BIM workflows for urban transport infrastructures & systems

Vincent KELLER – Thomas LESAGE – Christophe CASTAING (video)

Grand Paris express & Birmingham tramway

Join the conversation #AUCity #AU2018

AUTODESK. UNIVERSITY

Speakers

Vincent KELLER – Egis

Corporate BIM manager in Egis Rail

Design manager in major projects of infrastructures

BIM manager on the line 16 of the Grand Paris Express metro

Member of IFC tunnel and IFC Rail French task group

Convinced that a collaborative approach based on trust in people and data and better use of digital tools will improve the quality and performance of the construction industry and the value of its services

egis

Speakers

Thomas LESAGE – Egis

Working on the coordination and collaboration workflows with the BIM tools to connects and open the exchanges between the disciplines.

In the same time, I’m a project pilot for the development of the tools that improve the design workflows.

In the past, I’ve been working as a work supervisor on Building projects (data centers or schools) and after I focused on infrastructure project like Doha gold line metro in Qatar and Paris future line 15 est and 16 of the GPE.

Agenda

- Collaboration in BIM projects
- System modelling
- Dynamo for modelling
- Open BIM for the construction phase and as built
- BIM & GIS

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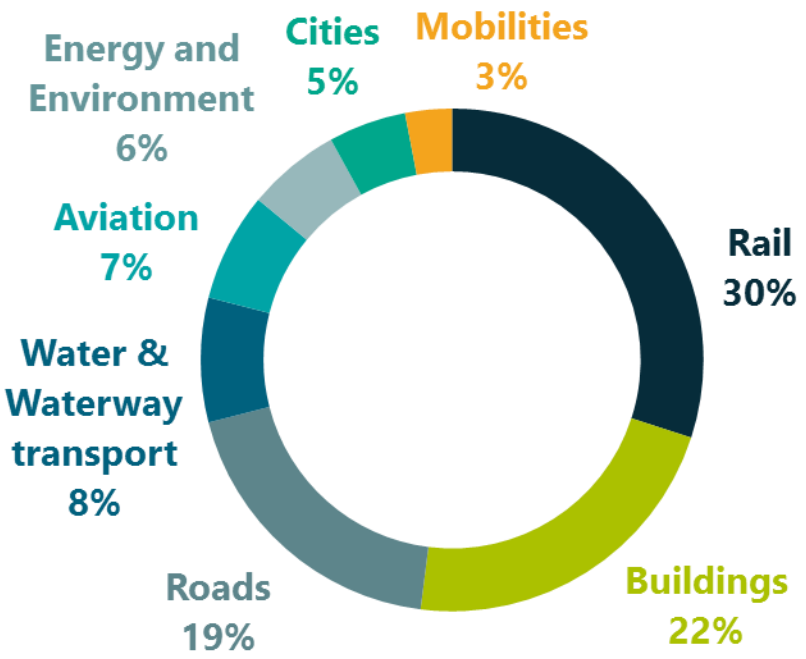
EGIS
Creative for the long term



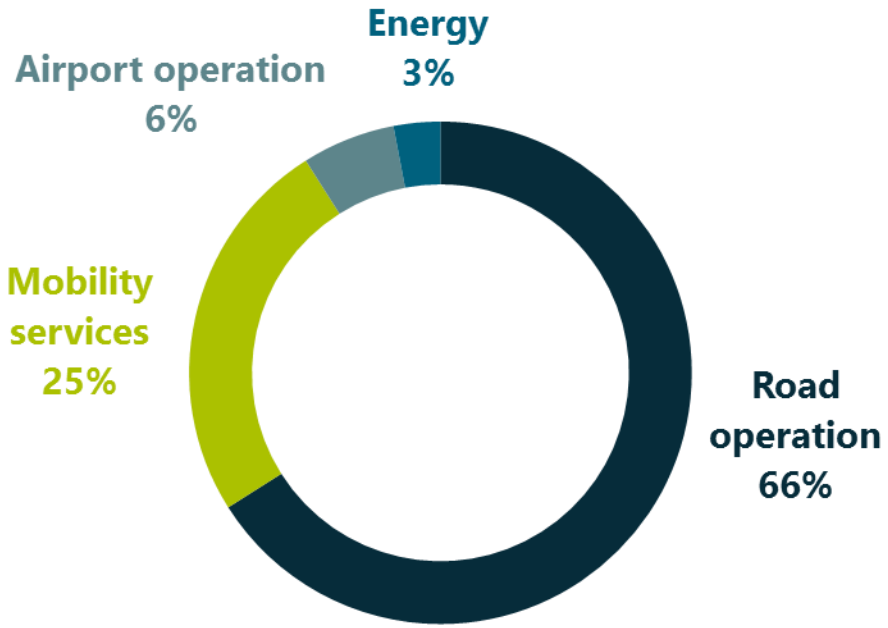
€1.050 Billion

MANAGED TURNOVER IN 2017

Engineering ***76%***

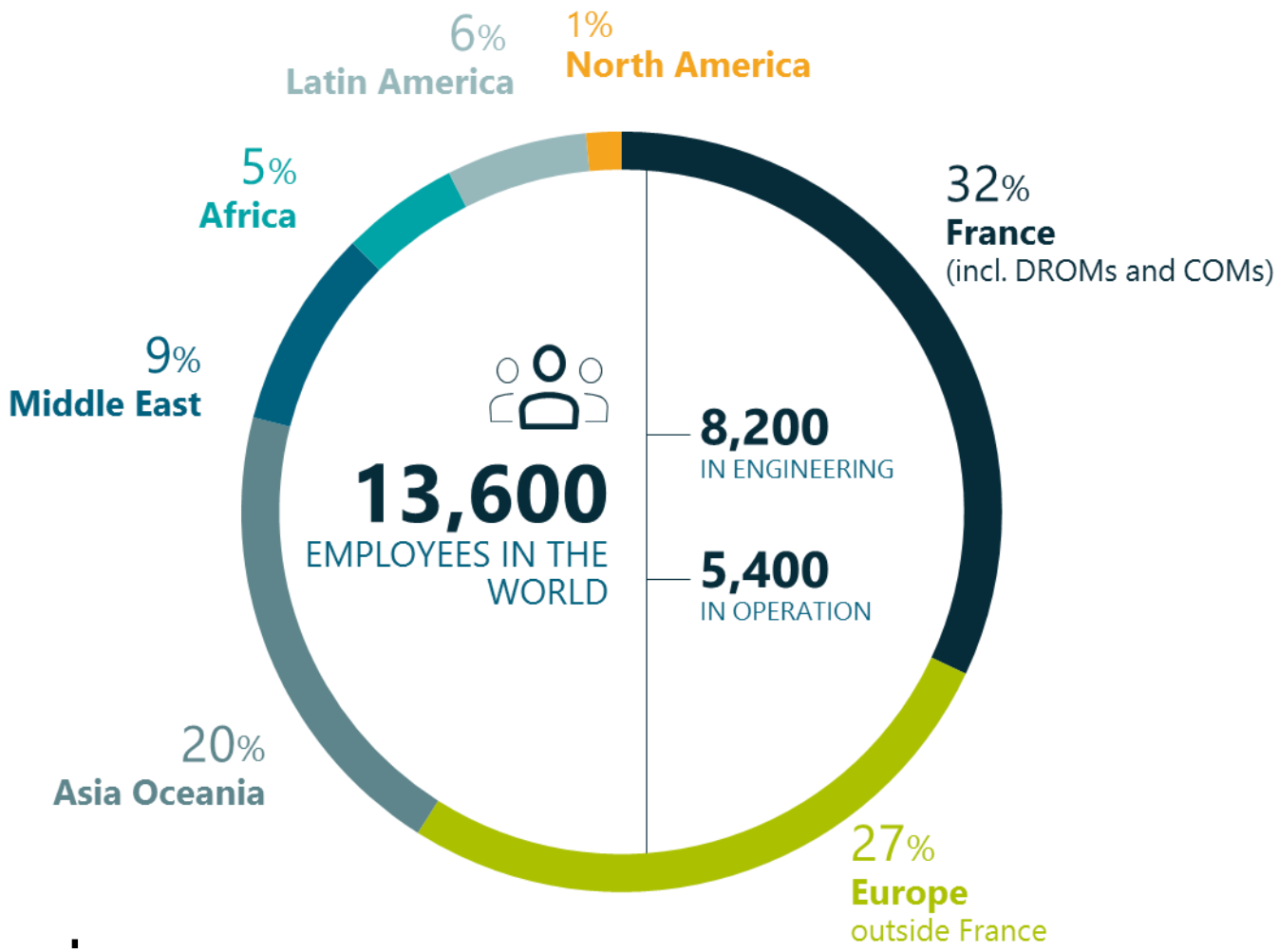


24% **Operation and mobility services**



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Human resources



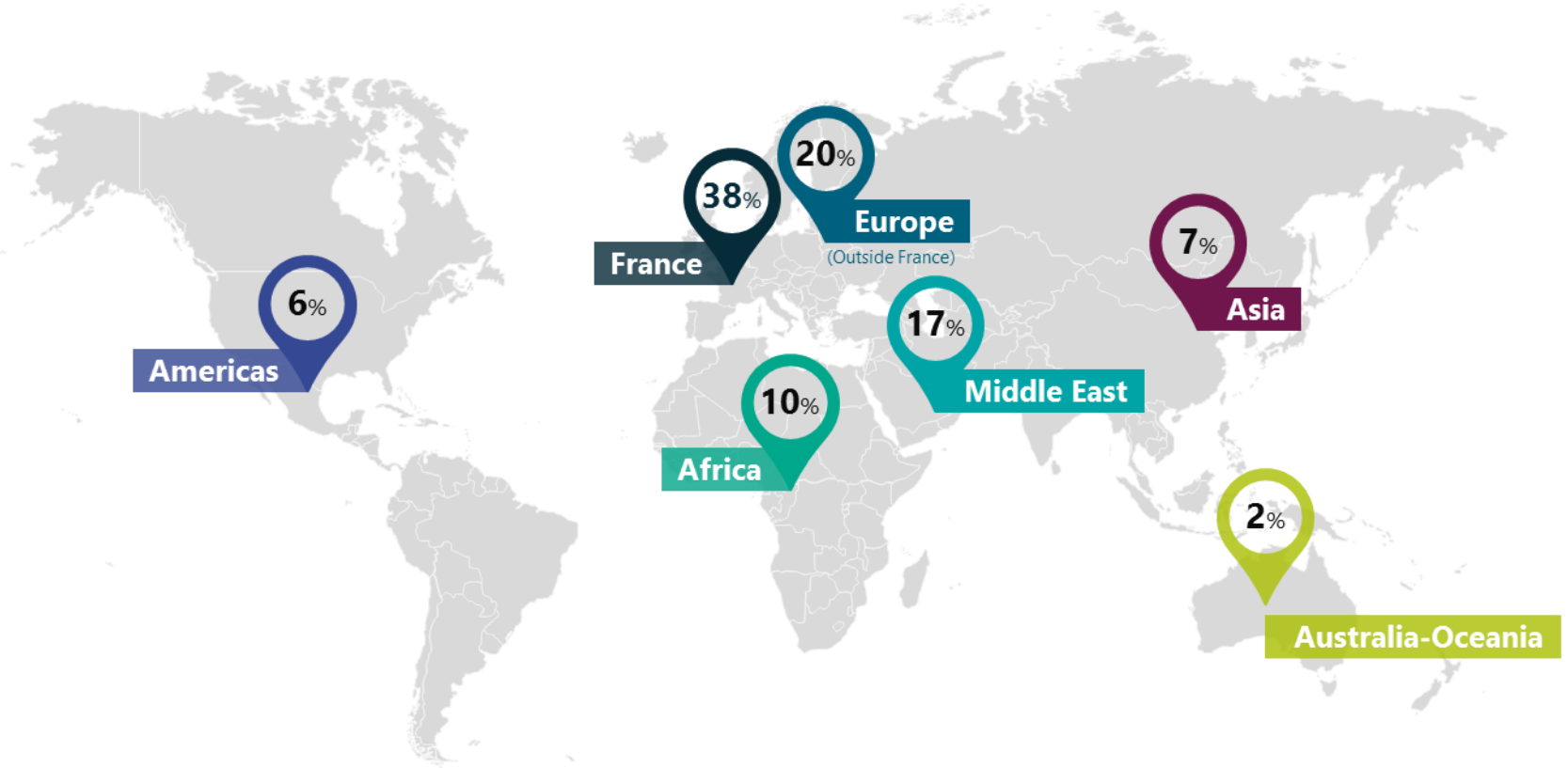
KEY HR PRIORITIES

- Safety and security of Egis' team
- Combine local and global HR organization to recruit key profiles
- Promote internationalization & mobility
- Reinforce our global talent management policy
- Pursue and accentuate our Training policy, in partiicular with Egis' campus

egis

Our presence worlwide

TURNOVER BREAKDOWN (2017) BY GEOGRAPHICAL ZONE



62%

of our activity is out of France

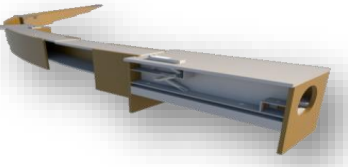
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Grand Paris Express – line 16
BIM for infrastructures & systems



