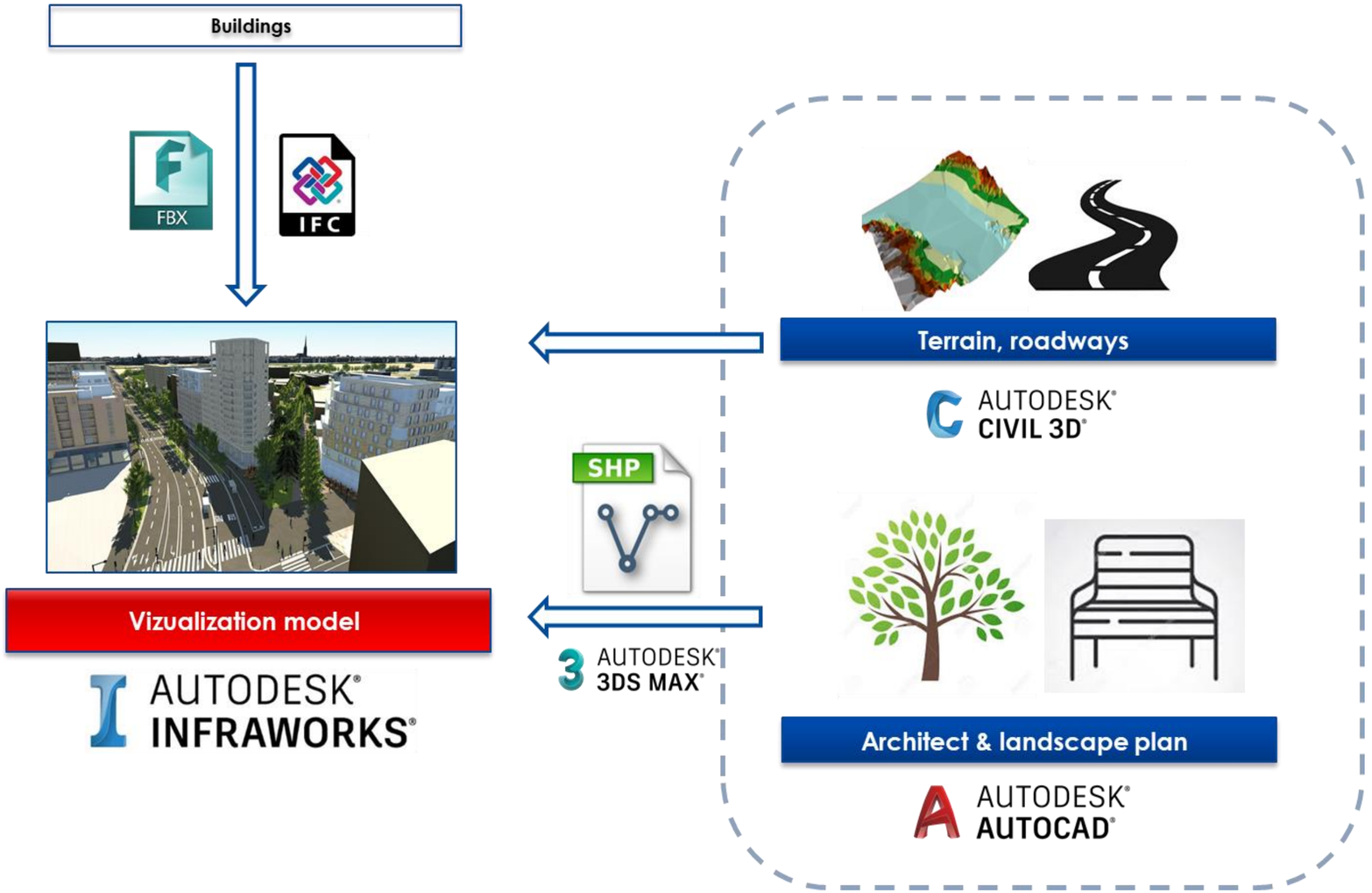





Z
X
Y
ET1 - 02(-245)-ET1 - C(-25) : Niveau 0 (142)
X: 1419046,068 m Y: 4187764,852 m Z: 142,698 m

