RÉPUBLIQUE FRANÇAISE
Liberté
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Cerema
CLIMAT & TERRITOIRES DE DEMAIN

3D beam structural analysis software

Use field

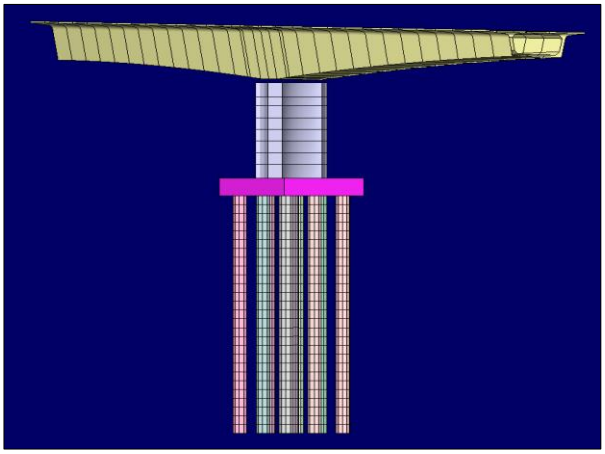
- Steel, reinforced concrete, prestressed concrete or composite bridges
- Box-girder bridges,
- Cable-stayed, suspension, arched bridges or bowstring...

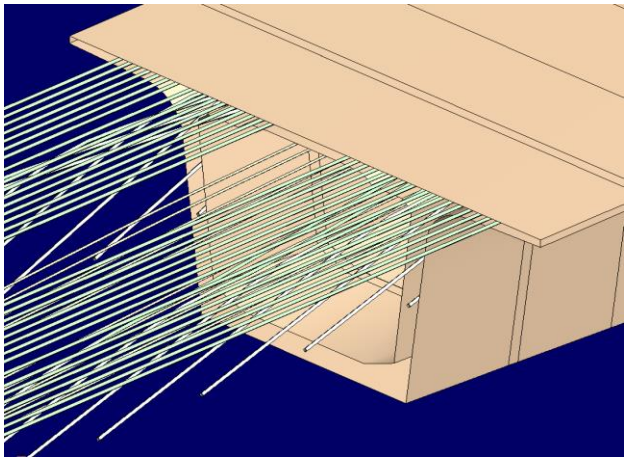
Model definition

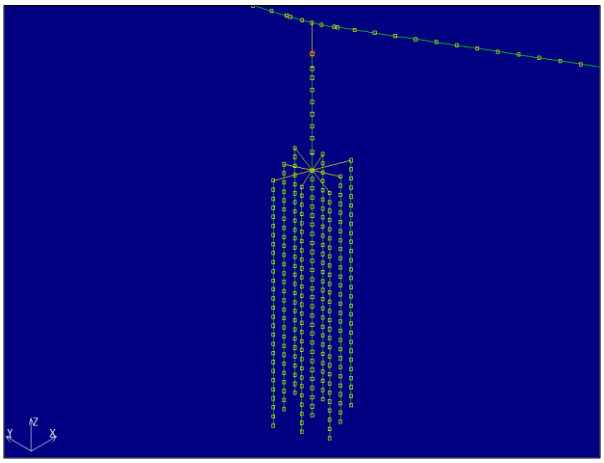
Geometric model

- Cross sections positioned in space
- Pre-stressing layout
- Reinforcing layout

PCP computes the characteristics of the corresponding beam model, relations between forces, normal stresses and shear stresses according to the thin-walled theory.