egis

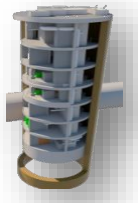
Grand Paris Express & EGIS



162 km of automatic metro lines



59 stations



More than 200 other construction

Skakeholders
~ 30 Architect
~ 10 Engineer
> 50 Contractors

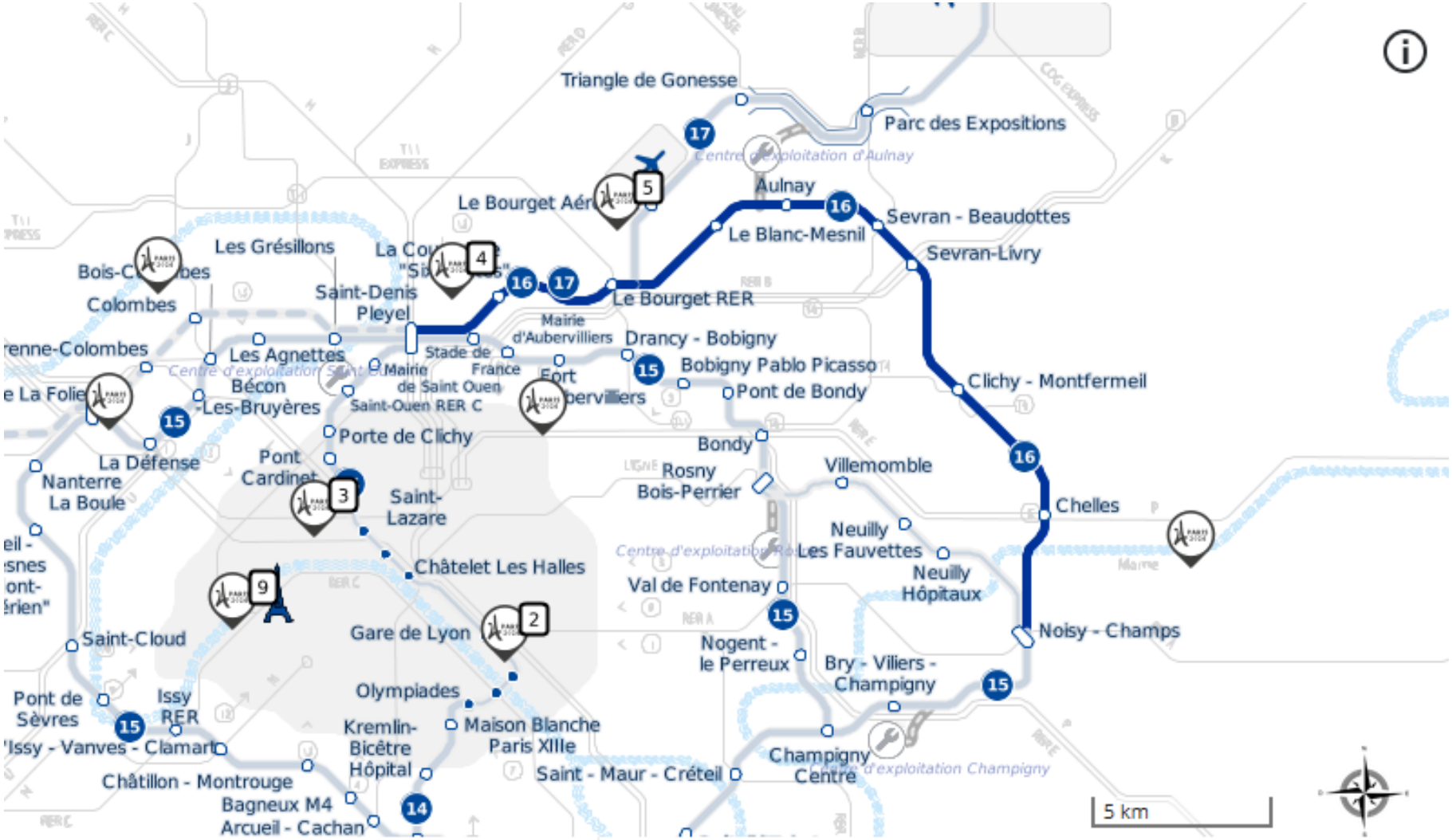
egis



Line 16 – Key Figures

Automatic
110 km/h
3 billion €
2024

- **Saint-Denis Pleyel**
- La Courneuve Six-Routes
- Le Bourget RER
- Le Blanc-Mesnil
- Centre d'exploitation Aulnay
- Aulnay
- Sevran Beaudottes
- Sevran – Livry
- Clichy – Montfermeil
- Chelles
- **Noisy – Champs**



egis

Line 16 – Key Figures

egis leads

Infrastructure / Building

Engineer: egis, TRACTEBEL Engineering, GDF SUEZ

Architects: duthilleul, AREP, Atelier Schall, B/N/T Beckmann N'Thépé Architectes, chartier dalix, architectes

~ 20 contractors

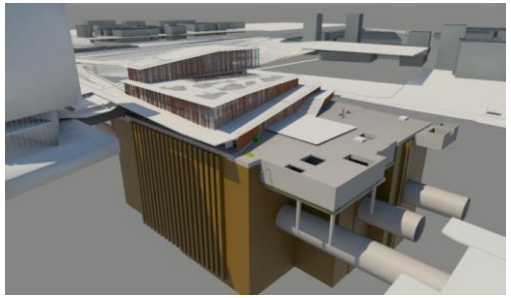
Architects (iconic stations)

