SYNAPSE |Generative Engineering

Applying Generative Design to Engineering

January - 2020

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THE PROBLEM

Design and cost estimating are constraint by

TIGHT DEADLINE   **CHANGING INPUT DATA**   **PERSONNAL EXPERTISE**

in a highly competitive and low-margin market

Design and cost estimating are **long** and **expensive**

Differentiating solutions are missed

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WHICH BENEFITS?

Optimal Performance

Explore a whole set of
solutions to keep
only the best one

Risk Management

Increase reliability of the
results by limiting human
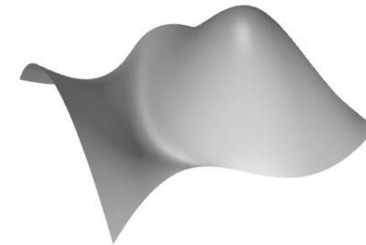errors

High and Secure ROI

Time reduction of the design
and cost estimating
processes

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WHAT IS PARAMETRIC DESIGN?

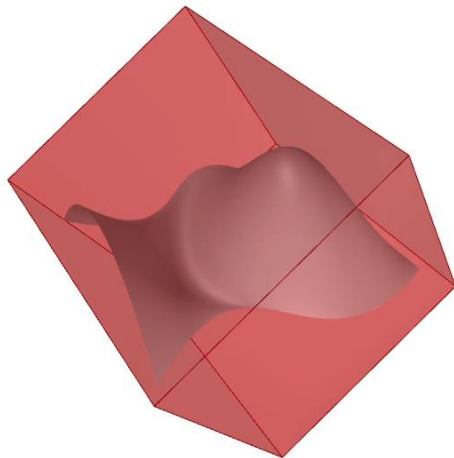A method of **making the properties of a model or object parametric** for easy modification.

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WHAT IS GENERATIVE DESIGN?

Parametric Design + Algorithms
=
Productivity | Creativity | Savings

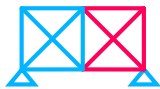

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GENERATIVE ENGINEERING

Geometric Rationalization

3D modelling and advanced form-finding techniques to optimize complex geometries for design intent, constructability and project-specific needs.

Structural optimization

Optimization tools and techniques use a dynamic structure model to browse through all existing solutions and to choose the best performing one.

Data-driven planning and design

Minimization of earth work, maximization of the positive impact of green areas and water views on inhabitants, etc.

Custom Software Development

Custom tools that augment, improve or replace the functionality of commercially available software.
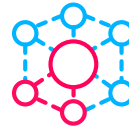
Interoperability

Use software APIs to streamline the design, analysis and documentation processes. Make easier communication between tools.

Data Analysis and Visualization

Provide insight by offering different modes of spatial data representation, mapping techniques and customized visualizations.

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WHO DOES SYNAPSE ADDRESS?
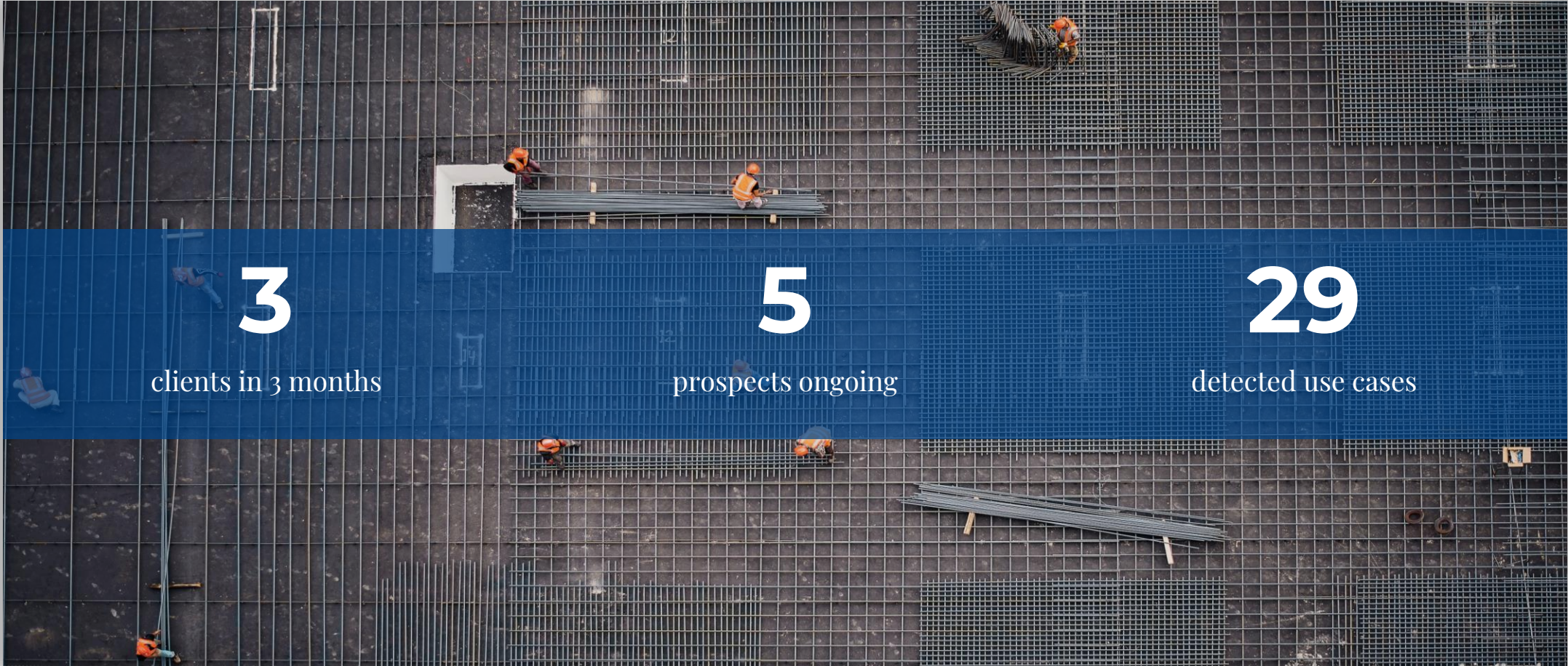
All design, construction and asset managers