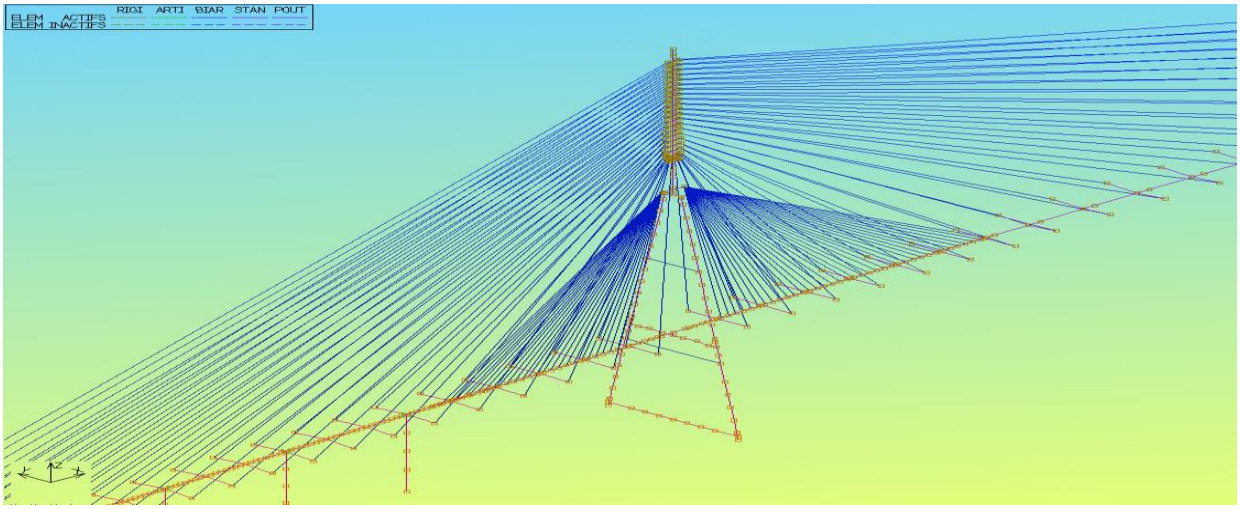






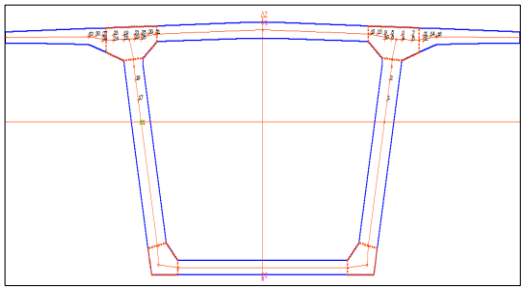
Structural model definition (full or partial)

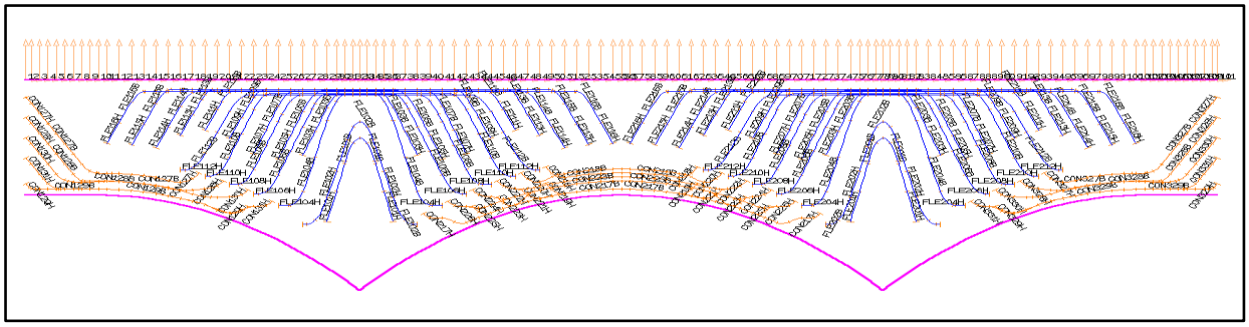
- Sections, inertia, twist center
- Model nodes
- Supports
- Hinges

