# CIVIL ENGINEERING

MASTER

**EPFL**

© Alexandre Gonzalez

Master students learn how to design, construct and maintain the diverse and complex infrastructures which shape our world: buildings, civil engineering structures, roads, railway networks, systems for the exploitation and transportation of water, materials, or energy.

Our master's degree in civil engineering allows students to perfect their fundamental knowledge, while specialising in one of the four proposed programmes:

structural engineering, hydraulics and energy, geotechnics, and transport and mobility.

It makes them capable of expressing themselves through projects that are innovative and safe, which must be achieved within increasingly demanding financial and environmental sustainable conditions.

# Designing a floating marina for Lake Geneva

Seeking an innovative way to address the lack of docking sites for leisure boats on Lake Geneva, Jamani Caillet drew the blueprint for a floating marina that offers up to one hundred additional mooring sites. Its location and its unusual construction and use set unique demands on its structure and design. An analysis of the hydrodynamic conditions of Lake Geneva confirmed the feasibility of the marina's structure. The above-water component, built on hollow re-enforced concrete casings that are connected with pre-stressing cables, is designed to accommodate the moorings, walkways for users, and the temporary storage of materials. The underwater component stabilizes the structure and, most importantly, protects the marina's inside from waves, keeping the boats out of harm's way. A metal framework lined with tree trunks acts as a breakwater, keeping waves to a minimum.

The floating marina can be accessed by shuttle boats. The innovative structure challenges previous approaches, while its implementation and construction must be conceived with the protection of the lakefront in mind.
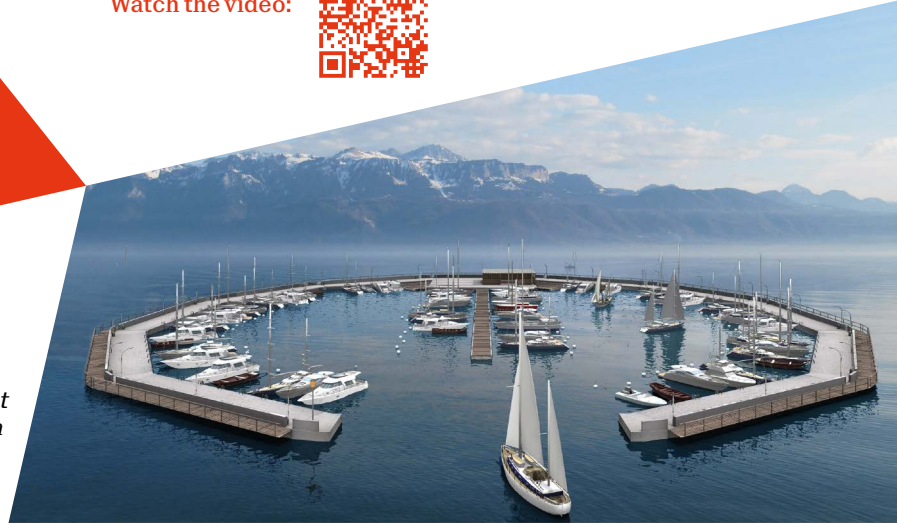
**Watch the video:**

*Olivia Künzli:*
*"If you are looking for a dynamic and international atmosphere, you should come to EPFL. And more specifically about civil engineering: I feel that the program is special because technical skills are here very closely related to creativity."*

**Watch the video:**

*Jamani Caillet's project for a Lake marina*

# Historical study on the Jument lighthouse and proposals for intervention

The Iroise Sea, at the most western point of Brittany, is known for its violent storms and deadly shipwrecks. Since 1853, when the mapping of the French coasts began, marine navigation in the area has become much safer. However, for close to a century, navigators only had the lights from the lighthouses as landmarks to guide them in the open sea. With the development of GPS navigation systems and the automation of lighthouses, the state of these structures has deteriorated rapidly, especially in the case of the Jument lighthouse.
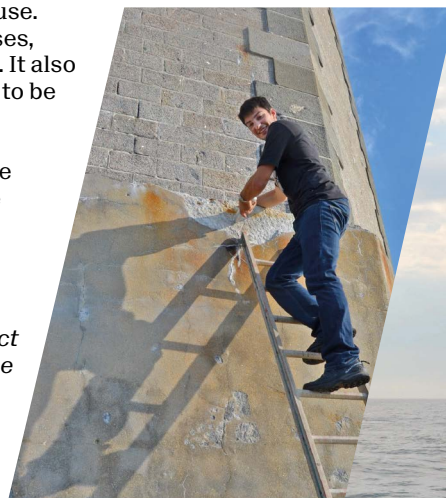
This project has permitted us to view a century old structure with a new regard, combining a historical study and numerical modeling. A 3D finite element model has been developed, taking into account the different structural reinforcements that have been made since the initial construction. The model has been submitted to impact forces resulting from breaking waves striking the lighthouse. The dynamic non-linear analysis was completed in phases, allowing the history of damage to the masonry to be retraced. It also enabled a scheme of the current state of cracking in the structure to be obtained.