Vizualization model

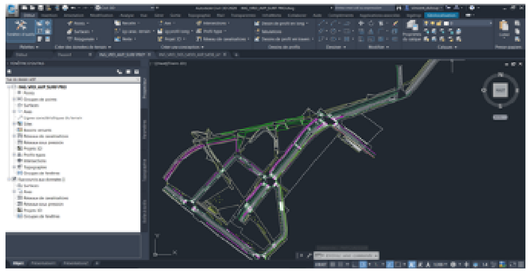
Vizualization model workflow



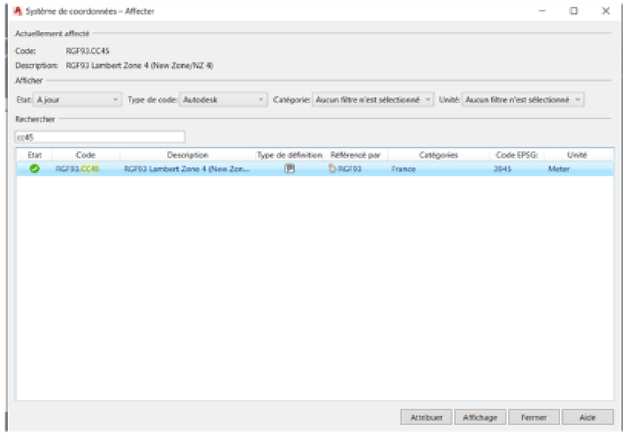
How to ?

FROM AUTOCAD MASTERPLAN TO INFRAWORKS 1/2

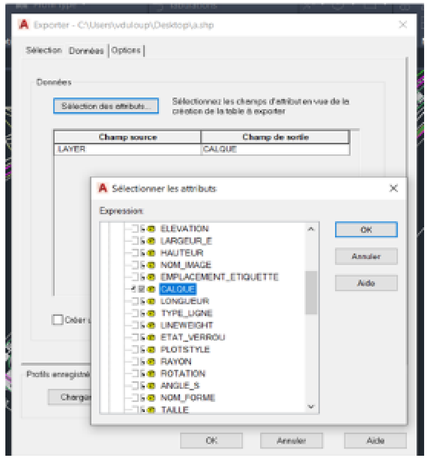
DWG → AUTODESK CIVIL 3D → SHP → AUTODESK INFRAWORKS



Setting coordinate system
« MAPCSASSIGN »



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

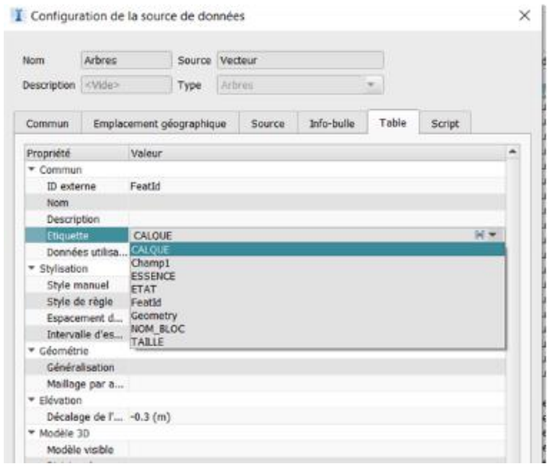


How to ?