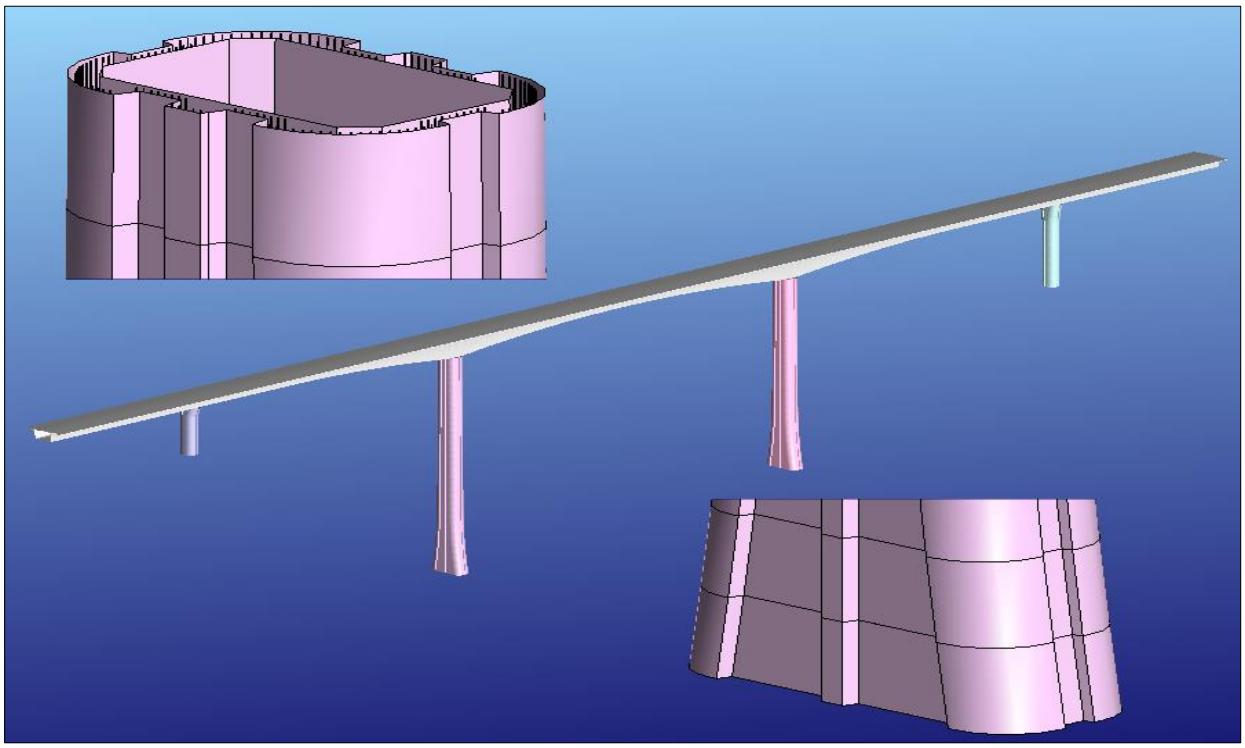


Data graphical checking

- Formwork drawing
- Pre-stressing and reinforcing drawing
- DXF output
- VRML output of the geometric model
- Structural model







Building simulation

Building methods

- With formwork
- Launching
- Balanced cantilevering
- Cable-stayed (temporary or permanent)

And all combinations of these methods.

→ Study of Iroise bridge with creep, launching and staying

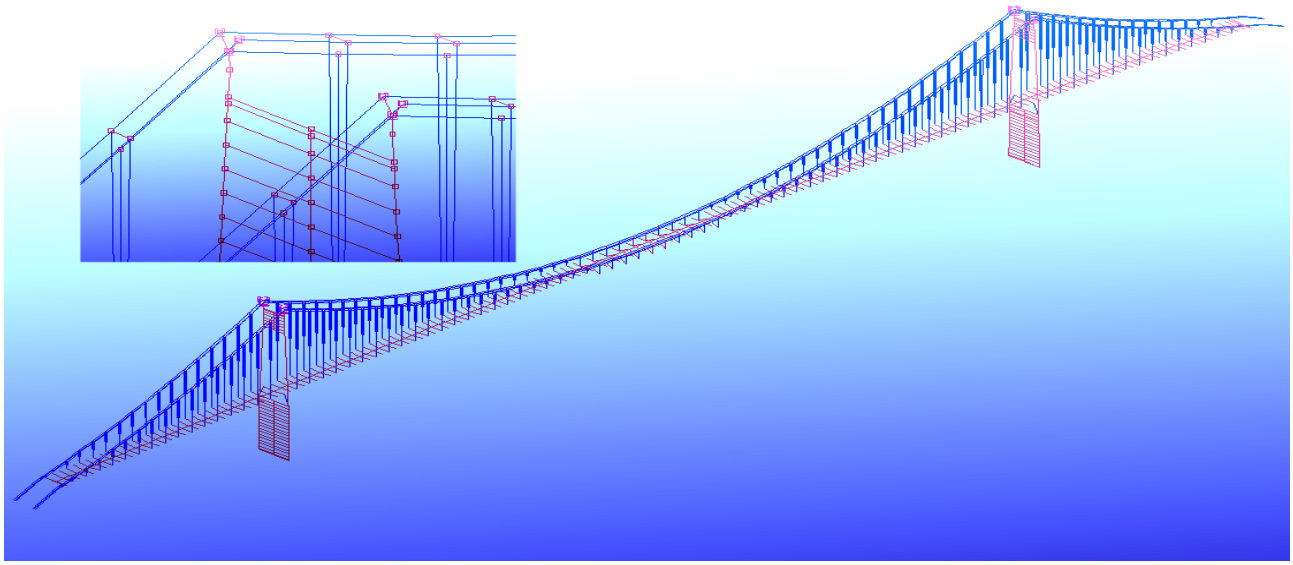
→ Study of Tage bridge with cantilevering by temporary staying and permanent staying