KENGO KUMA AND ASSOCIATES
隈研吾建築都市設計事務所
MIRALLES TAGLIABUE EMBT
2 PORTZAMPARC

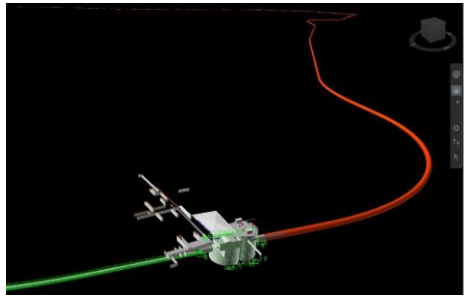
Systems

Engineer: egis, setec

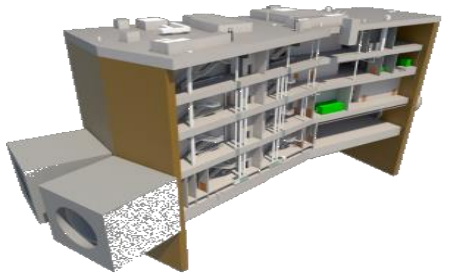
~ 40 contractors



9 stations



29 km of Tunnels

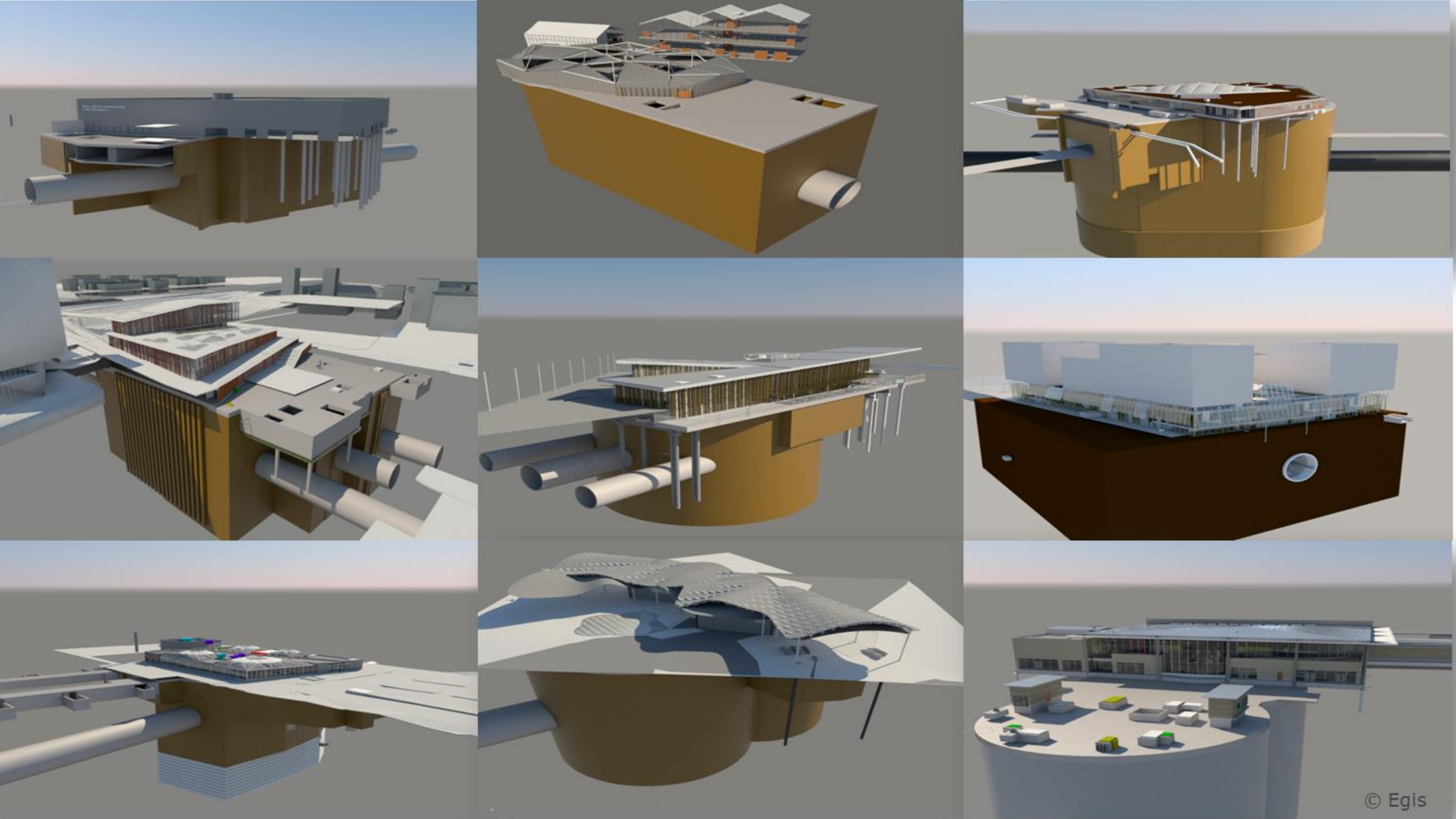


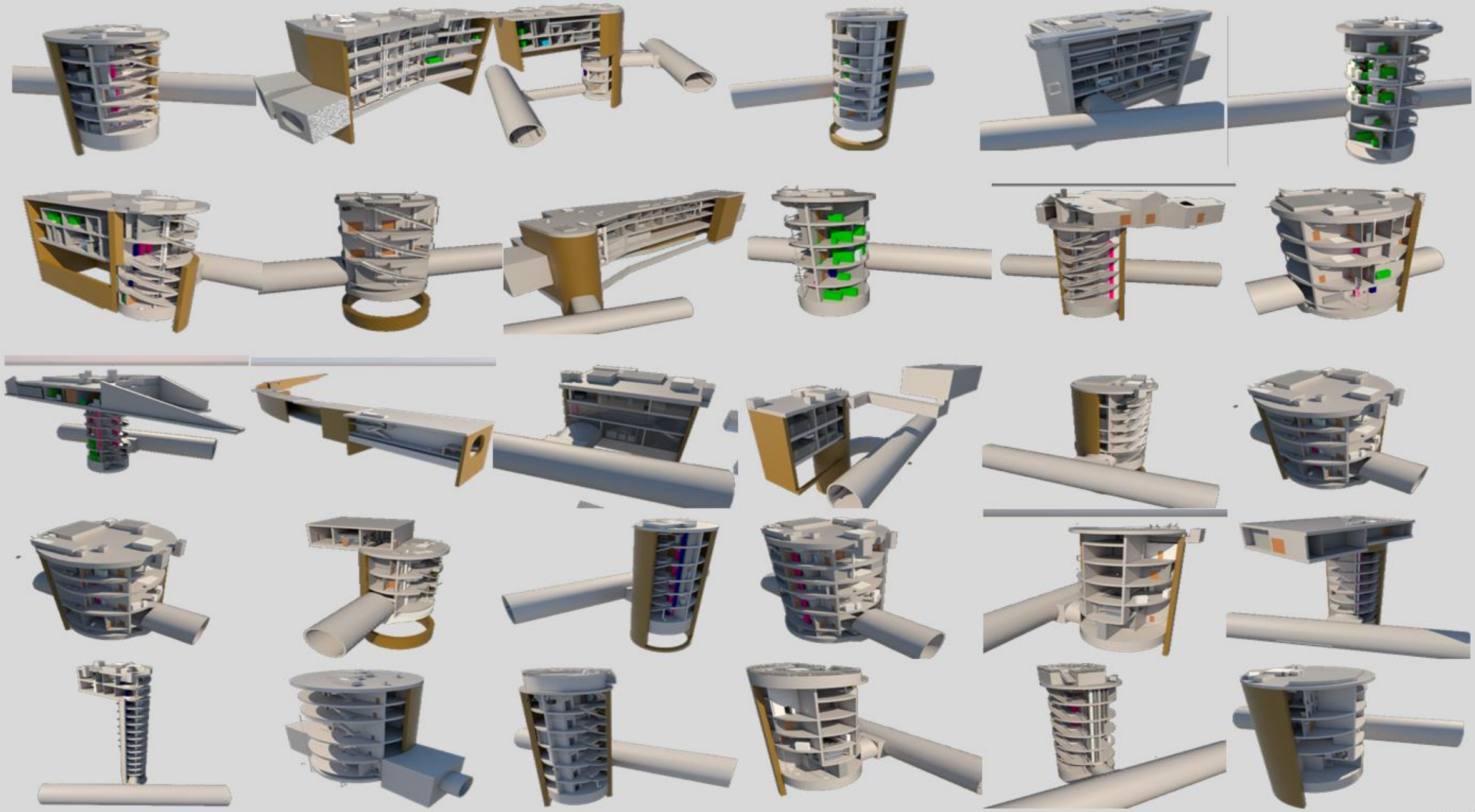
34 Other Construction



1 Maintenance Site

egis


© Egis

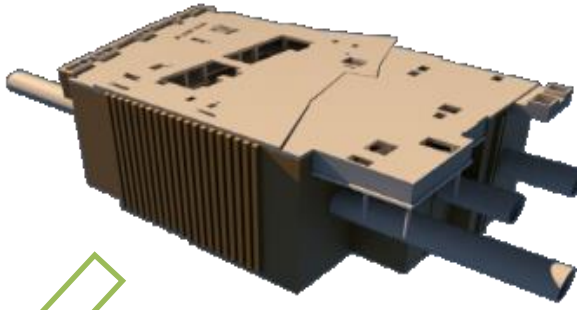


© Egis



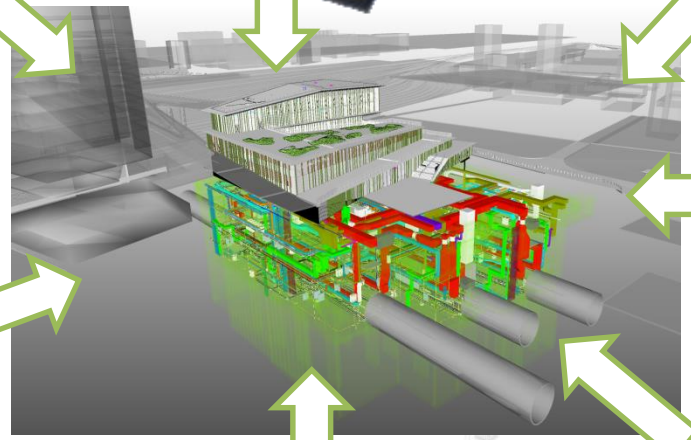
SUB STRUCTURE





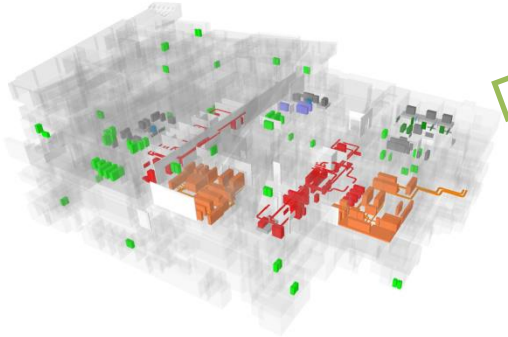
UNDERGROUND STRUCTURE

SITE & ARCHITECTURE

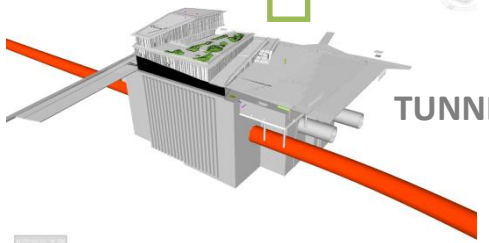


SECOND- WORK

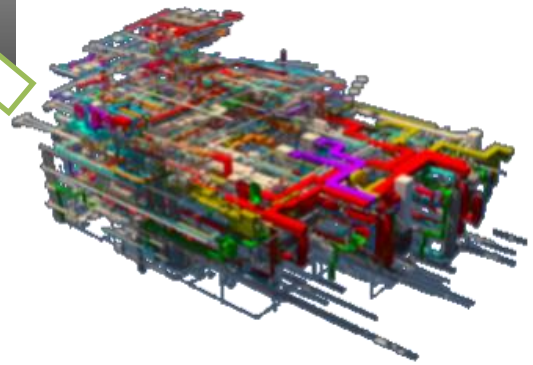




SYSTEMS



TUNNEL



MECHANICAL, ELECTRICAL, PLUMBING

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Requirements and Challenges

- New stations in a high urban density in full mutation
- Modify urban systems > modify urban assets > update database of assets

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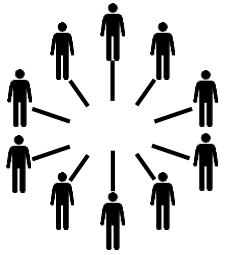
- Optimize infrastructure costs & transport system performance
- Extend BIM to linear infrastructure and system facilities

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Requirements and Challenges

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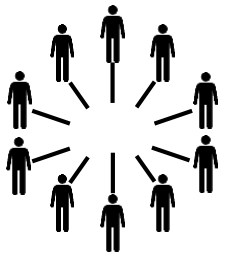
- Optimize scheduling > reduce wasted time > enhance collaboration
- Extend BIM to new actors

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Requirements and Challenges

- New stations in a high urban density in full mutation
- Modify urban systems > modify urban assets > update database of assets

- Optimize infrastructure costs & transport system performance
- Extend BIM to linear infrastructure and system facilities



- Optimize scheduling > reduce wasted time > enhance collaboration
- Extend BIM to new actors

- Optimize operation & maintenance / PLM
- Deliver “As built” model for the maintainer

- Owner requires a BIM asset data base
- Owner’s BIM specification Book

How can we manage so much complexity ?



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BIM strategy

- Federate stakeholders … step by step
- Common rules
- Generate interoperability

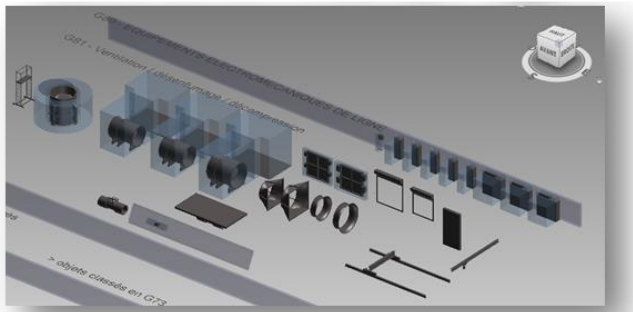
Model

Full modelling
Relevant LOD

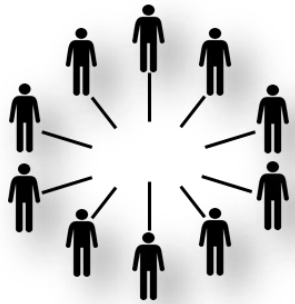
Common
objects libraries

Objects database





Process



Relevant processes
Automatic modelling

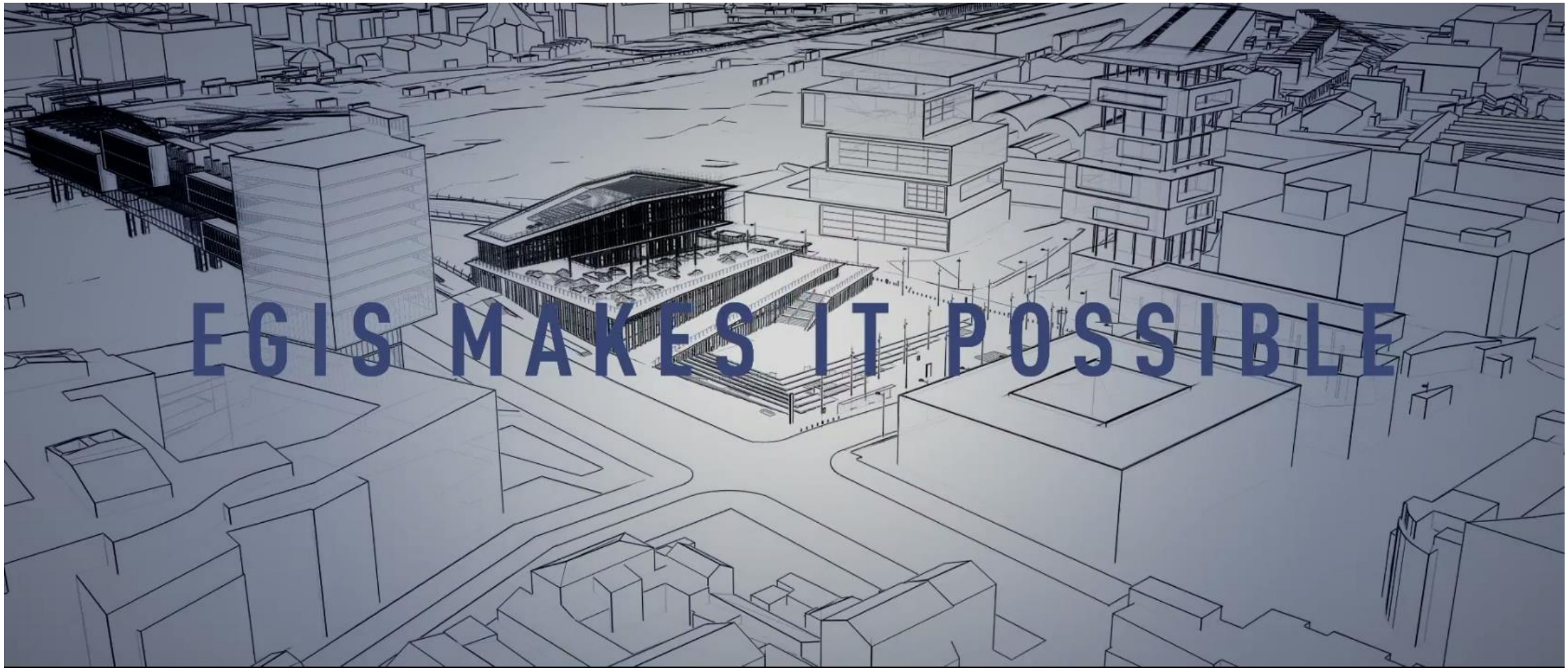
New powerful
collaboration tools



Standardized
exchange

egis

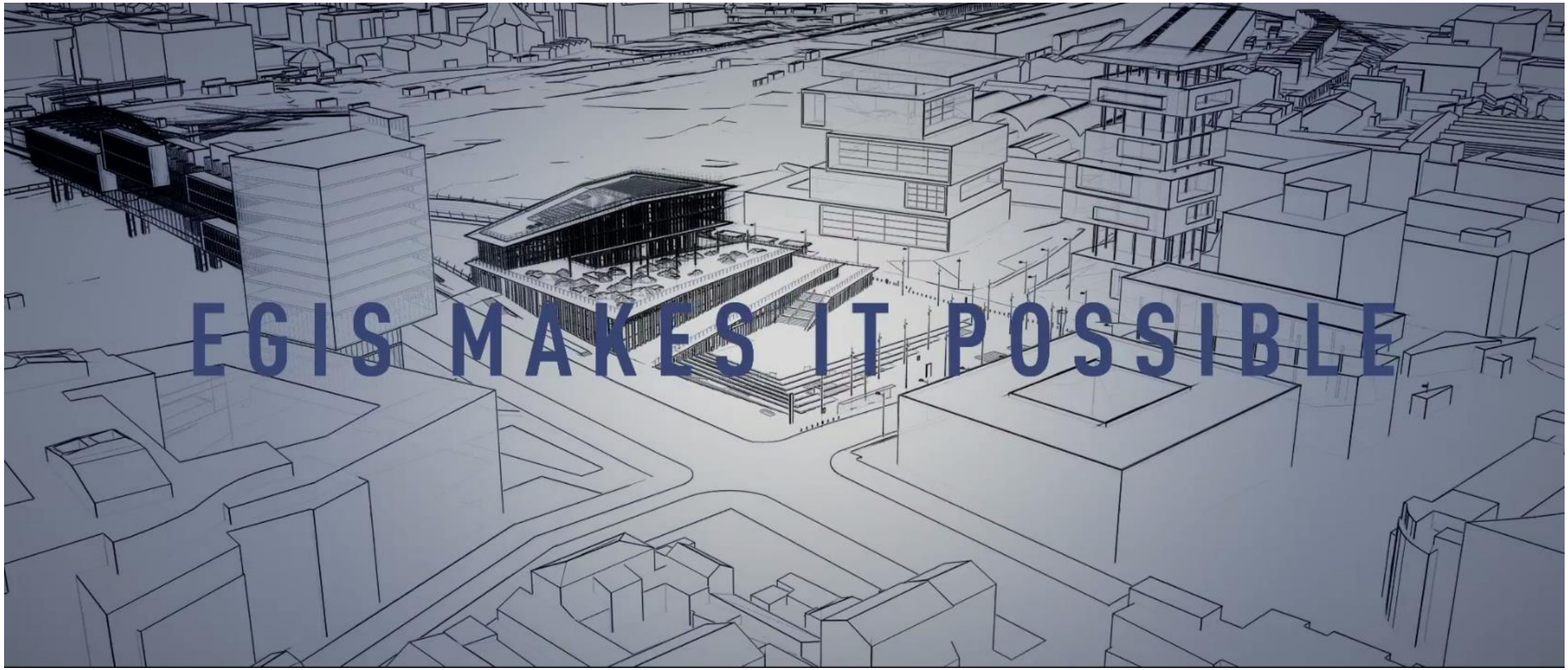
How …



???

egis

How …



… thanks to the Autodesk tools.

egis

Let’s go further in BIM modelling!