Design issue

Design exploration, structural calculation, geometric optimization, form finding, planification, iterative process

Cost estimating issue

Tight deadline, many iterations, multi-partyism

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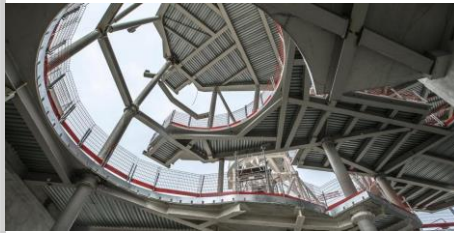VINCI

3

clients in 3 months

5

prospects ongoing

29

detected use cases

VINCI FACILITIES
- Space Management
- Operation cost estimating

VINCI CONSTRUCTION FRANCE
- OptiTram
- Energy renovation*
- Macro planning

EUROVIA
- Gravel pit exploitation
- Sewerage system

SOLETANCHE BACHY
- Foundations *
- Retaining wall design (Berlin wall, Diaphragm wall)

FREYSSINET
- Stay cables
- Suspension cables

SPIECAPAG ENTREPOSE
- Pipeline design tool *

SOGEA SATOM
- Reinforced concrete box
- Tank

VINCI ENERGIES
- HV electrical grids
- Cables supports
- Production lines

VINCI CONSTRUCTION UK
- Plan logistic
- Student accomodations
- Hospitals

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* Ongoing projects

OUR TEAM

Alexandre Cousin

Synapse Founder
Method Engineer &
Developer

Nicolas Metge

ISC Director
Structural Engineer &
Architect

Antoine Jacottin

R&D Civil Engineer

Romaric Quentin

R&D Mecanical Engineer
& Computationnel Design

Tristan Barth

Architect

Sebastien Maitenaz

Laboratoire Navier PhD
Structural Engineer

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2015

Parametric Building

Truss Beam

Presidential rostrum design

Form Fiding (shell)

2017

Reinforced concrete box

2019

Space Planning

Energetic renovation panel

Steel frame robotization

2016

Bowstring bridge

Alignment optimization

Optipont

2018

OptiTrame

OptiMan

Tunnel ring sequence

Walkway design

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OUR PROCESS

1 **Understanding** the use case
or
Process analysis to **detect** a use case

2 Collaborators **training** and tool
development **management**

or

2 **Tool development**

3 **Integration and deployment** of the Generative
Design tool in the operational process

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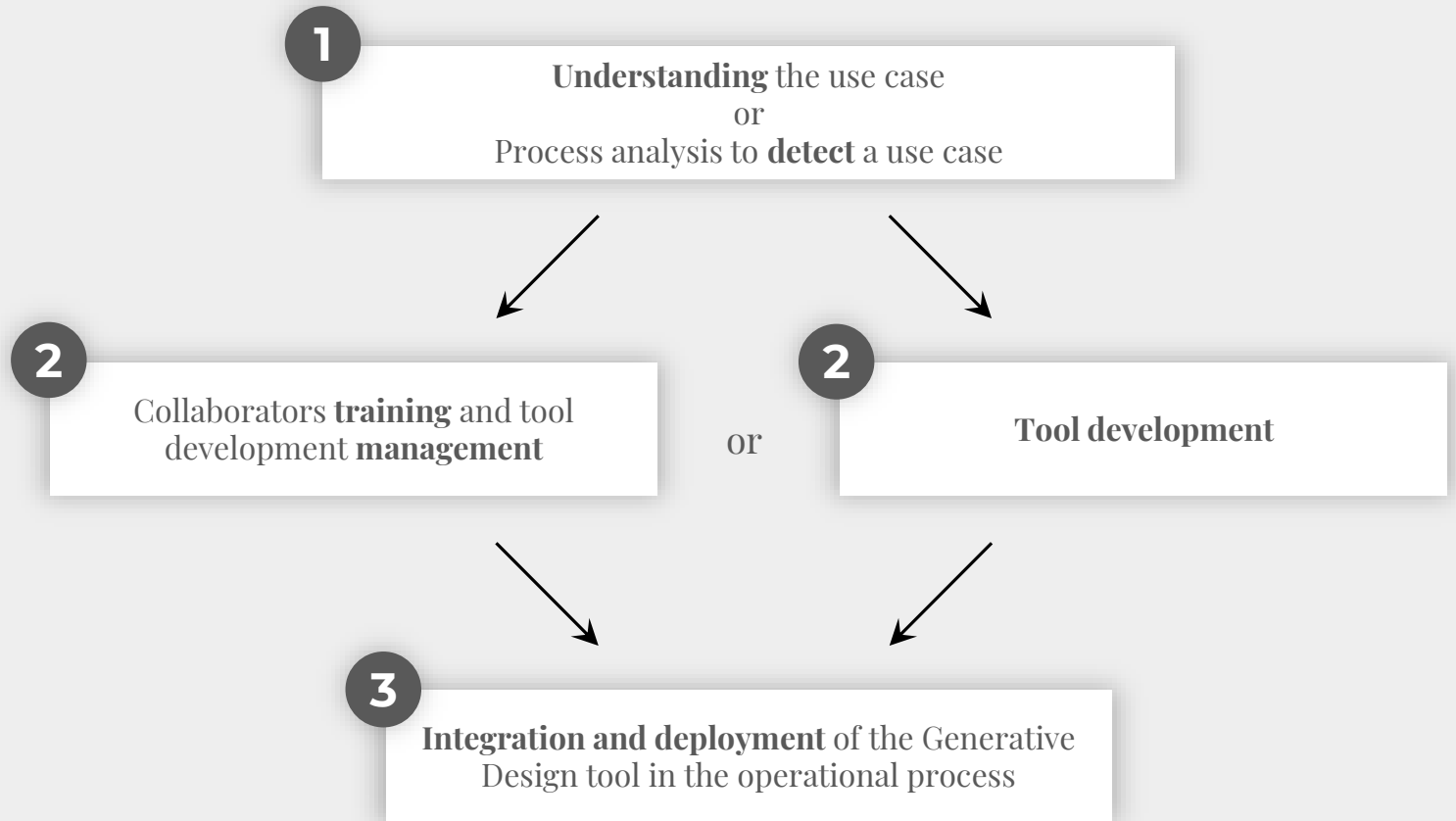
OUR SERVICES

