

Design, mechanical optimization and digital fabrication of reinforced concrete beams.

Reinforced concrete construction is sometimes compared to craftsmanship in the sense that many tasks remain essentially manual. Heavy and time-consuming site activities have a direct impact on the design of the elements, oversizing and the risk of manufacturing errors. It is clear that reinforced concrete will nevertheless remain in use in the years to come. Minimizing the environmental impact of structures built with this material means minimizing quantities, optimizing its use, but certainly also having a more ambitious vision, taking into account the reversibility of our actions, for example the demountability and possible reuse.

Several works are going in this direction in the Navier laboratory and in relation with the digital construction platform Build'In of the Ecole des Ponts.

The work to do is part of this context and on parametric precasting in reinforced concrete. New techniques, robotics and software development are at the heart of the subject, for reinforcement, assemblies, handling, mass-customization, tracing and quality control. The work also concerns the development of original mechanical optimization methods based on ultimate state behaviour with consideration of two materials, steel/concrete, and the different tensile and compressive behaviour of concrete, making the problems non-linear.

The main deliverable of the PhD should be a demonstrator of a concept and a specification of a potential industrialization.