- No solution on the market

Objectives :

- Model according to a system logic (Lineaire Referencement System)
- Model ponctuel elements at reasonable prices
- Be able to produce deliverables and Final Implementation File

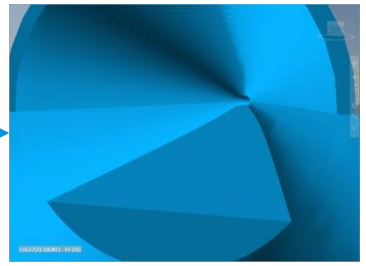
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BIM4Tunnel High Level Model Authoring process overview

Linear modelling

Geometry
(LandXML, CAD files…)

Vertical profile



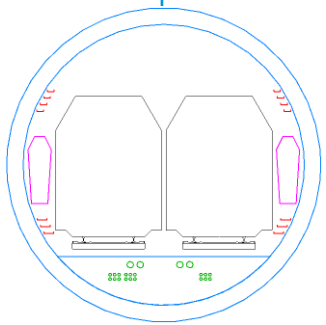
Tunnel Structure

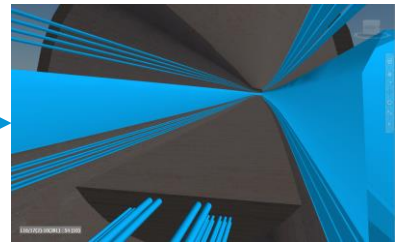
Georeferenced alignment

Equipment placement axis

BIM equipment in Civil3D

Typical section





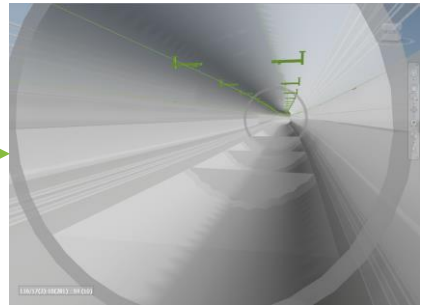
Linear equipment

Punctual equipment placement

System engineering Data Base
Equipment placement information
(.rfa reference, placement along alignment, cant information…)*

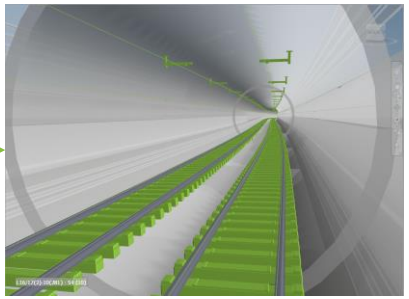
Equipment placement

ID equipment



Catenaries placement

System engineering
Rail BIM Equipment System Libraries



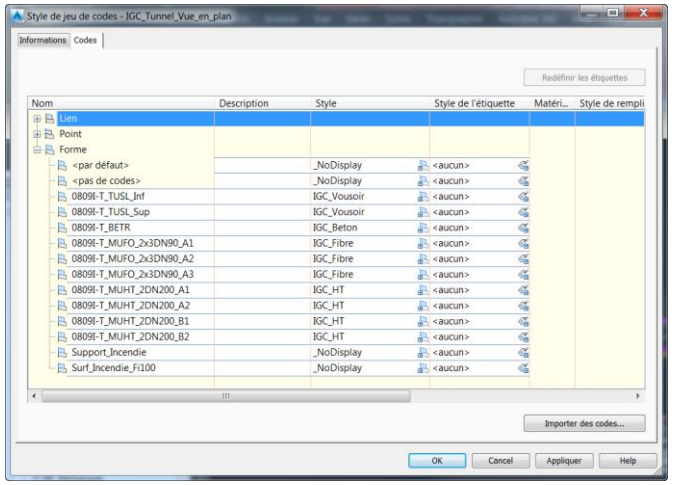
Sleepers placement

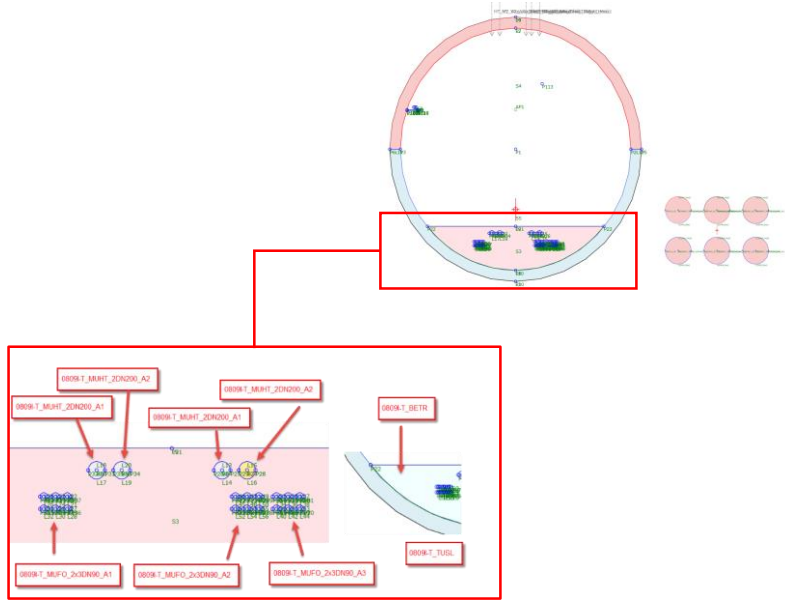
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Model Authoring Tunnel - C3D

Structuring information before modelling

- Define templates and deliverables
- Naming convention
- Setting styles and labels
- Punctual equipment information requirement
- Division strategy for models





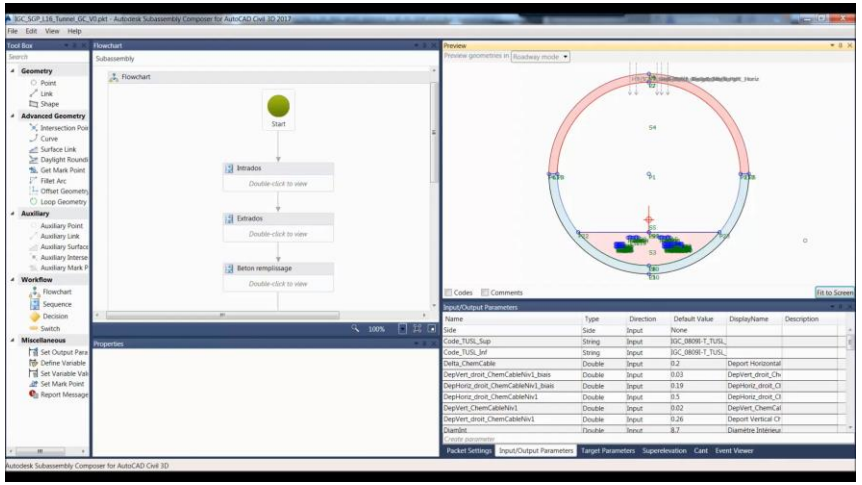
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Model Authoring Tunnel - C3D

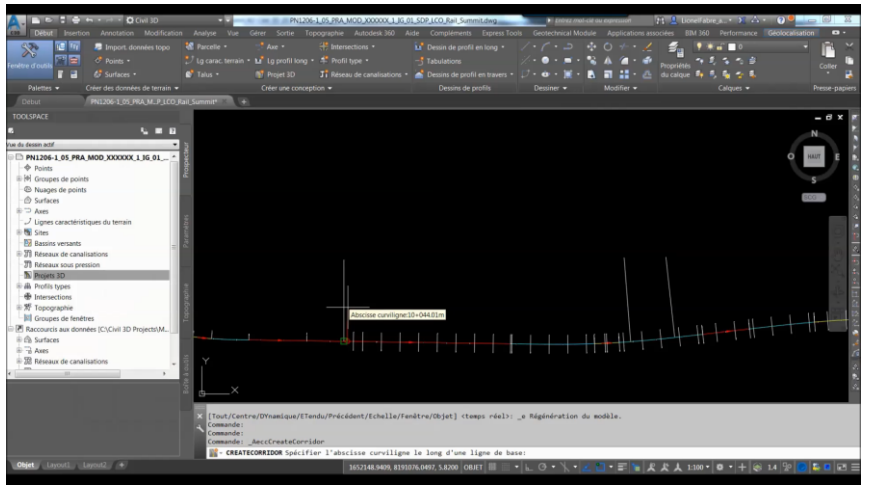
Linear modelling Protocol

1

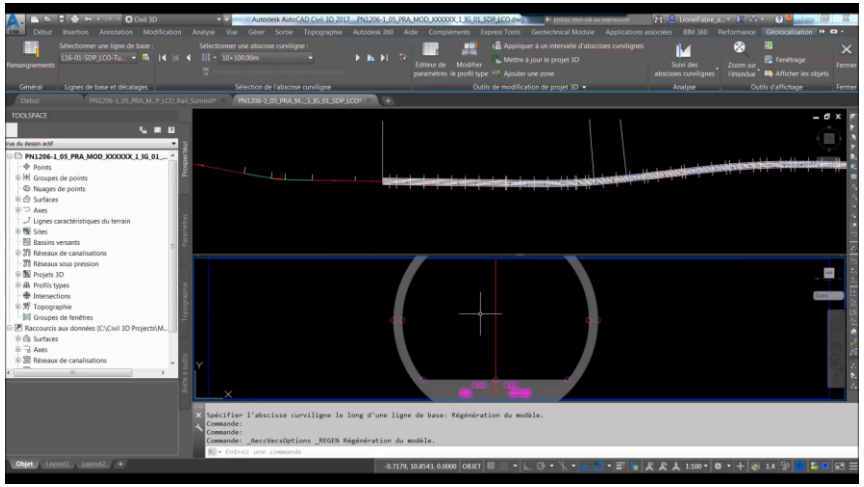
SAC



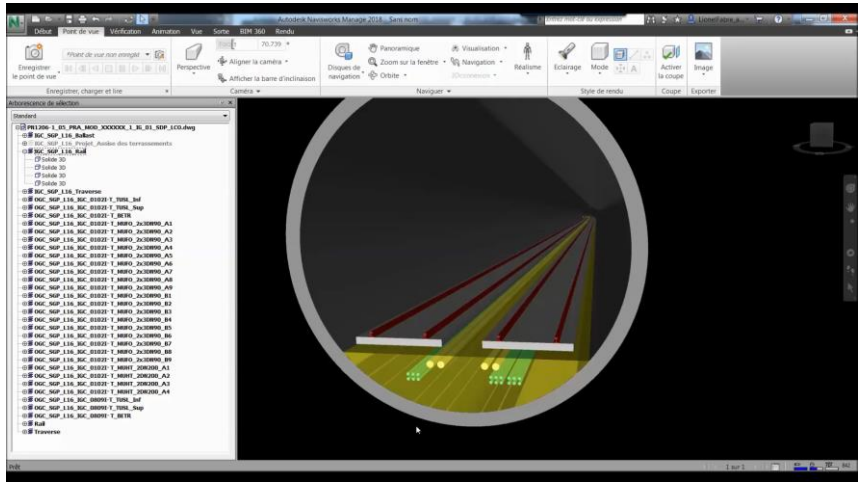
2



3



4



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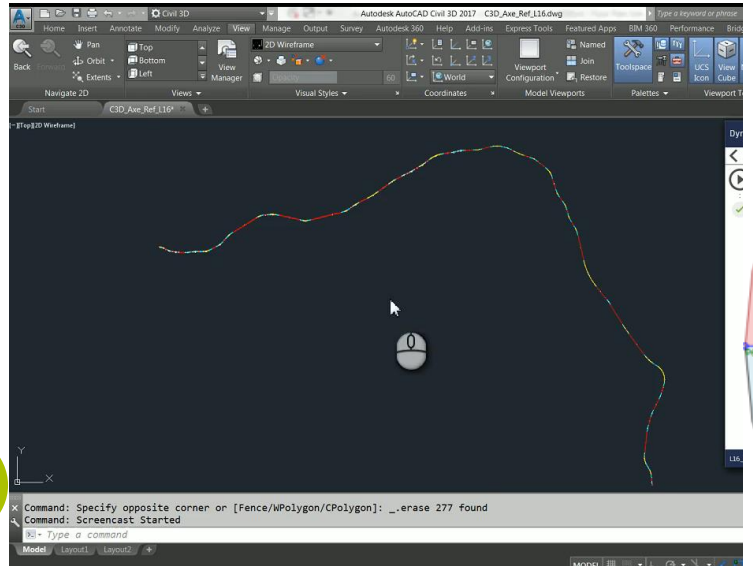
Model Authoring Equipment placement

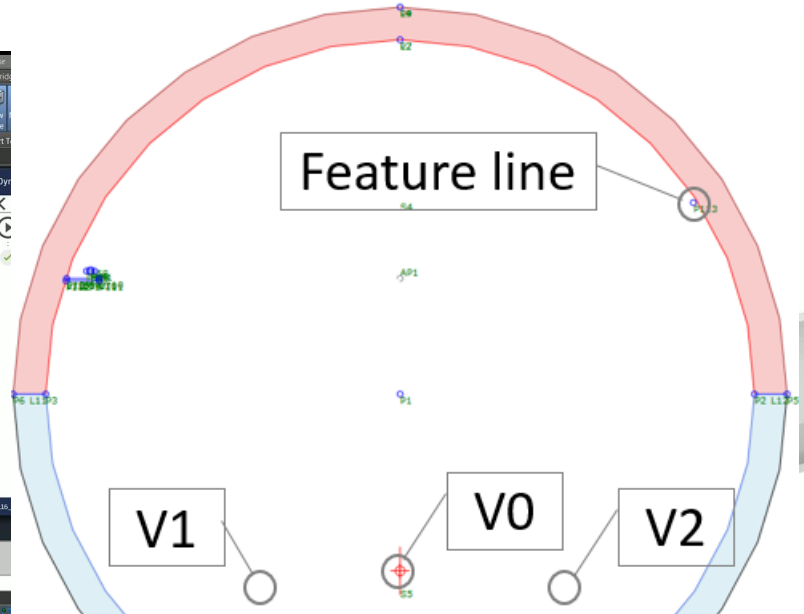
Alignment name

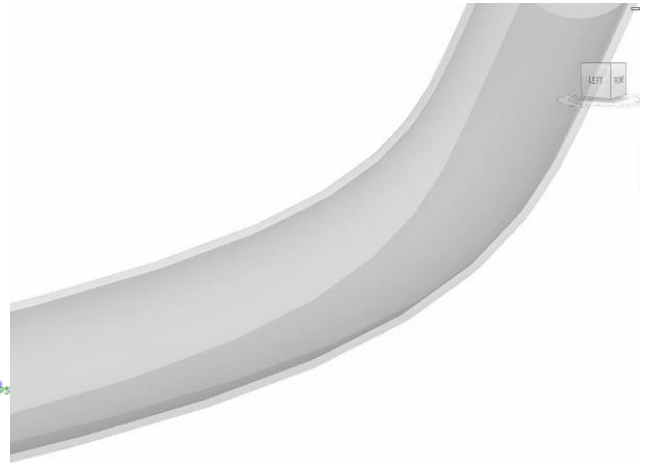
Family/Type name

Famille	Type	Axe de reference	Axe d'implantation	PK	Gisement	Pente	Devers
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10344,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10354,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10364,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10374,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10384,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10394,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10404,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10414,9	0	0	0
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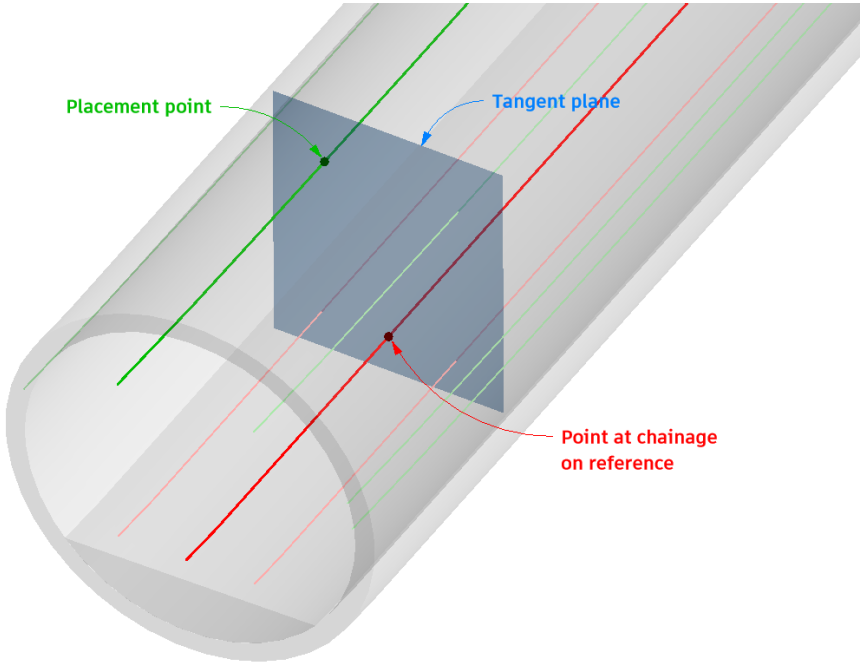