Delayed phenomena and their interactions

- Creep and shrinkage of concrete with French and European regulations
- Steel relaxation
- Creep redistribution of forces in the structure

→ Study of the Meaux bridge launching taking account of the concrete creep

→ Study of the Rhin bridge with European creep law



- Material non-linearity:
  - concrete law: parabola rectangular, Sargin, BPEL, EC2
  - steel: linear or elasto-plastic laws
- Geometric non-linearity with large displacements and rotations
- Linear and non linear buckling
- Creep, material non linearity and geometrical non linearity interaction
- Non linear study of stayed and suspended bridges

→ Study of nonlinear buckling of Colagne piers

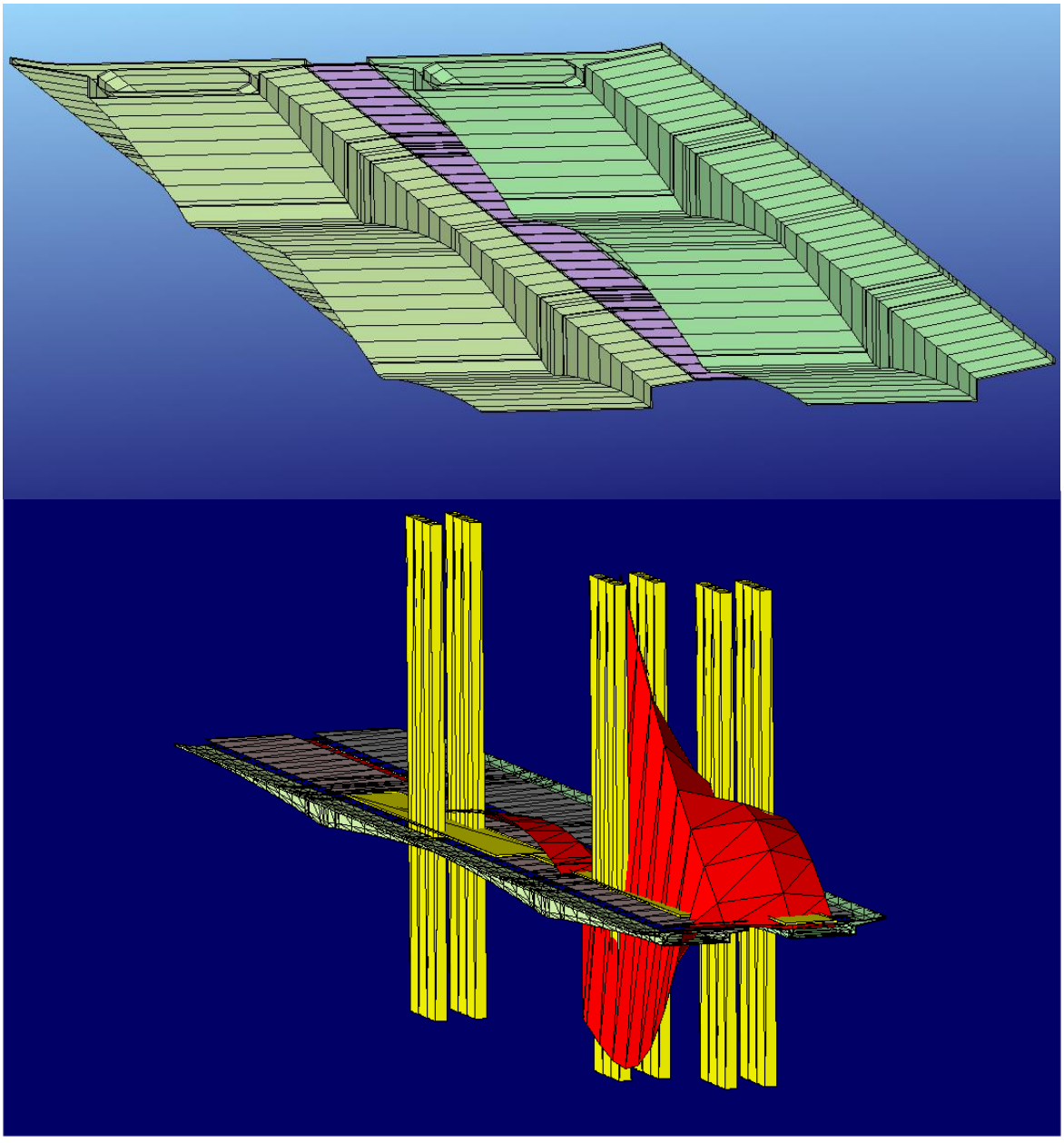
→ Replacement of main cables of Tancarville suspended bridges with full process simulation