Consulting

Processes exploration

Professional training

Tool development management

Software development

Understanding the problem

Parametrization

Optimization

Integration

Financing and exploitation

Investment

Development

Exploitation

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WHAT MAKE US BETTER?

01. Technical knowledge

All our team come from technical world. Structure engineer, method engineer, architect, etc.

02. Co-design

We co-design side by side the solution corresponding with your technical issue.

03. Integration

A tool is made to be used. One of the most important steps the integration into your operational process.

04. AI & Optimization

We master Artificial Intelligence and optimization technologies to create the most efficient tools.

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Annexes

2015 – Parametric Building
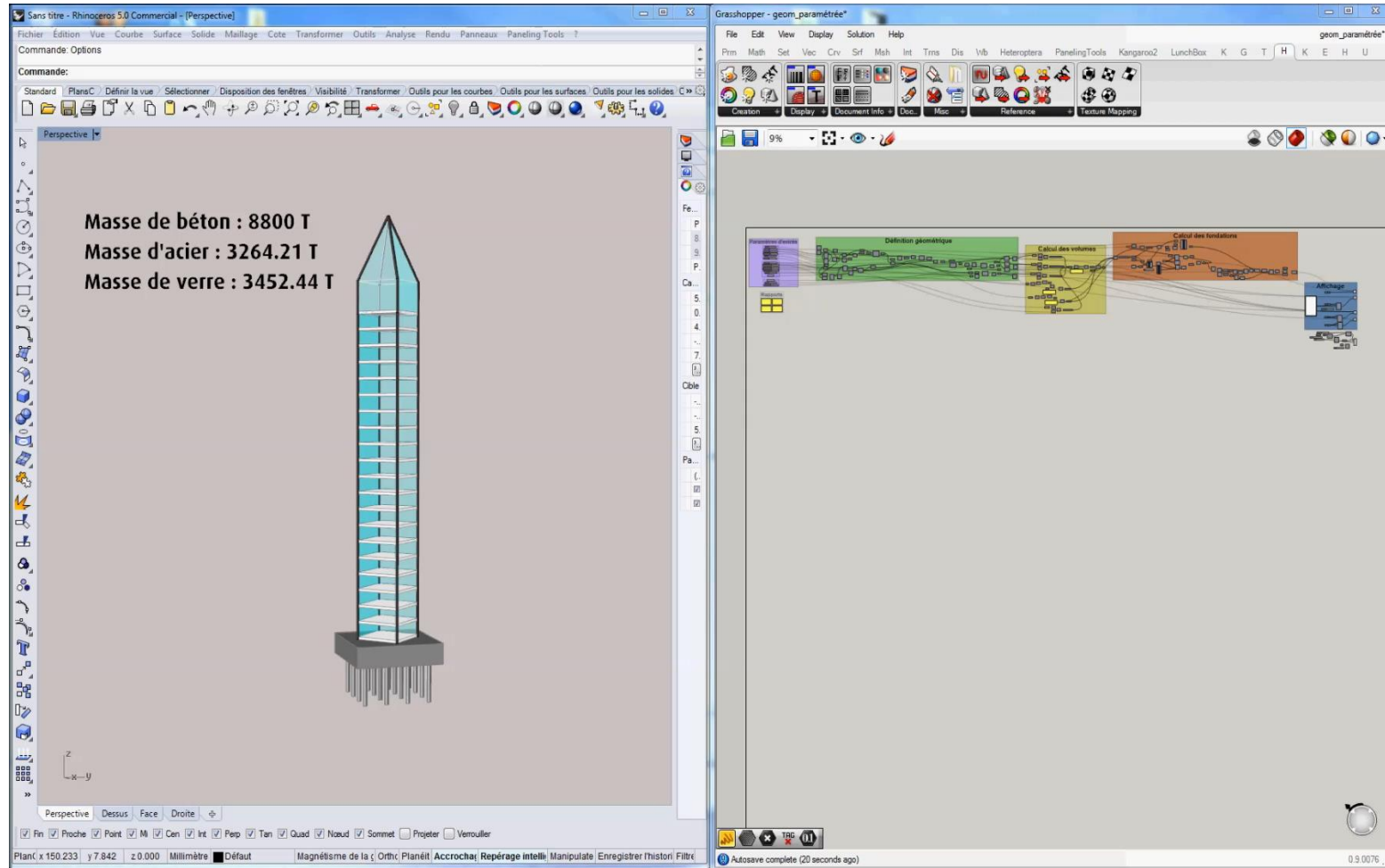
2015 – Truss Beam