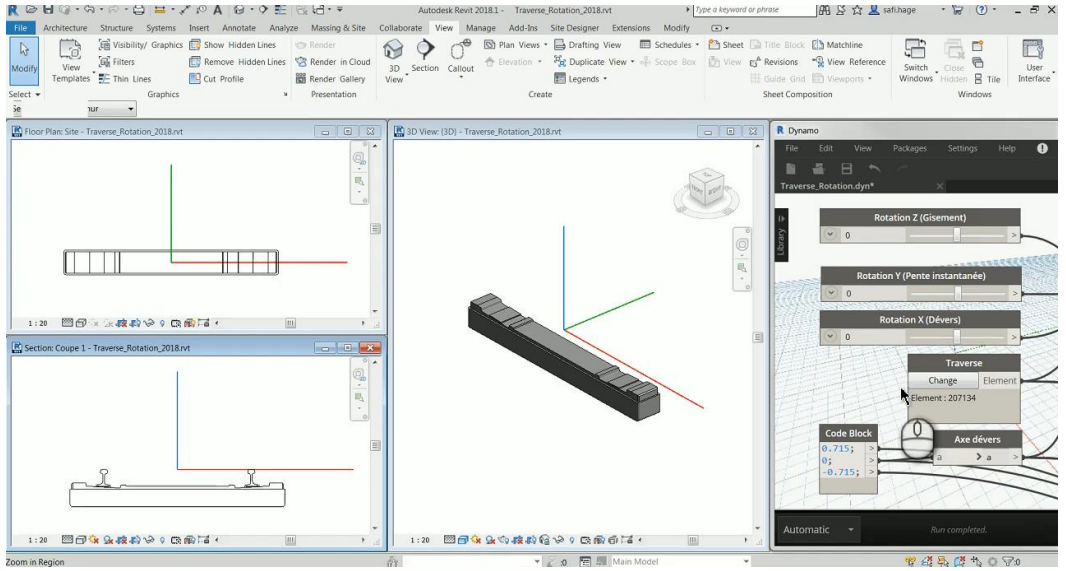




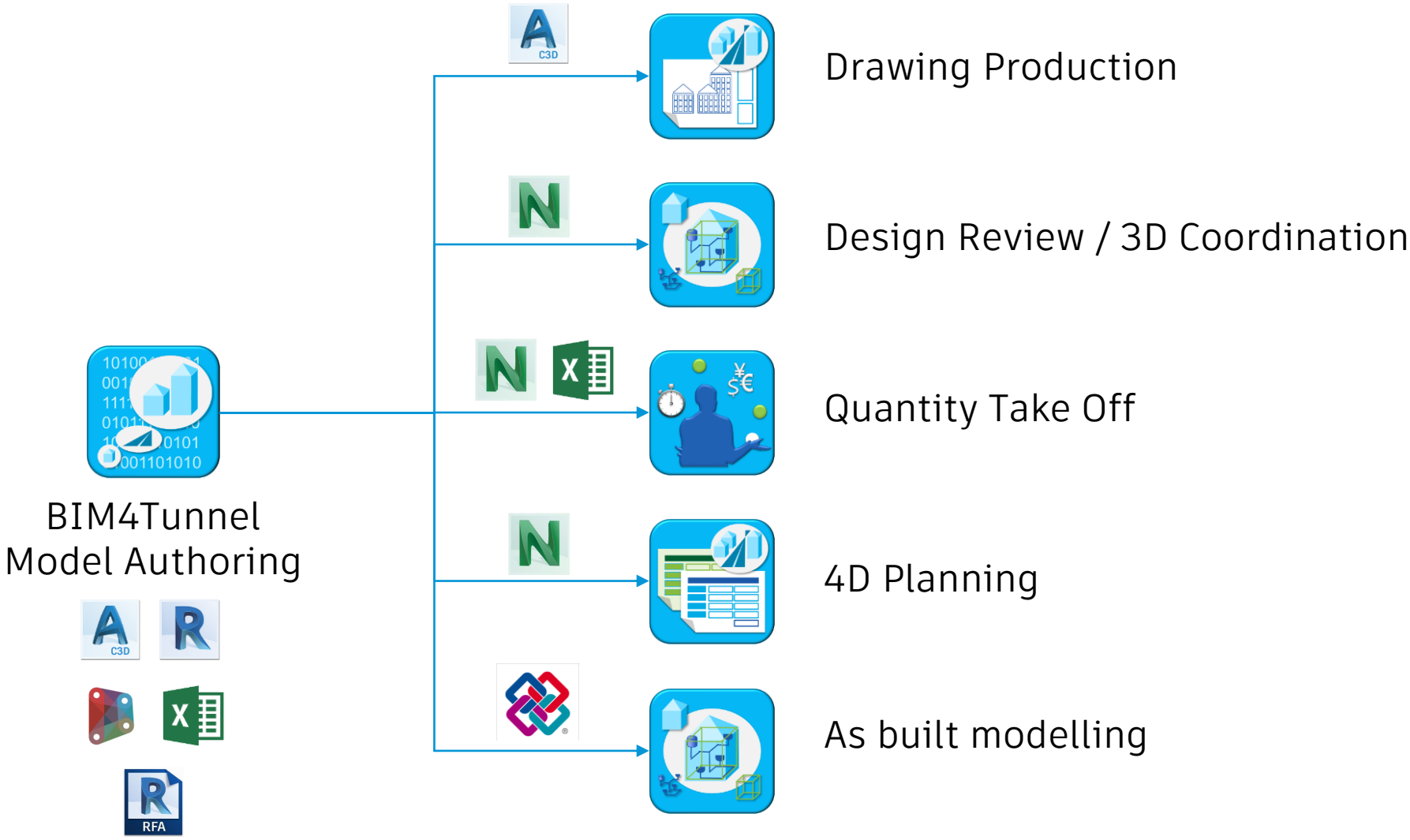
Model Authoring placement concept

Famille	Type	Axe de reference	Axe d'implantation	PK	Gisement	Pente	Devers
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10344,9	0	0	0
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G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10374,9	0	0	0
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G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10394,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10404,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10414,9	0	0	0
G14_CATE_Suspension Simple Chandelle	Suspension Simple Chandelle	01-SDP_LCO-V1	G14_0102I_CATE_Suspension Simple Chandelle_V1-XLINE	10424,9	0	0	0



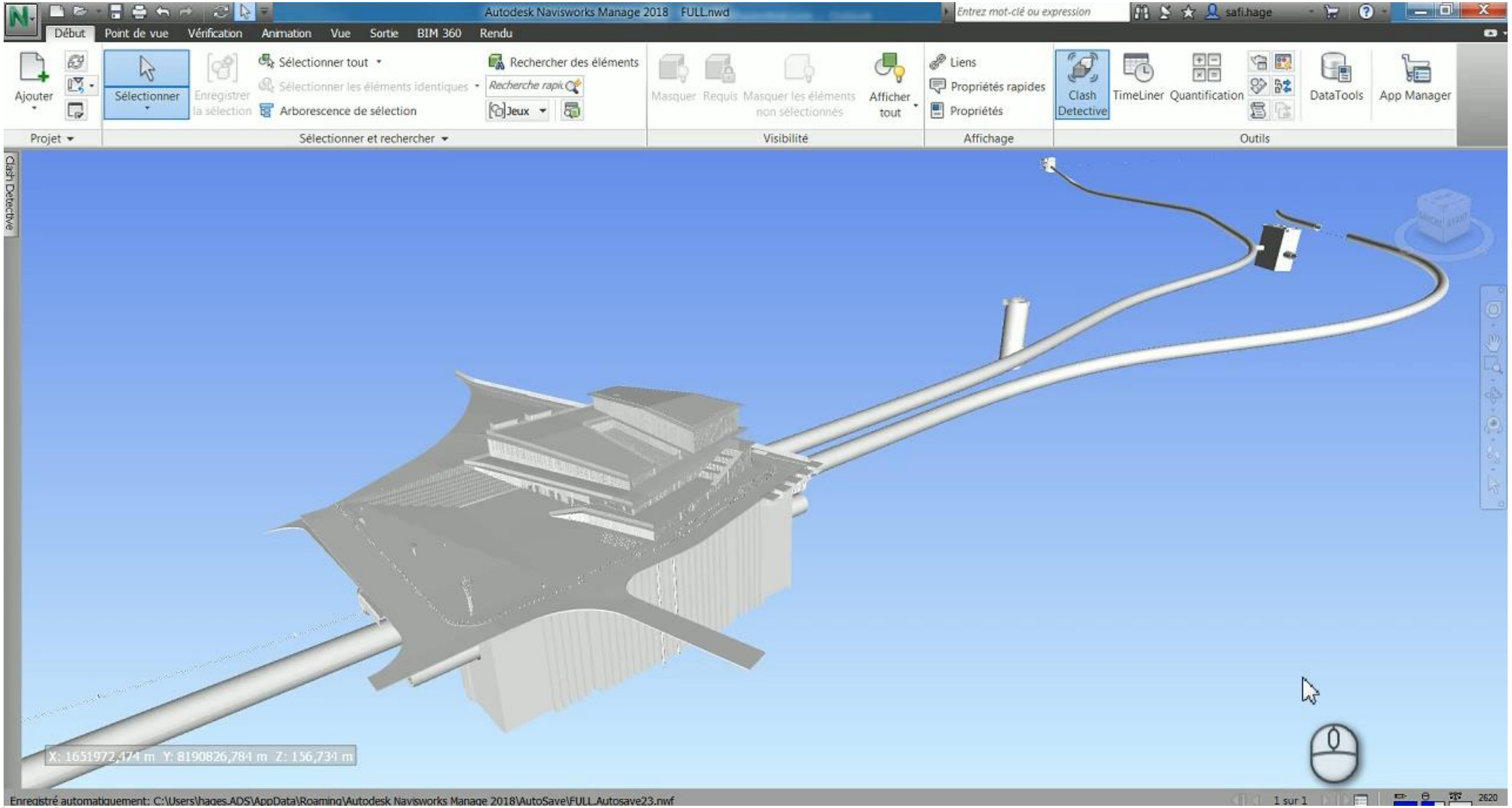


BIM uses unlocked



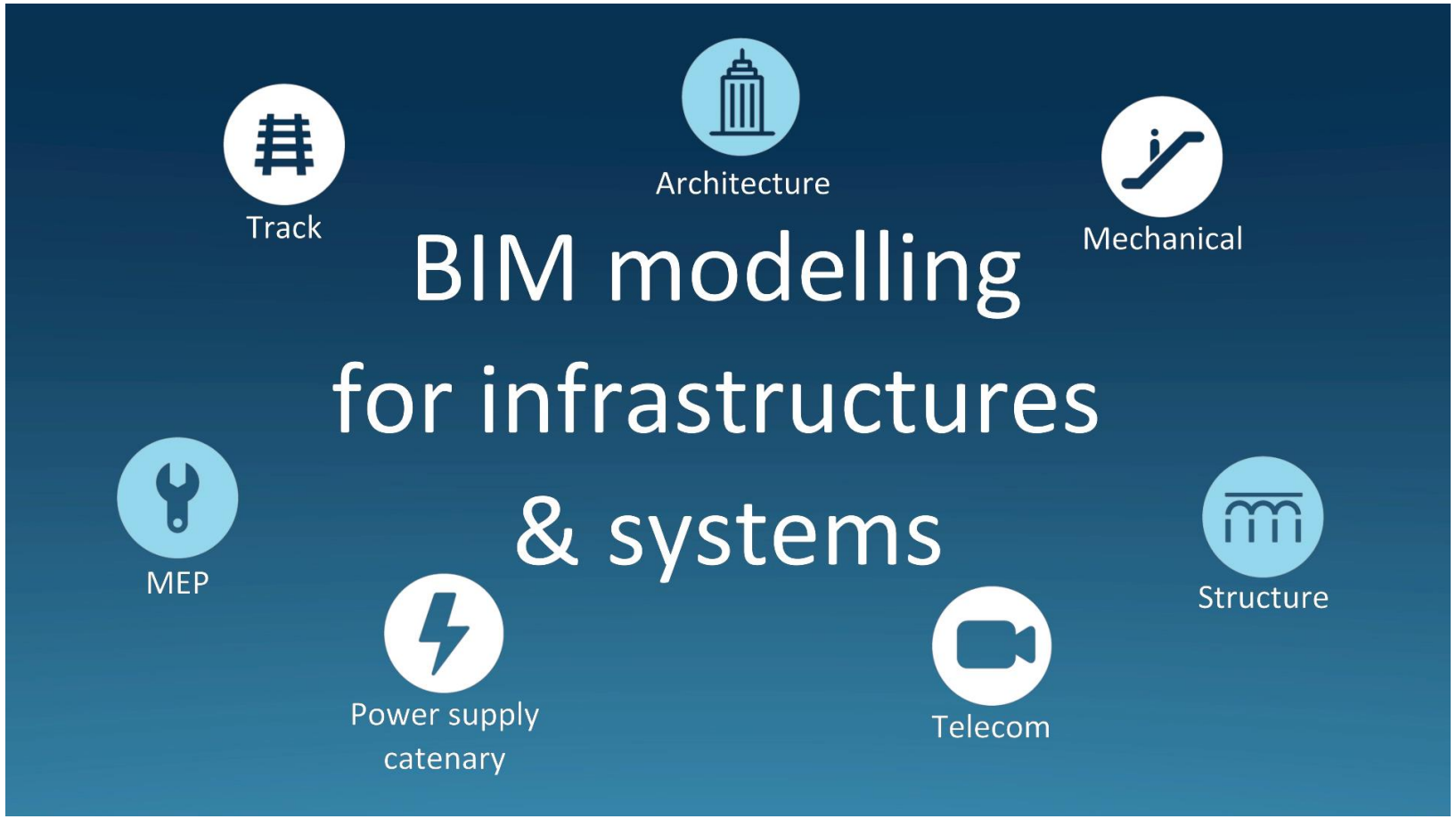
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Optimize design by 3D Coordination