Operating loads

- Influencing area of single beam or complex frame supporting the loads
- Maximal forces, displacements, normal stresses, shear stresses and reactions at supports
- Vertical and horizontal loads
- Codes loads: French code, Eurocodes
- General loads defined by the user

→ Study of Meaux bridge with European loads.

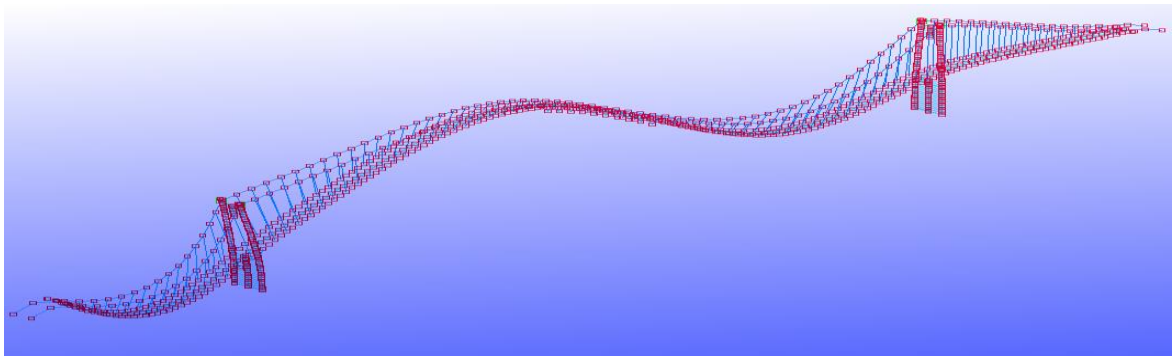
→ Double box-girder study with a global influencing area.



Modal dynamic analysis

Classical analysis

- Modal analysis with tangent rigidity
- Calculus of modal damping for composite structures
- Calculus of modal parameters: generalized mass, participation factor …



Seismic spectrum analysis

- Response spectrums: AFPS, Eurocodes
- Response spectrums defined by the user
- CQC or SRSS combination method
- Calculus of local or global equiprobable maximal loads[1]
- Data output for CDS software

→ Seismic study of Rhin bridge.

Spectrum analysis of buffeting wind

- Defining spectrum characteristics of wind
- Defining of stationary aerodynamic factors
- Calculus of the aerodynamic damping
- Calculus of the inter-modal correlation factors and combination of the modal responses
- Calculus of local or global equi-probable maximal loads
- Data output for CDS software

→ Wind study of Verrieres bridge.

[1] According to the book *Calcul dynamique des structures en zone sismique*, Alain CAPRA et Victor DAVIDOVICI, Editions Eyrolles

Step by step dynamic analysis[2]

General analysis

- Impacts loads
- Material breaks
- Moving loads
- Harmonic loads
- Earthquake loads
- Nonlinear dumping
- Linear or no linear analysis
- Cyclical elastoplasticity: classic or Takeda

→ Rupture of the suspender of Aquitaine bridge.