FROM AUTOCAD MASTERPLAN TO INFRAWORKS 2/2

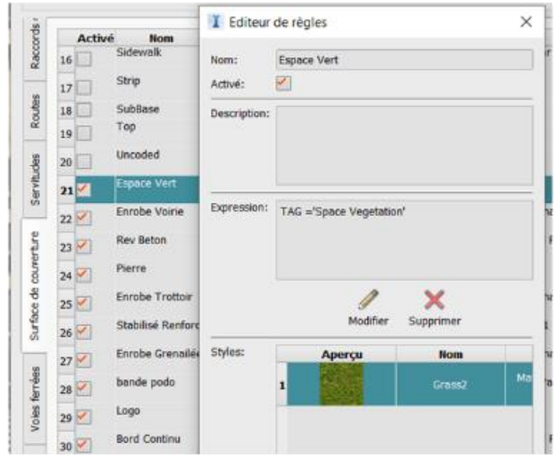
Importing GIS datas in Infraworks

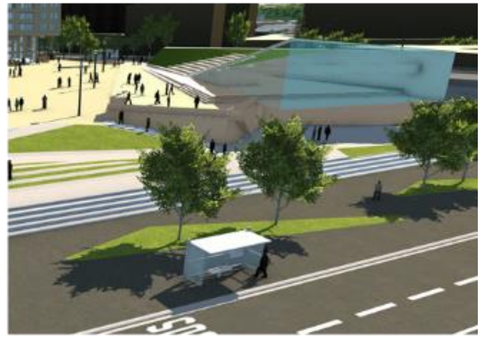
Assignment of the attribute to a free field (ex Tag)



Creation of a rule style

Expression : Tag = ‘attribute value’