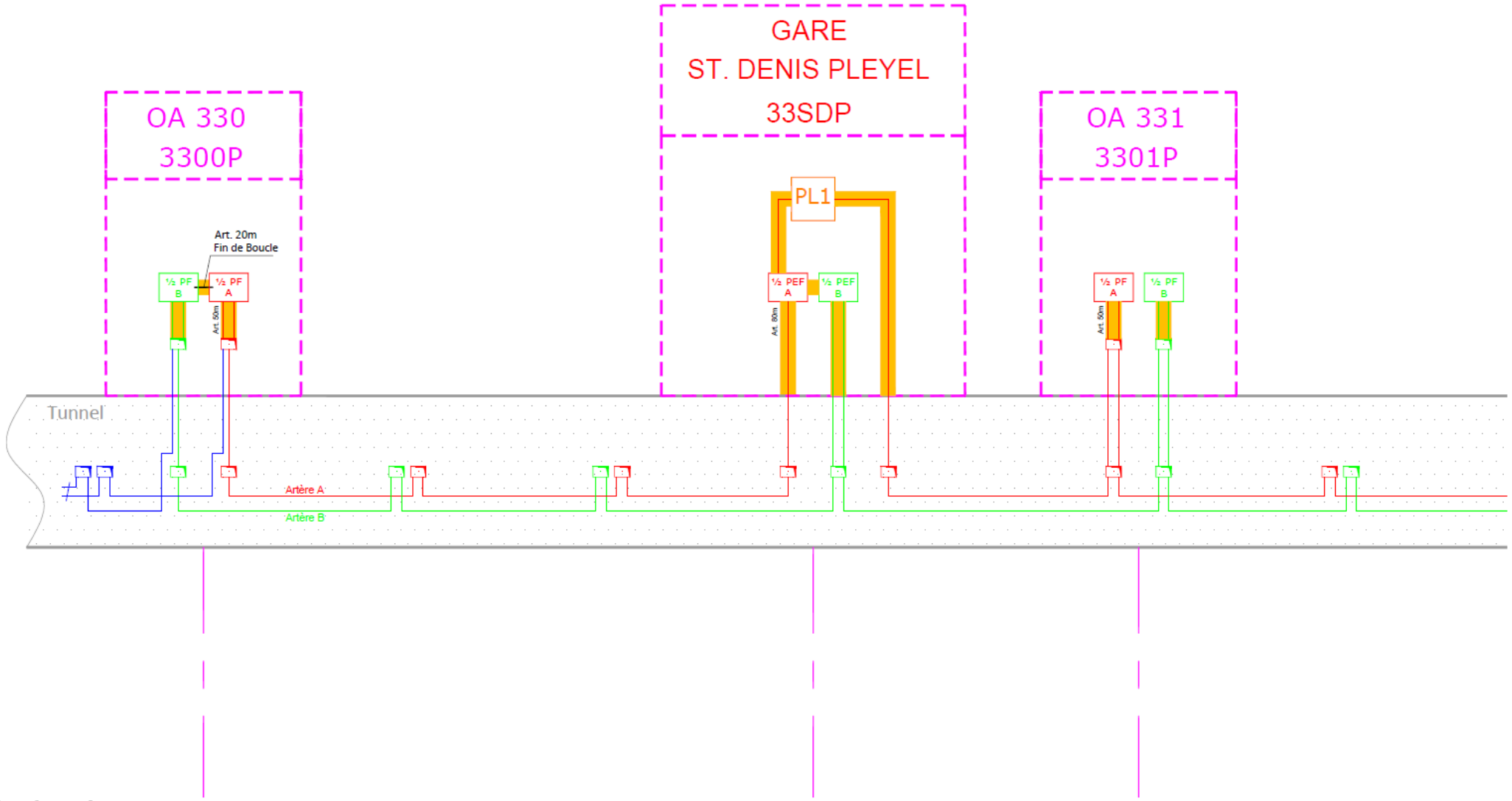
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Unlock decision making by a 3D Coordination workflow



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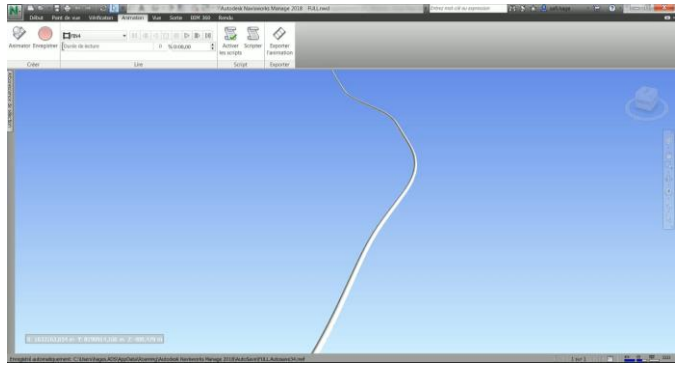
Infra / systems consistancy checking



Global Infrastructure overview

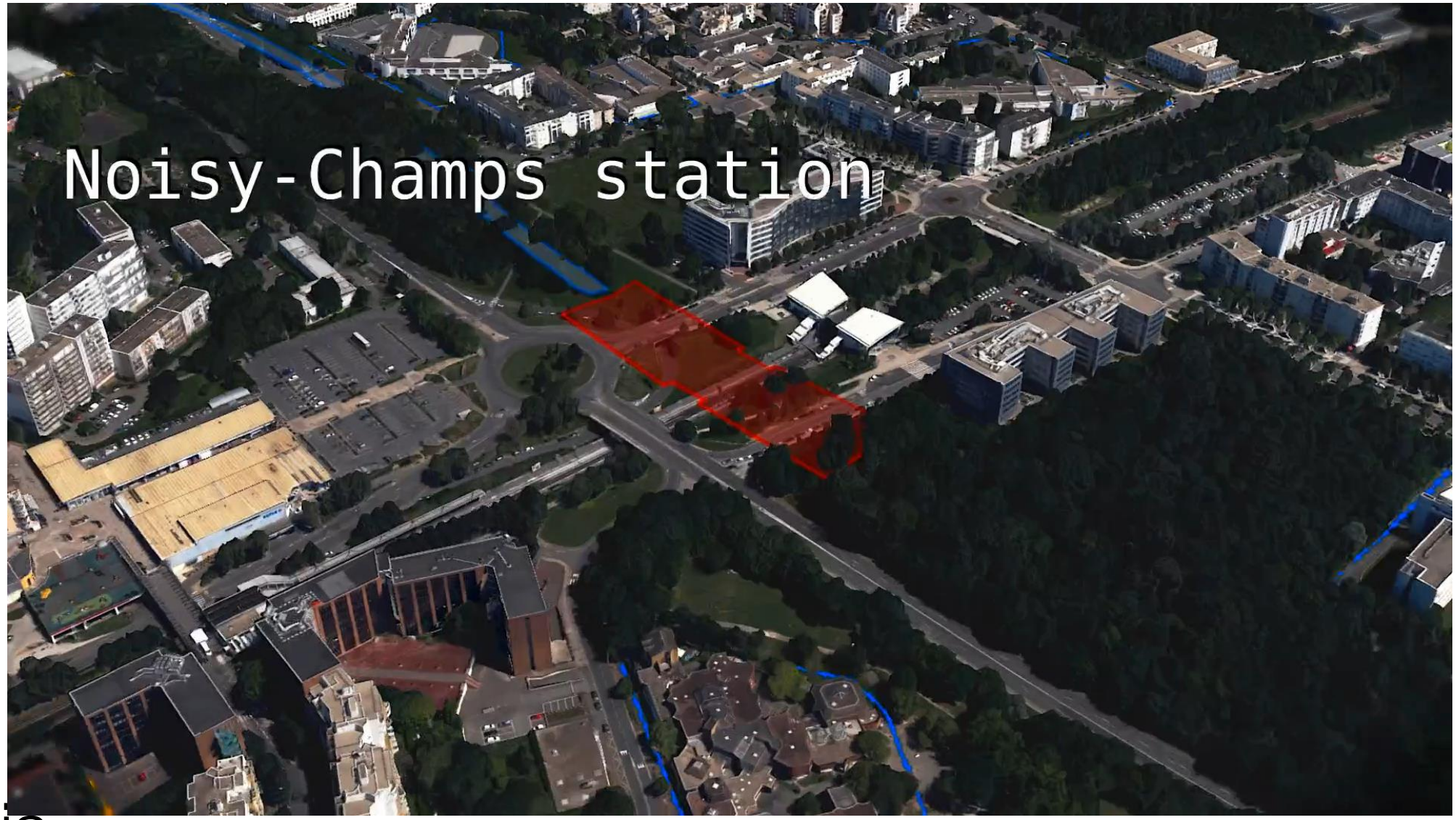


Société du Grand Paris - Ligne 16 - Gare de Saint Denis Pleyel - Maitrise d'oeuvre Egis/Tractebel - Maitrise d'oeuvre architecturale : Kengo Kuma and associates DIGIWIP 2018 ©



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Global Infrastructure View



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Golden BIM award in 2017



LE MONITEUR CTB
BIM D'OR
LAURÉAT 2017



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Next steps … build & deliver



buildingSMART
International home of openBIM

MN4rail

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Why open BIM is a key challenge ?