Analyse stochastique du vent turbulent

- Synthetic wind generation according to spectral characteristics
- Checking of the wind characteristics
- Possible dampers
- Several wind generations
- Linear or No linear analysis

→ Wind study of Colagne bridge

[2] According to the book *Calcul dynamique des structures en zone sismique*, Alain CAPRA et Victor DAVIDOVICI, Editions Eyrolles

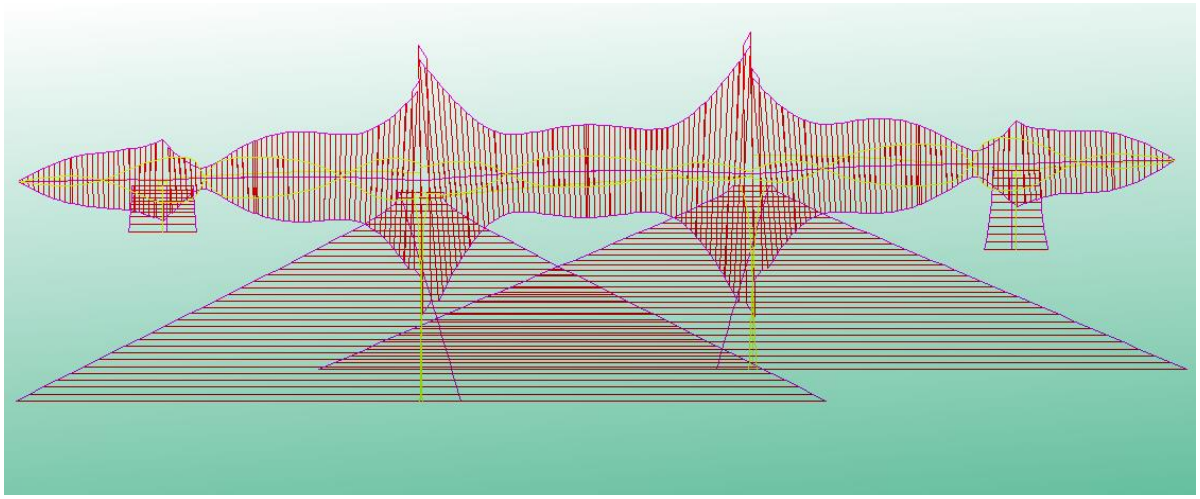
Results process

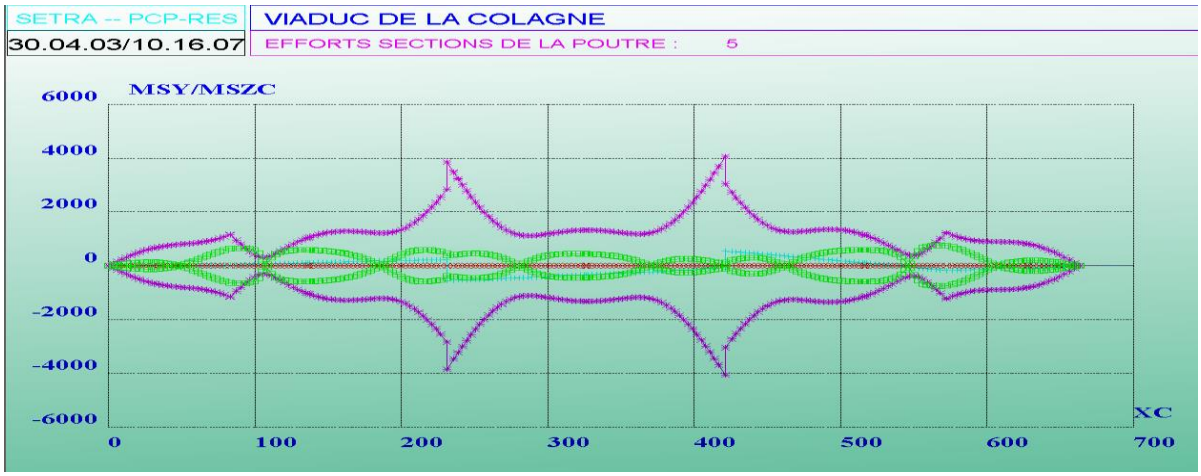
Études réglementaires

- Weighting forces and stresses
- Linear or quadratic combination of results
- Checking stresses
- Calculating reinforcement
- Output for CDS software