Tips

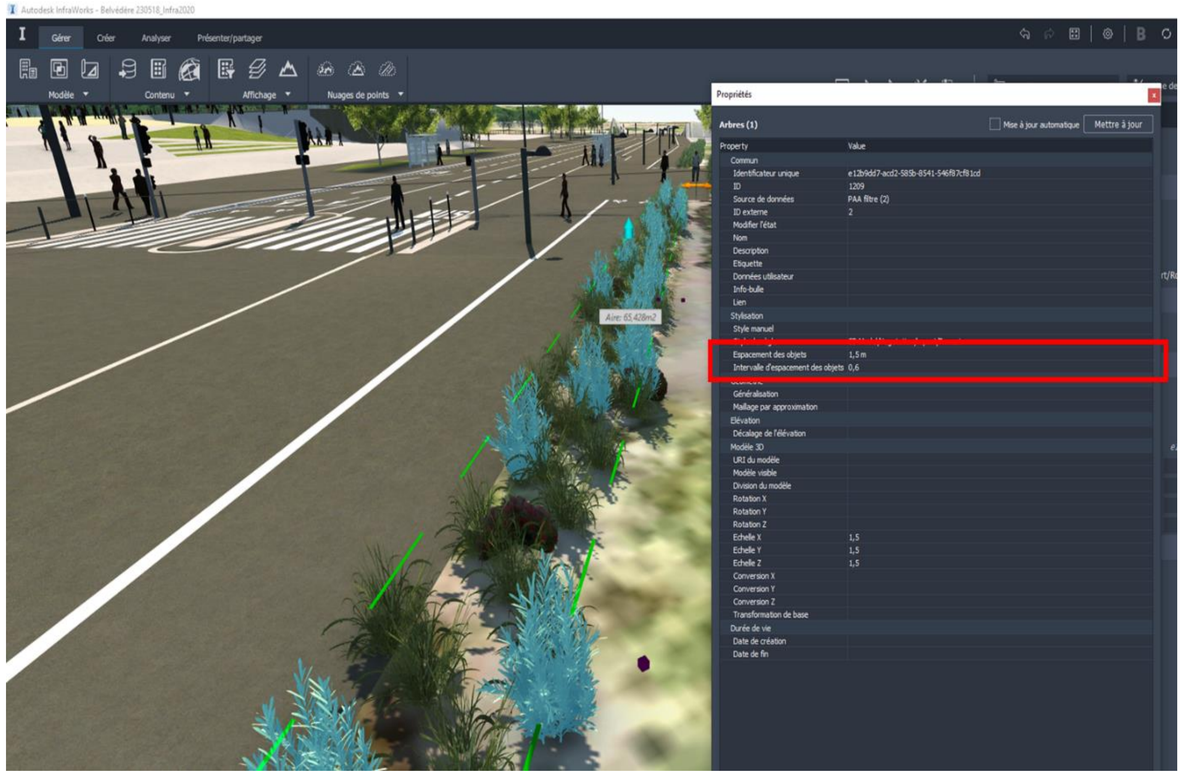
INTEGRATING PLANTED TREE AREAS FROM GIS

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

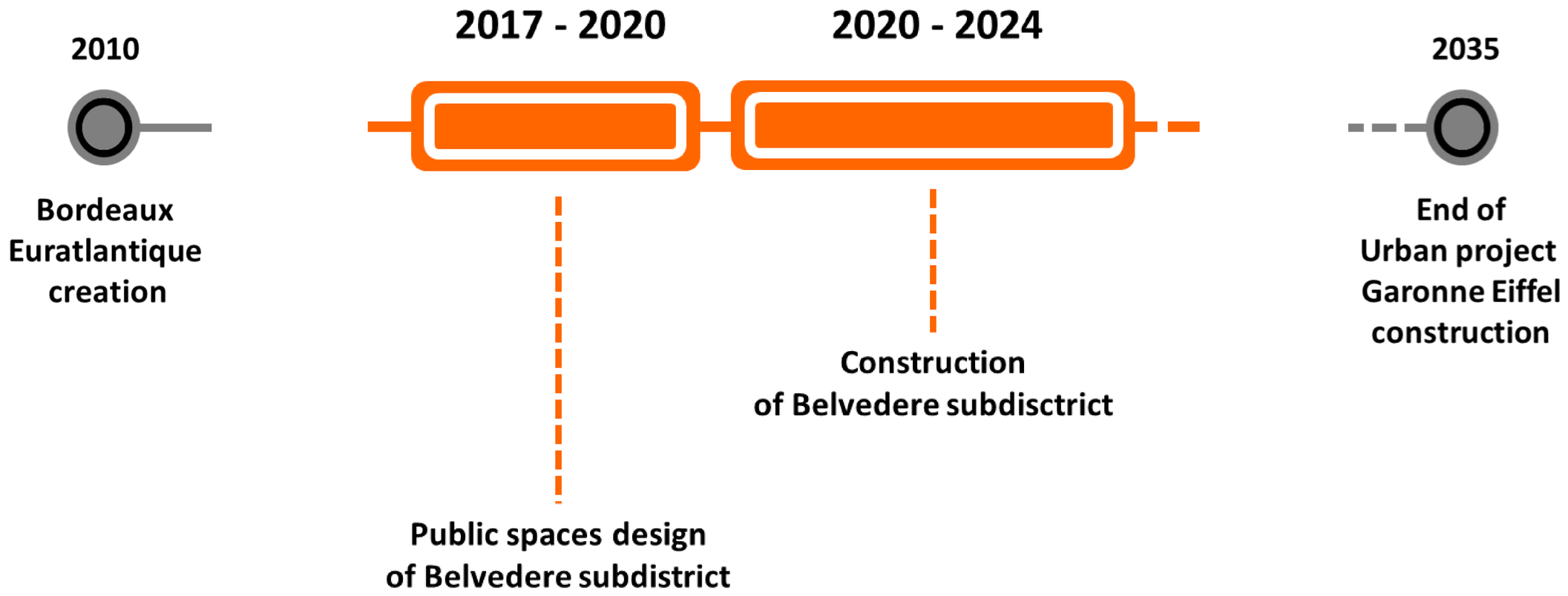
anima®

People animation

INGÉROP
Inventons demain

Let’s conclude !

What’s next ?


2010
Bordeaux
Euratlantique
creation
2017 - 2020
Public spaces design
of Belvedere subdistrict
2020 - 2024
Construction
of Belvedere subdisctrict
2035
End of
Urban project
Garonne Eiffel
construction

Facilitate decisions

Thank you !
Q&A

AUTODESK®

Make anything™