Christophe CASTAING – Egis

Director of the project BIM by EGIS SA/ Director of the digital engineering plan

BIM Task Group Chairman EFCA European Federation of Consulting Associations

Chair the CST Medi@Construct

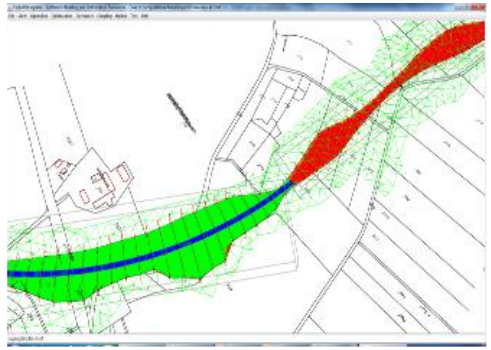
Chairman of Infrastructure room – bSI

And standard committee member

Deputy director of the National Project MINnD

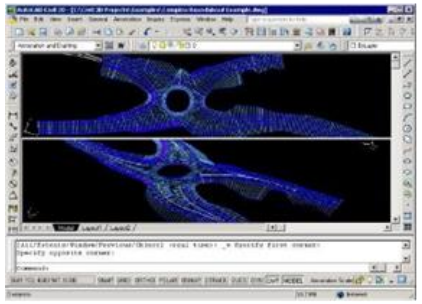
Editorial Committee of PTNB

Scope of IFC 5
Focus of supporting infrastructure work



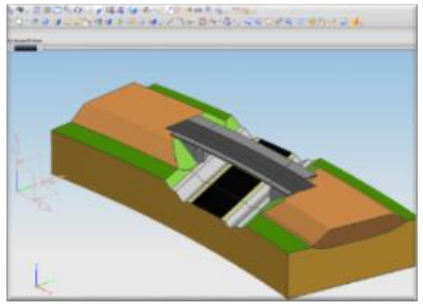
Alignment

Common baseline



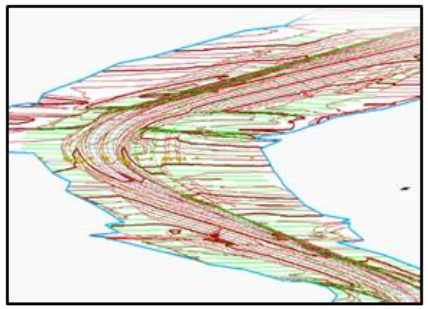
Roads

IFC-Road



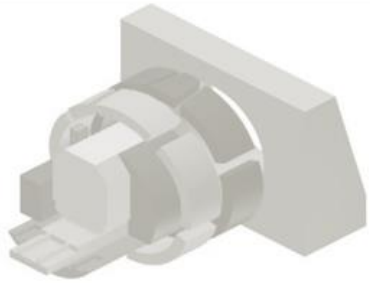
Bridges

IFC-Bridge



Railways

IFC-Railway

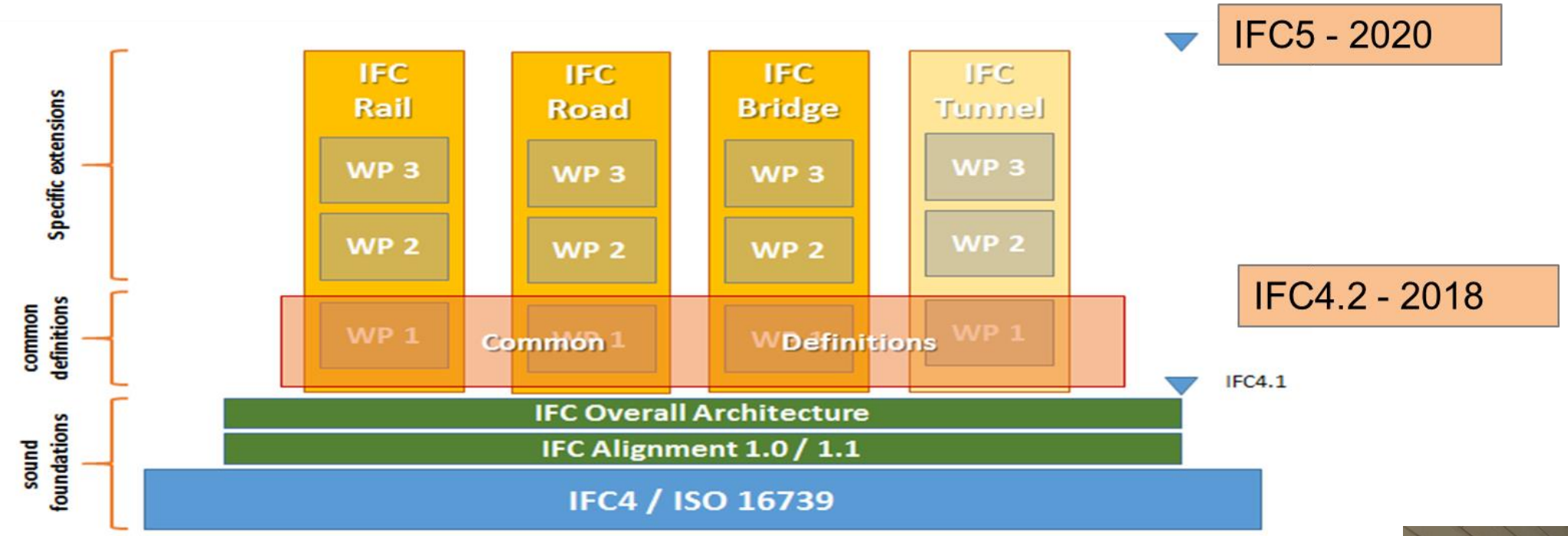


Tunnelling

IFC-Tunnel

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IFC extension for infrastructure Scheduling



A common conceptual model



IFC Rail kick-off meeting in Beijing – January 2018





Birmingham Tramway
BIM & GIS



Global Light Rail Awards 2017

Technical Innovation Category

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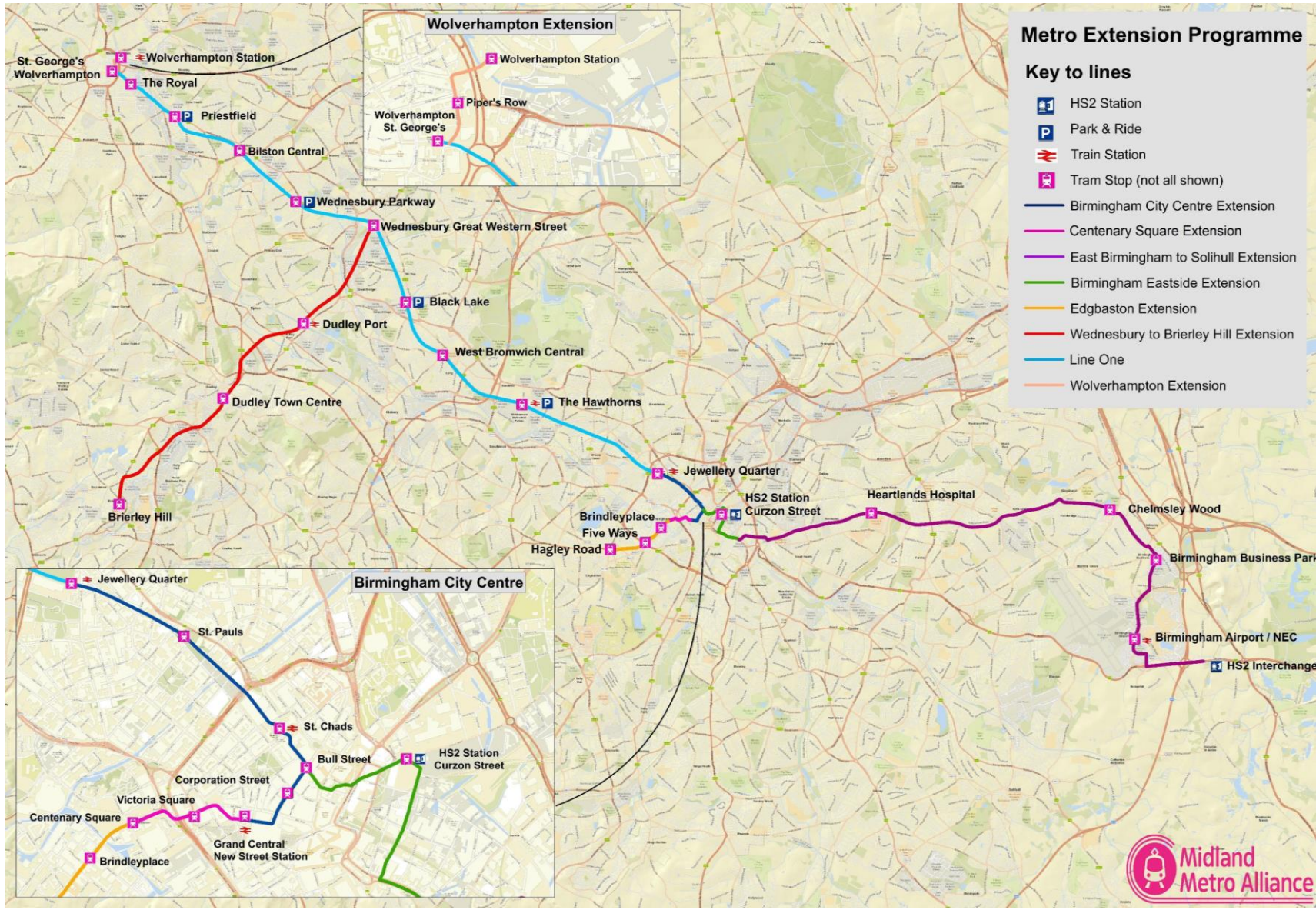
The project

Ten year programme;

- Extension of existing network
- The creation of news lines

Alliance's goals;

- Collaborative operation
- An integrated team
- The implementation of BIM processes to reduce costs



source MMA

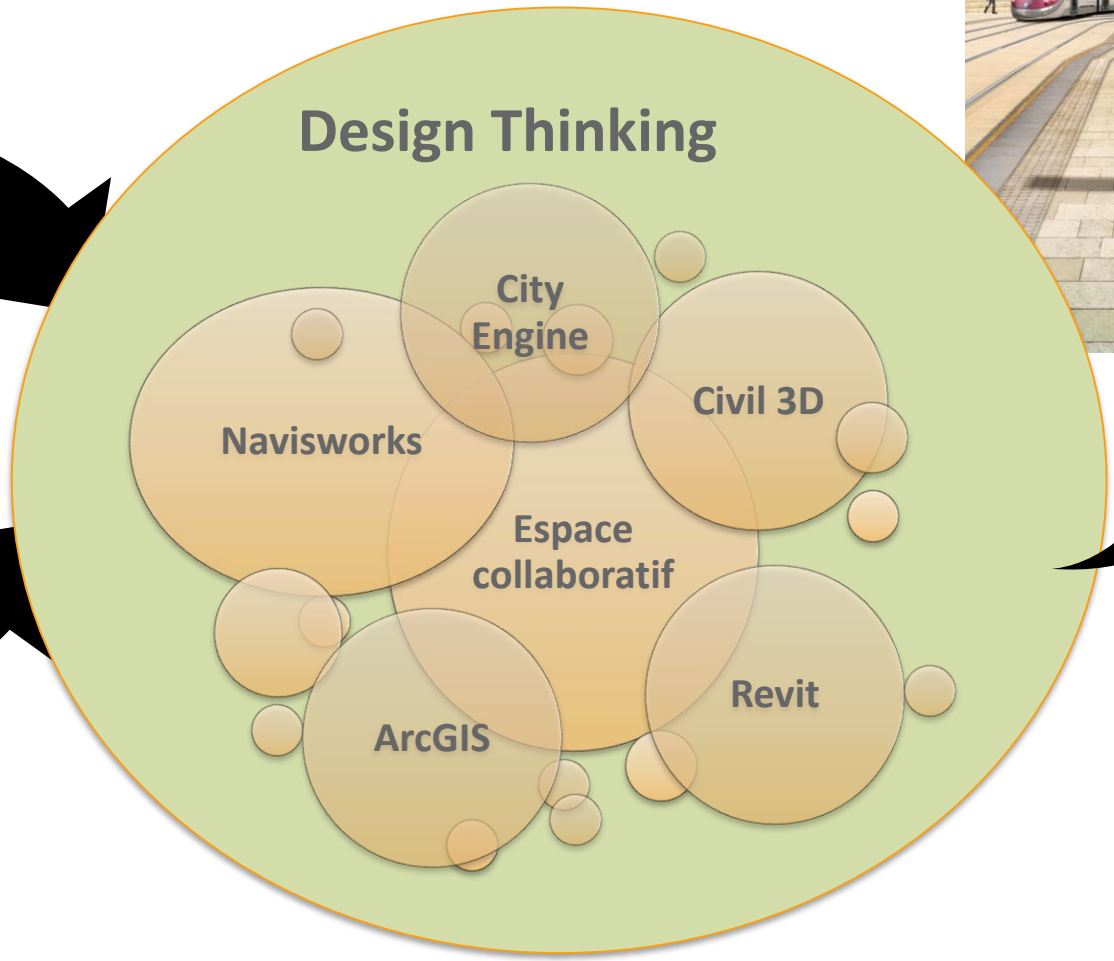
The challenge : how to ovierview the project to make good decisions ?