2015 – Presidential rostrum design

Espace entre gradins : 6.0m

Profilé le plus long : 22.6m

nombre de places = 1819

Longueur totale = 158.9m

Estimation du volume de béton hors fondations : 792m3
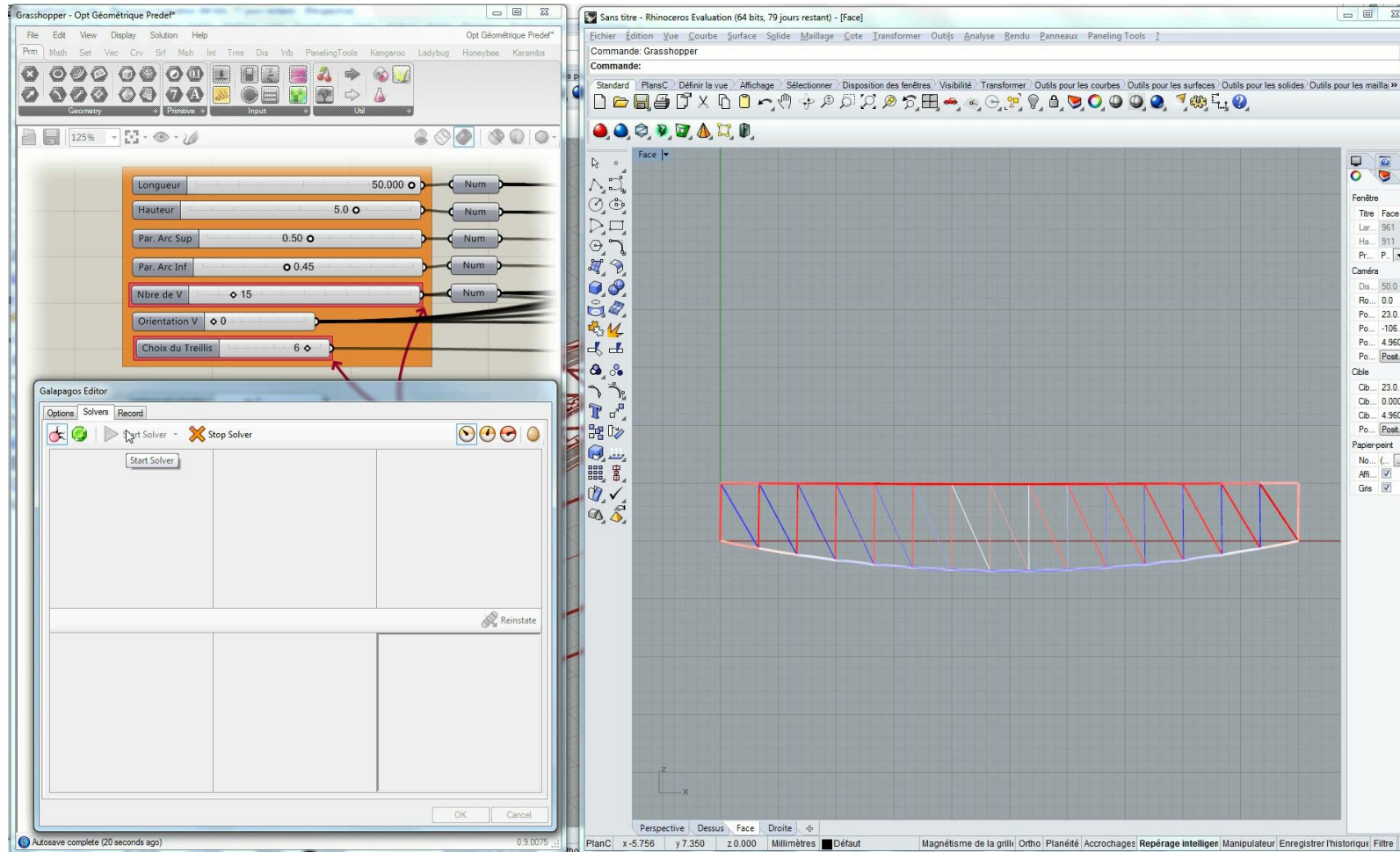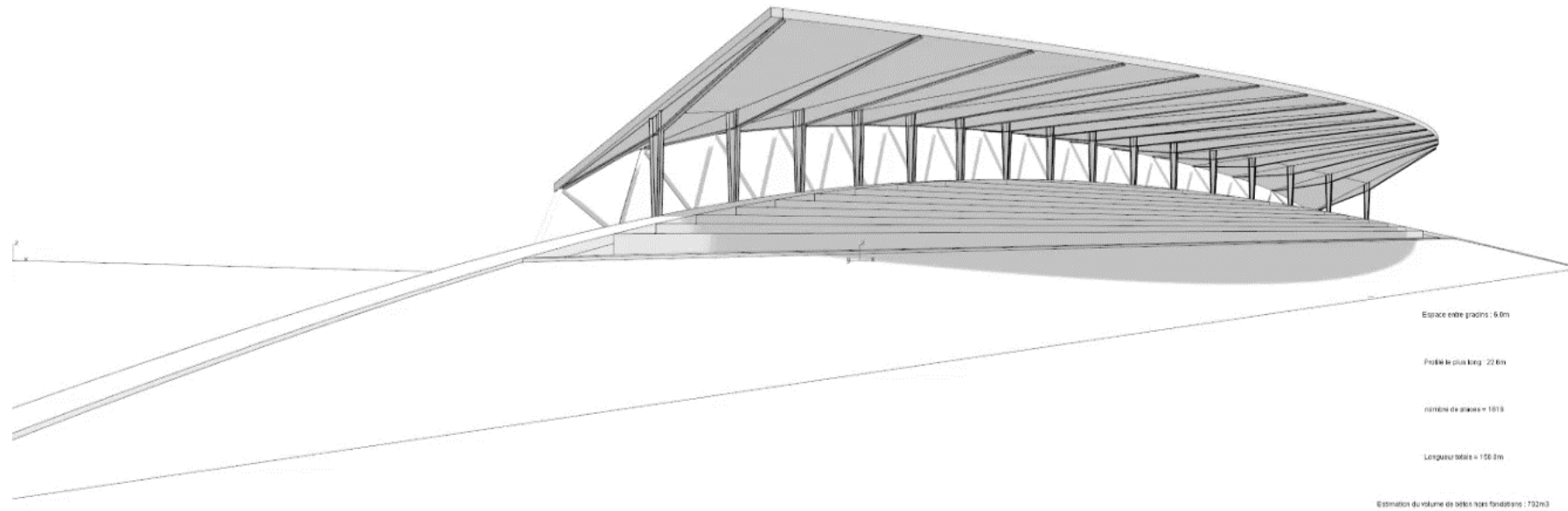
2015 – Forme Finding (shell)
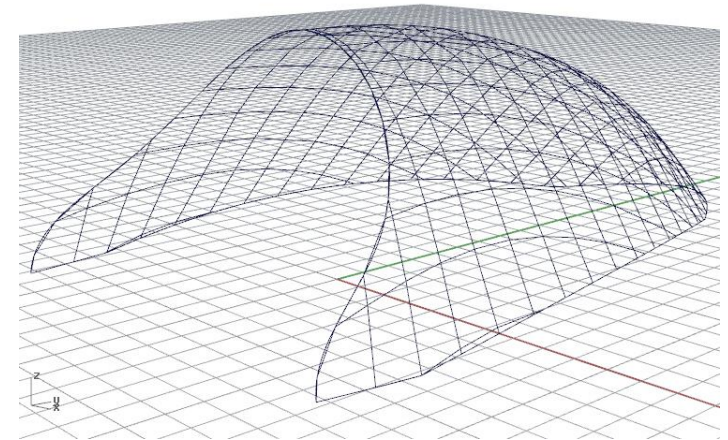