Post traitement graphique des résultats

- Data plotted on structure
- Charts of data
- Influency areas
- Output of spreadsheets
- Mobile loads location

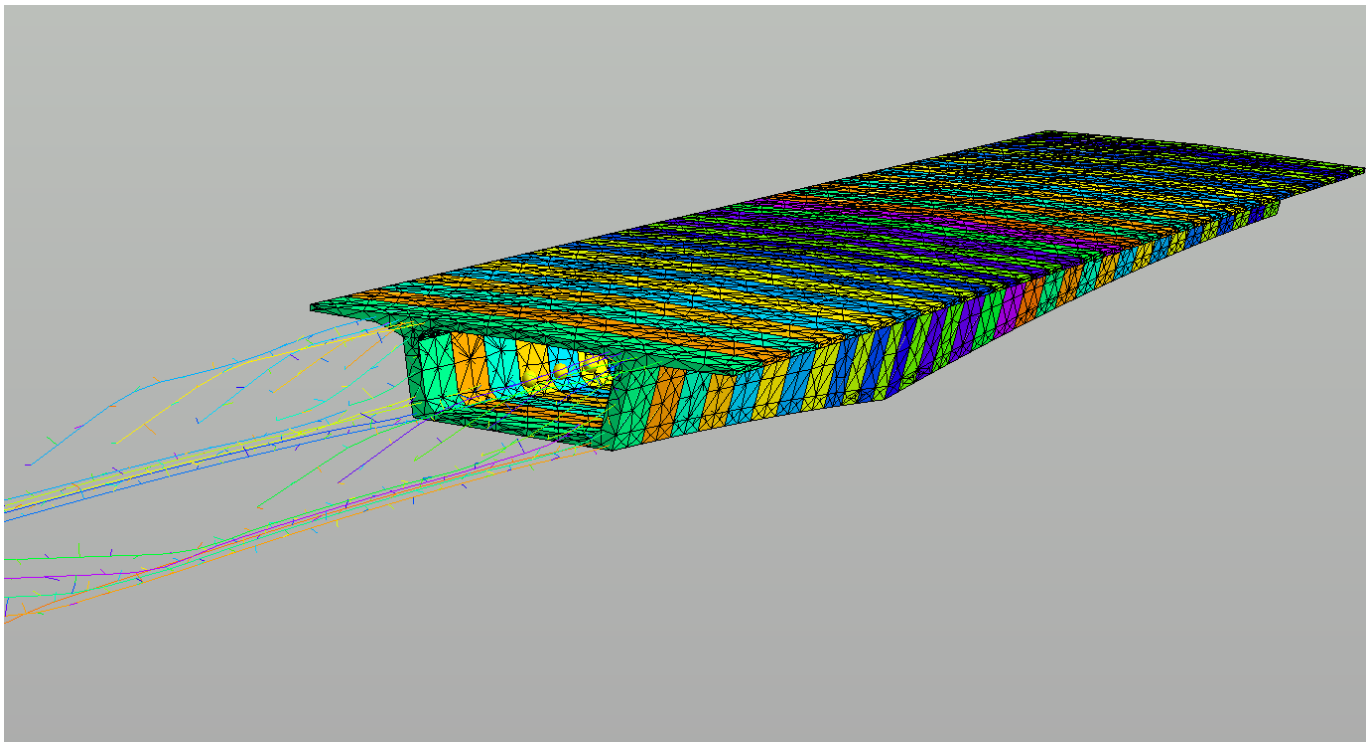




1.1 Study on a finite elements computation software

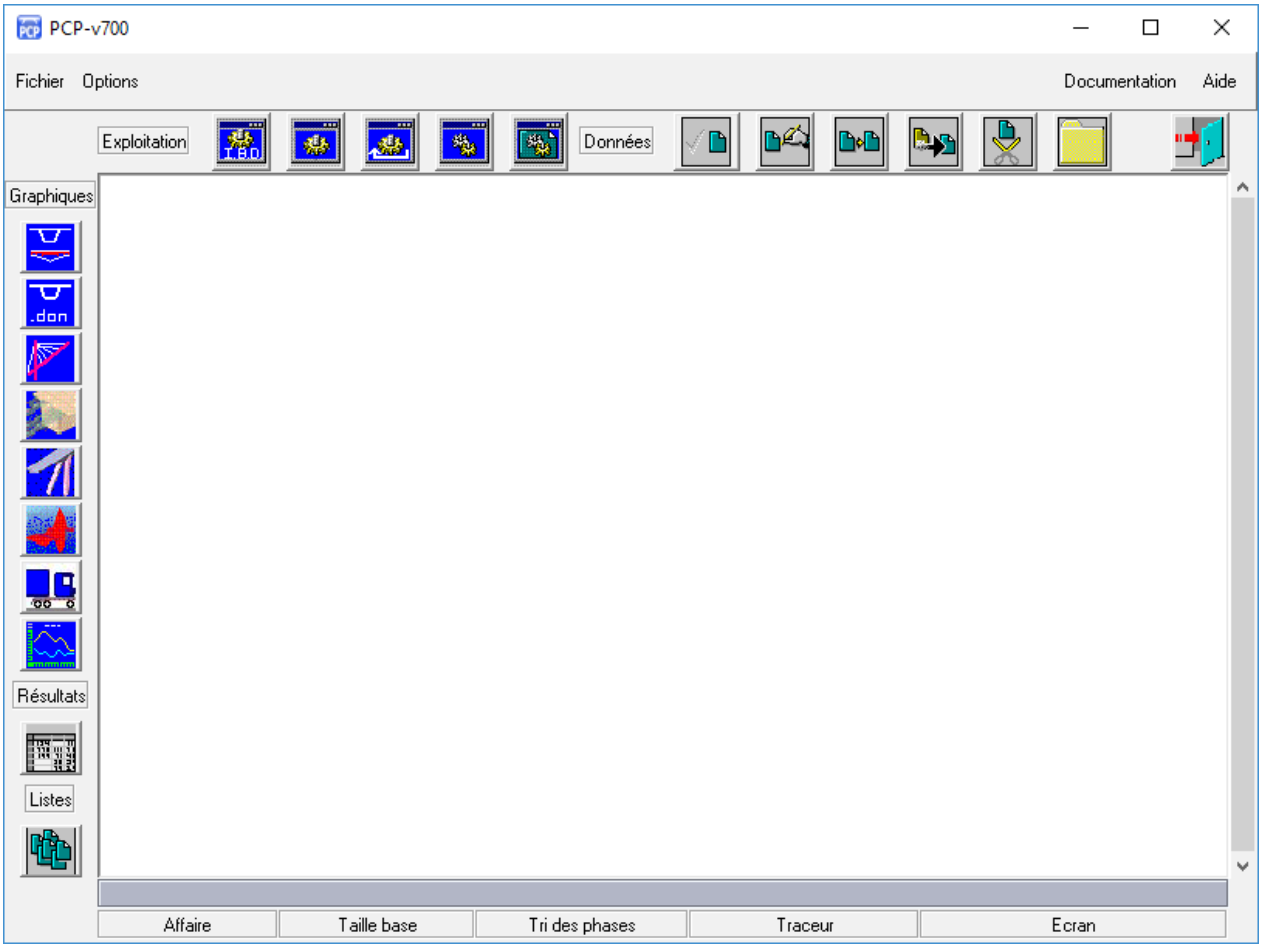
PCP provides the possibility to proceed with a study on a finite elements computation software, without having to redefine the geometric model. The following files are generated when requested by the user:

- A mesh file with linear, surface or volume elements
- A command file (specific to Code_Aster)



UI and data input

- Programs launching by UI
- Input by files with high level data
- Input by spreadsheet
- Several projects managing
- PDF user guide integrated
- UI and user guide available in French and English


PCP-v700
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Options
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Exploitation
Données
Graphiques
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Résultats
Listes
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Prices

Please refer to our website:

http://www.setra.fr/html/logicielsOA/LogicielsOA/tarifs.html

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