Expectations from people

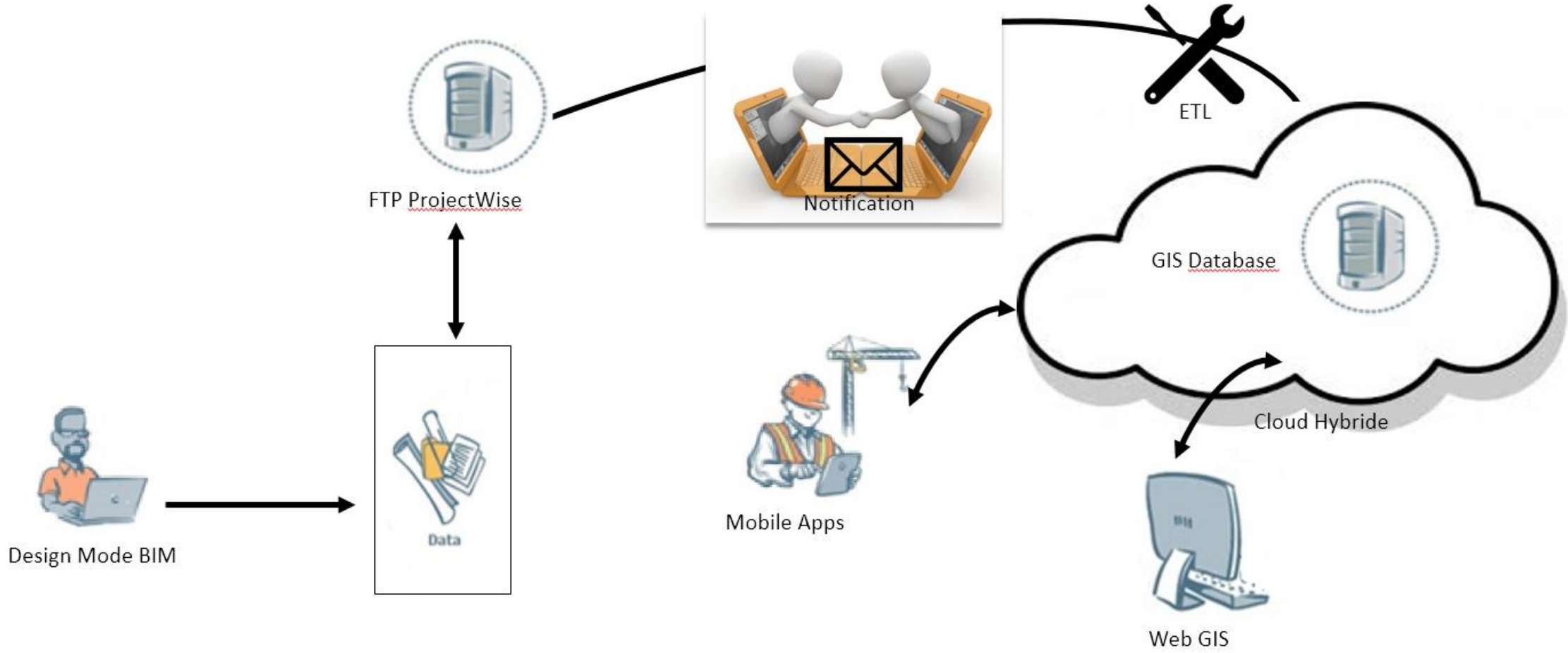


Needs of collaborators

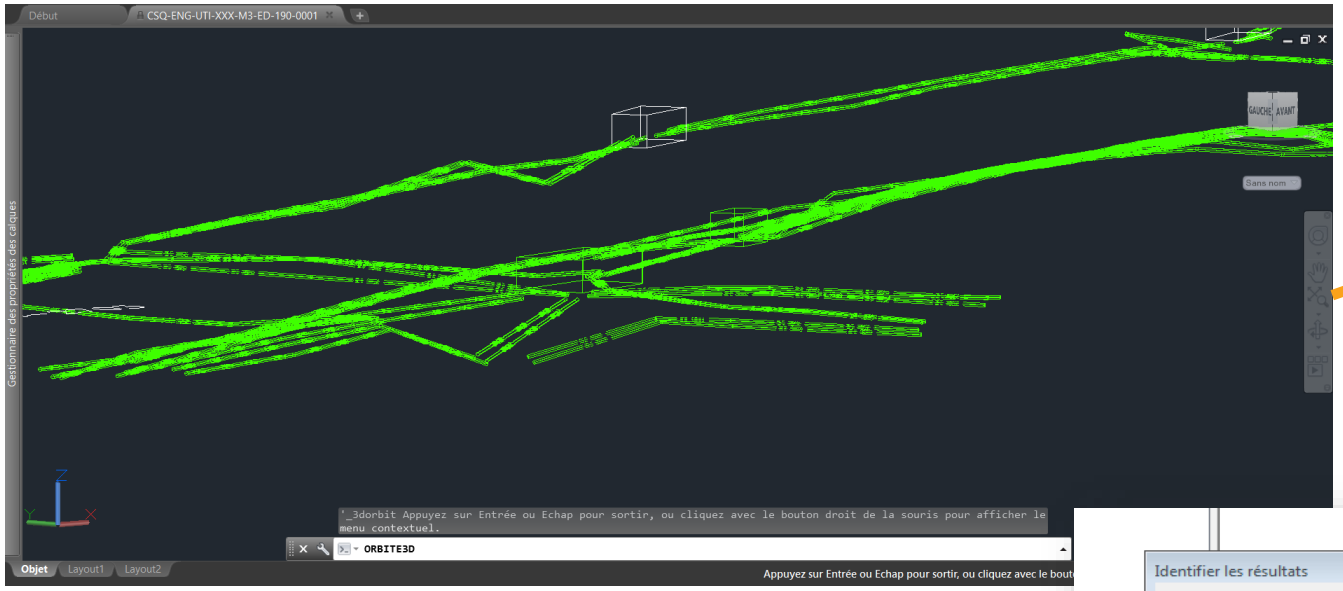


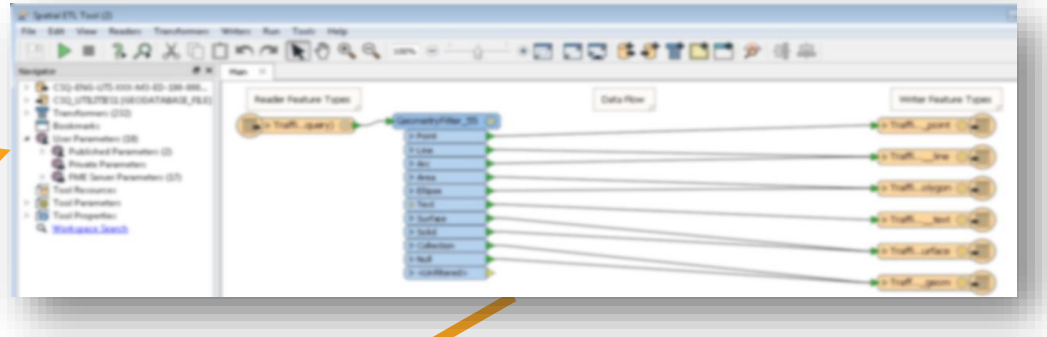


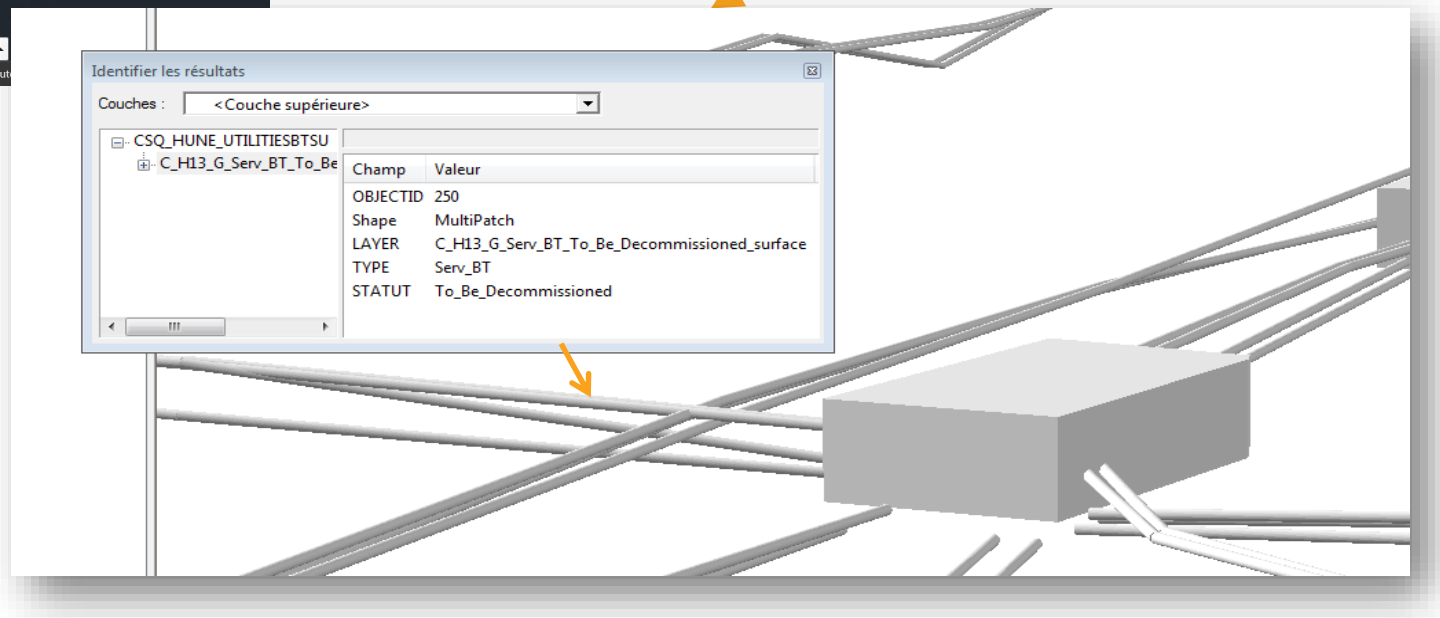
Workflow – Data Exchange



Interoperability : the key to collaborative mode







Data utilities

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A shared solution : WebGIS



- A une maquette numérique de l'avenir



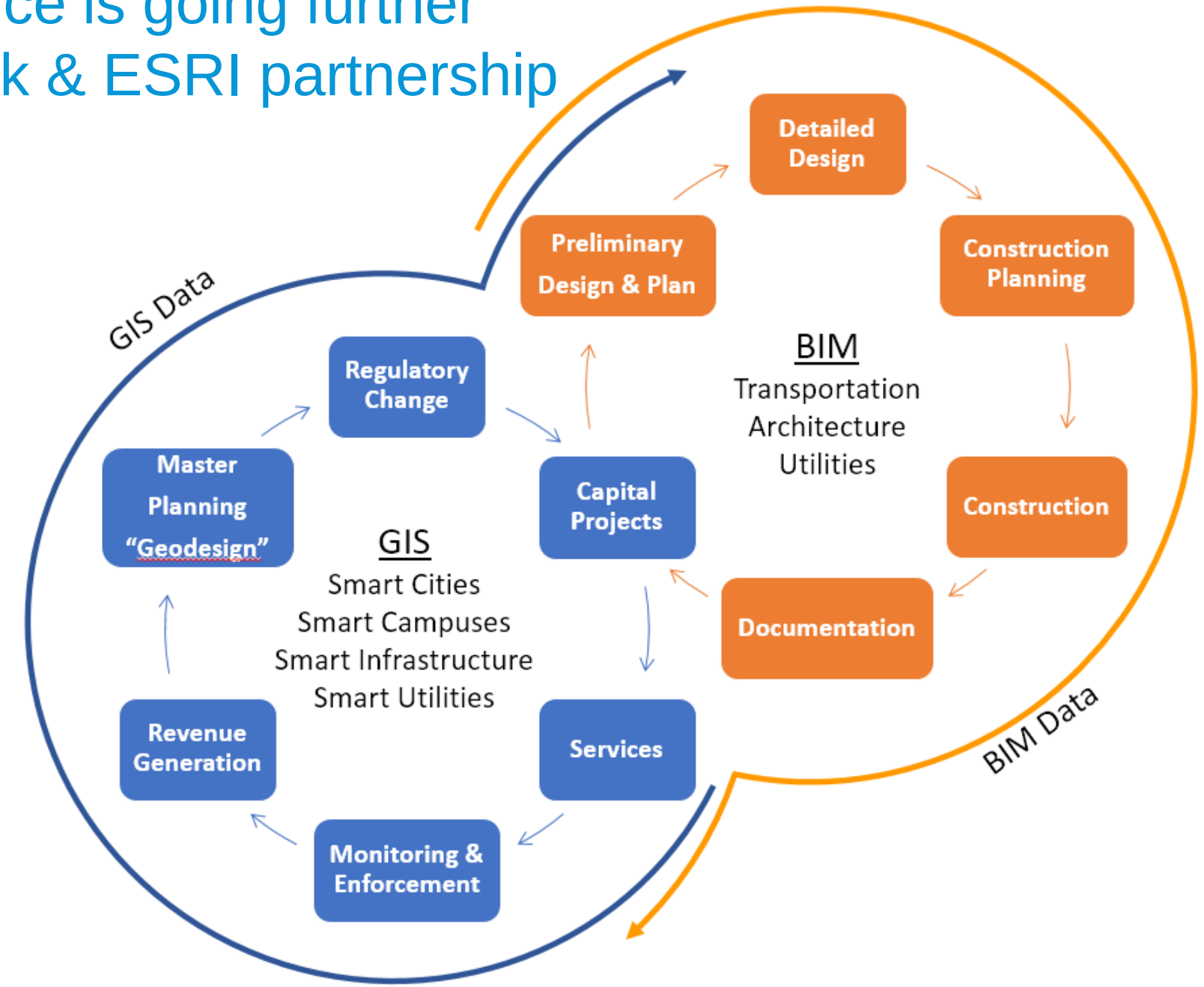
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BIM & GIS convergence is going further thanks to the Autodesk & ESRI partnership

BIM / GIS

or

GIS / BIM



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Conclusion

Decision making and communication is easier by using models that include all the disciplines and tools like Navisworks and the GIS to give an overview of the project

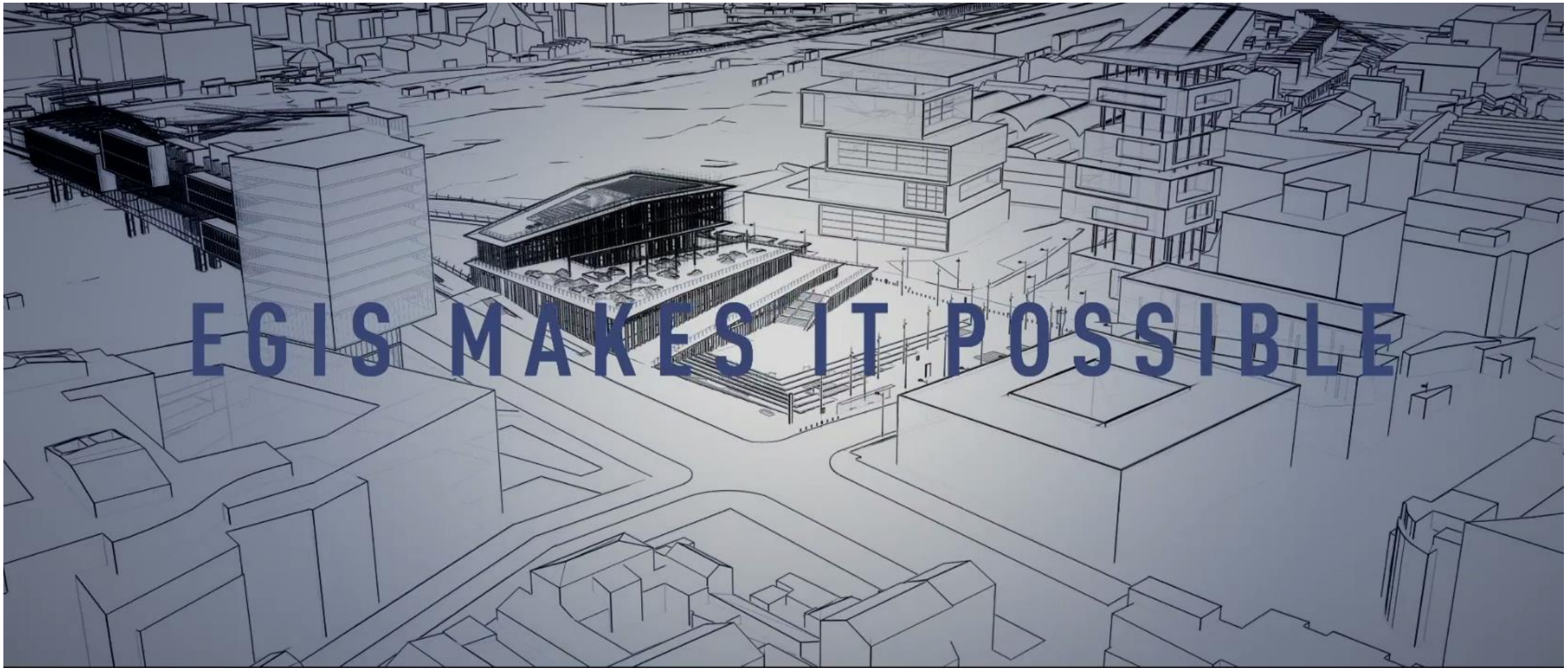
Using Dynamo is a way to save time to model the systems equipments

The structured object database is becoming the core of the modelling

Product Life cycle management needs to include all the assets in the database

One step to BIM level 3 if and only if the data can be shared in open format to make them sustainable

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... with Autodesk.

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