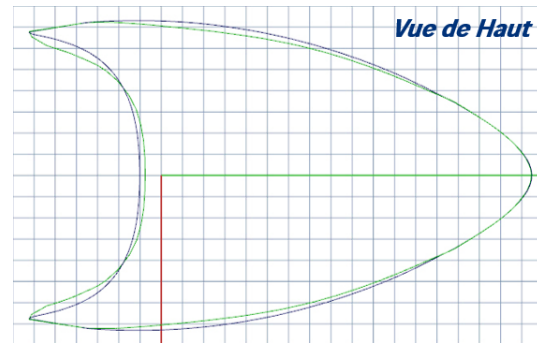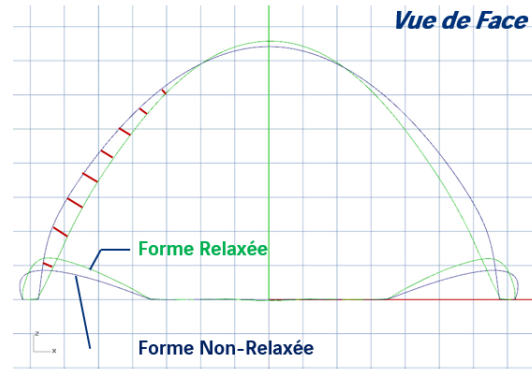
2016 – Bowstring bridge
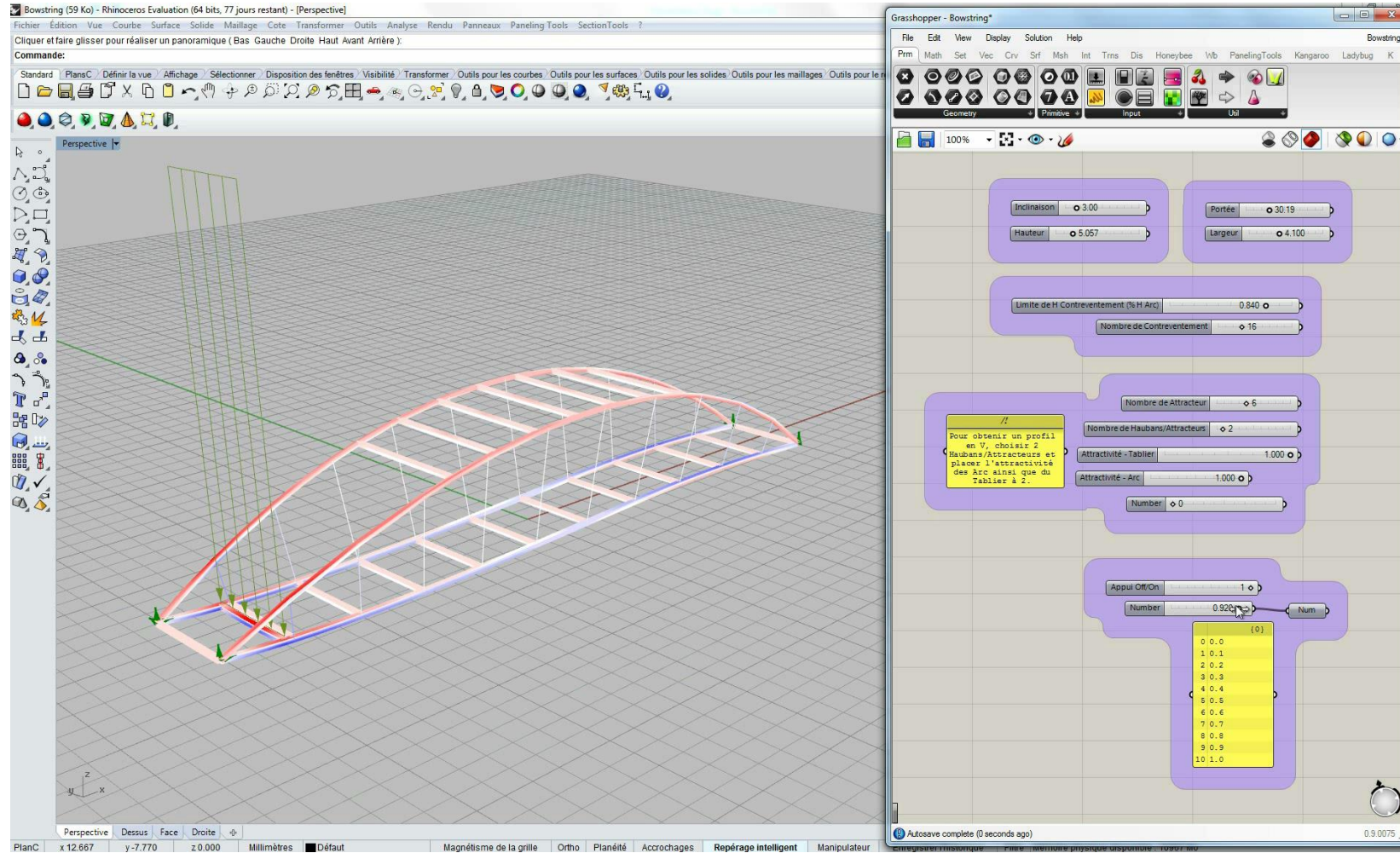
2016 – Alignment optimization
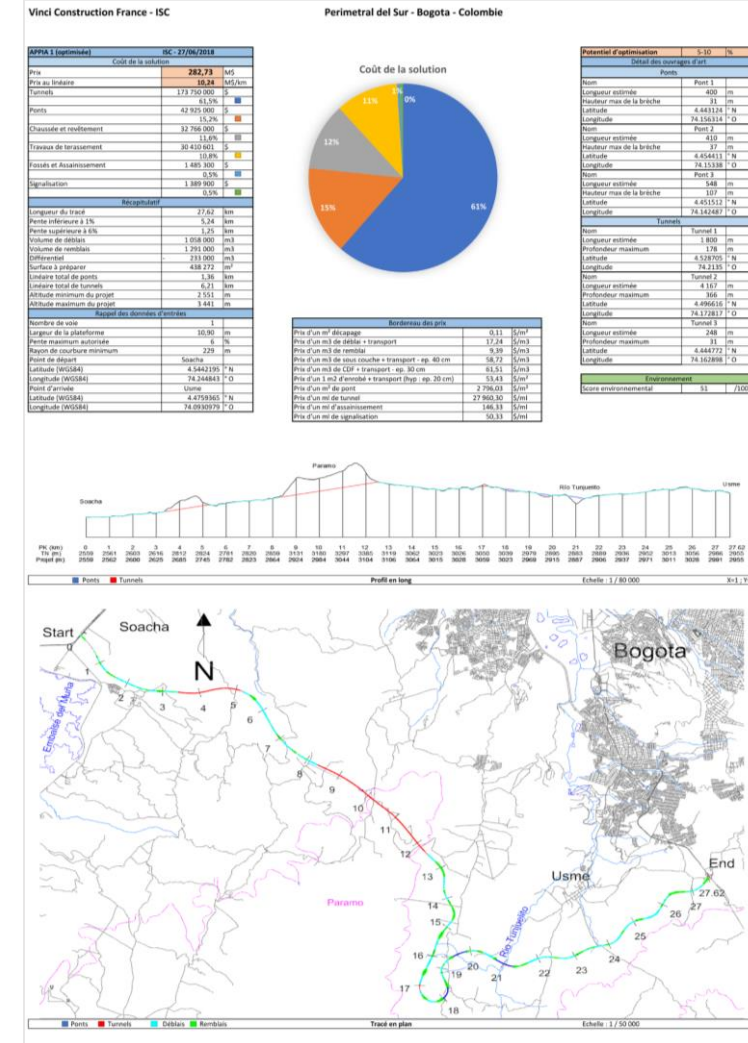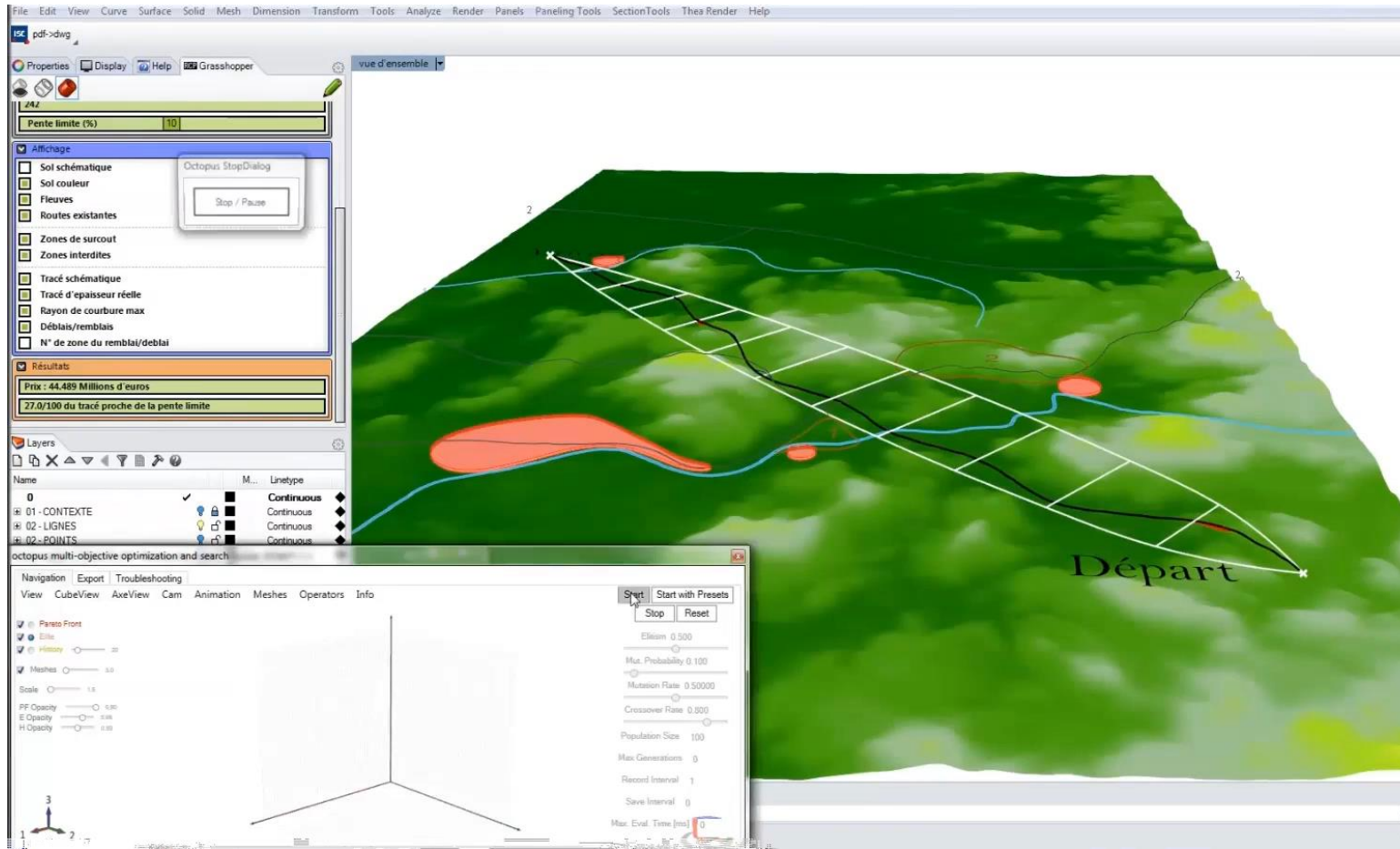
2016 – OptiPont
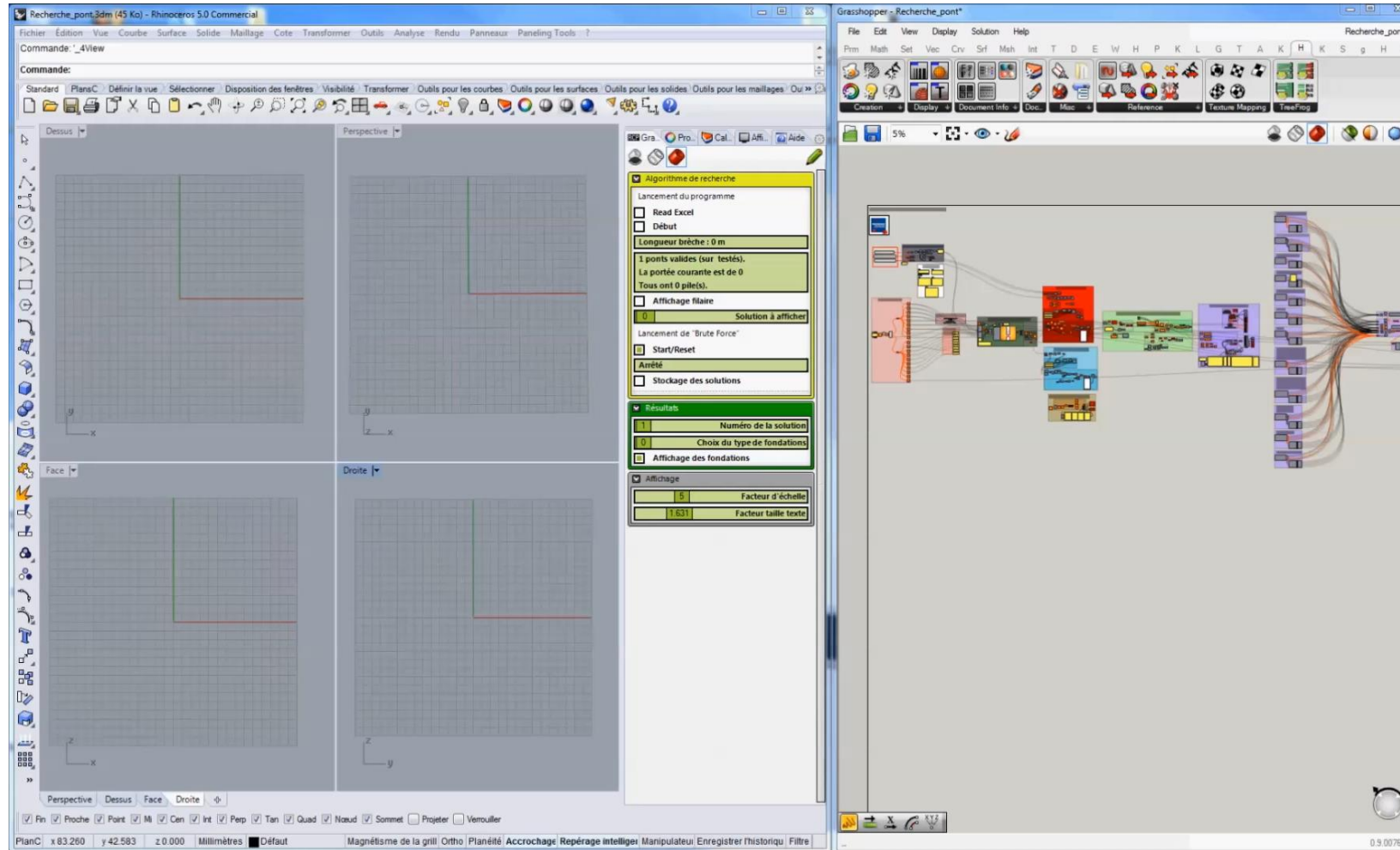
2017 – Reinforced concrete box

2018 – OptiTrame

2018 – OptiMan

1. Récupération des dimensions des mannequins depuis la maquette BIM

2. Optimisation de la conception des mannequins dans OPTIMAN
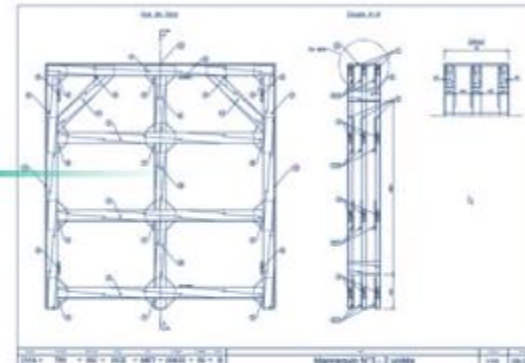
3. Automatisation des plans de fabrication des mannequins

2018 – Tunnel ring sequence
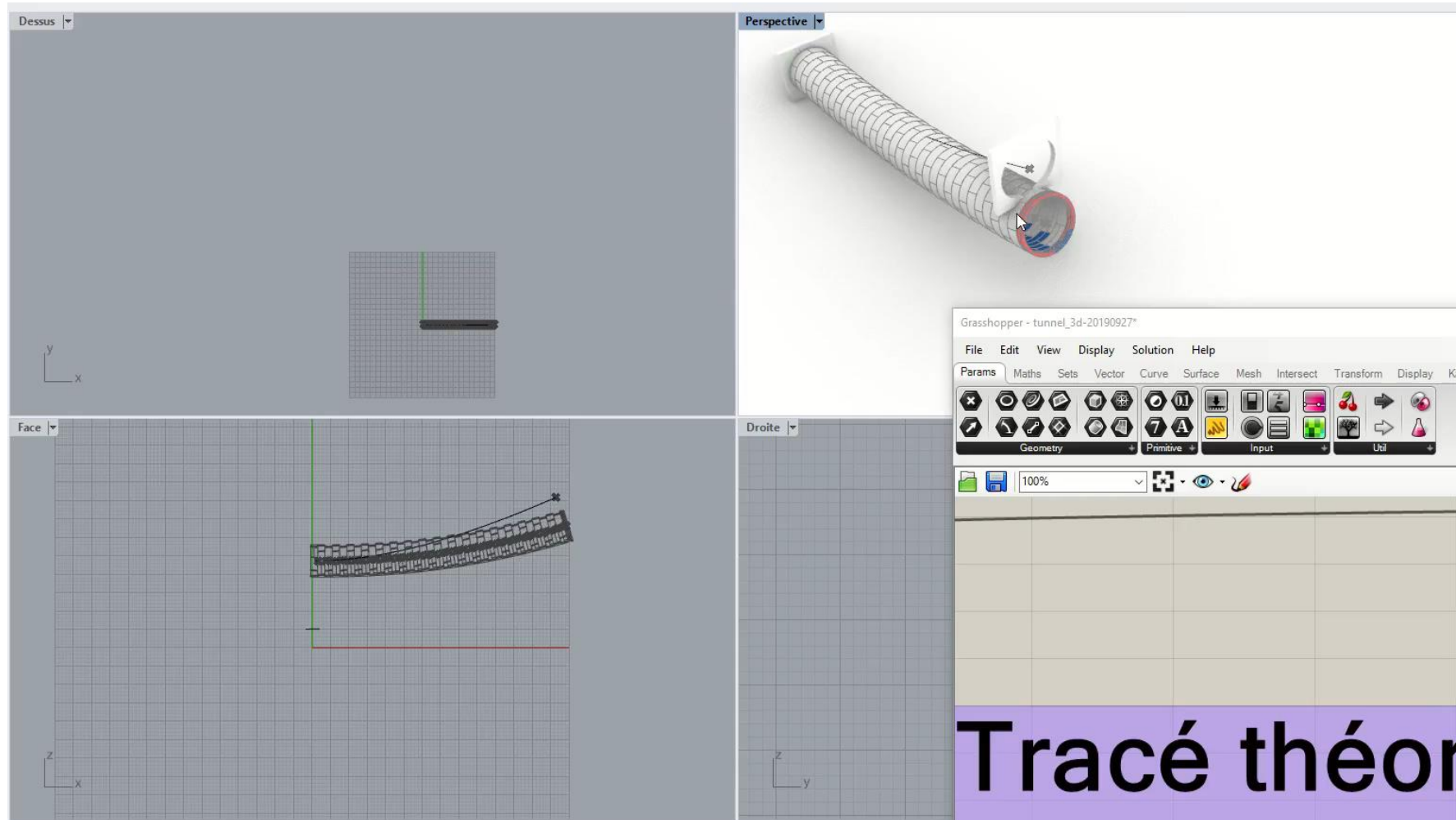
2018 – Walkway design

2019 – Space Planning

2019 – Energetic renovation panel

2019 – Steel frame robotization