*Benaboud Haroun:*
*"The Master's degree in civil engineering gives a perfect background in both theory and practice. I could work on projects in the seismic design field using the advanced numerical modeling application in a lab at EPFL. I also worked in a real estate project for a couple of months. This allowed me to see the broad career opportunities offered to civil engineers."*

It is a challenge to find economic solutions for structures that will be submitted to such climatic conditions. The Ultra-High Performance Fibre Reinforced Concrete (UHPFRC), due to its outstanding mechanical and corrosion resistance, will certainly become the reference material for reinforcing such maritime structures in the future.

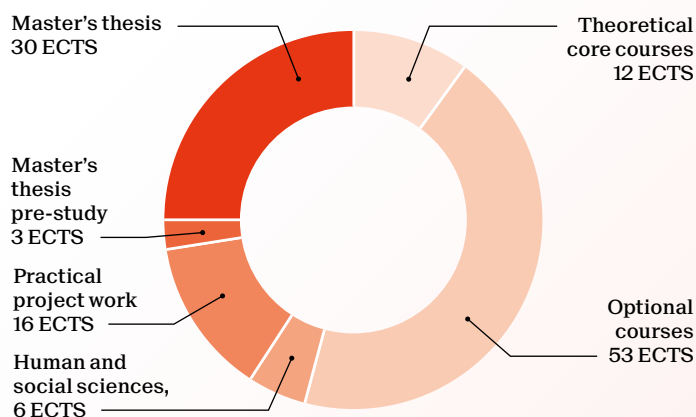*Christophe Loraux's master project at the Jument lighthouse*

Master of Science in
# CIVIL ENGINEERING

2-year program - 120 ECTS



Master's thesis
30 ECTS

Master's thesis pre-study
3 ECTS

Practical project work
16 ECTS

Human and social sciences,
6 ECTS

Theoretical core courses
12 ECTS

Optional courses
53 ECTS

The program includes an 8-week compulsory internship

Students may choose to pursue a 30 ECTS specialization:
B Geotechnical Engineering
C Transportation and Mobility
D Structural Engineering
E Hydraulic Engineering and Energy

Or a 30 ECTS Minor:
- Computational Science and Engineering
- Integrated design, Architecture and Sustainability (IDEAS)
- Energy
- Management, Technology and Entrepreneurship
- Urban Planning and Territorial Development

A specialization or Minor is included in the 120 ECTS credits.

The EPFL civil engineering academic performances are top-rated at the international level. Its master curriculum is widely recognized for the high quality of its training and offers very good perspectives of professional insertion.
The increased demand in Switzerland for highly qualified engineers in the civil engineering sector provides excellent career prospects for our students. Civil engineering consulting firms, state administrations and construction companies all benefit from hiring our graduates. Furthermore, the scientific skills and the versatility of our engineers also allow them to pursue very diverse professional activities. Whatever path you choose, you will collaborate with numerous partners from the domains of architecture, environment, sociology, economy, energy, or politics. The know-how of the Swiss civil engineers is very well respected abroad, which also opens the door to an international career.

School of Architecture, Civil and Environmental Engineering
go.epfl.ch/master-civil-engineering
Contact: sgc@epfl.ch

| Course | Specialization | | | | Credits |
|---|---|---|---|---|---|
| **Theoretical core courses (4 courses to be chosen)** | | | | | **12** |
| Building energetics | | | | | 3 |
| Dynamique des structures | | | D | | 3 |
| Fundamentals of traffic operations and control | | C | | | 3 |
| Geomechanics | B | | | | 3 |
| Ouvrages hydrauliques et aménagements hydroélectriques | | | | E | 3 |
| **Optional courses** | | | | | **53** |
| Computational geomechanics | B | | | | 3 |
| Energy geostructures | B | | | E | 3 |
| Engineering geology for geo-energy | B | | | | 3 |
| Géologie de la construction et de l'environnement | B | | | E | 3 |
| Geophysics for engineers | B | | | | 3 |
| Innovation for Construction and the Environment | B | C | D | E | 2 |
| Slope stability | B | | | | 3 |
| Travaux souterrains | B | | | E | 3 |
| Advanced continuum mechanics | B | | D | | 3 |
| Nonlinear analysis of structures | | | D | | 3 |
| Programming concept in scientific computing | B | | | | 4 |
| Selected topics in mechanics of solids and structures | B | | D | | 3 |
| Advanced composites in engineering structures | | | D | | 3 |
| Advanced design of concrete structures | | | D | | 3 |
| Conception des constructions en bois | | | D | | 3 |
| Matériaux et structures | | | D | | 3 |
| Structure et architecture | | | D | | 3 |
| Structures complexes | | | D | | 3 |
| Structures en béton, chapitres choisis | | | D | | 3 |
| Structures en métal, chapitres choisis | | | D | | 3 |
| Advanced steel design | | | D | | 3 |
| Ponts en béton | | | D | | 3 |
| Seismic engineering | B | | D | E | 3 |
| Structural stability | | | D | | 3 |
| Structures existantes, bases | B | | D | E | 3 |
| Structures existantes, chapitres choisis | B | | D | E | 3 |
| Barrages et ouvrages hydrauliques annexes | B | | D | E | 3 |
| Éco-morphologie fluviale | | | | E | 3 |
| Hydraulique fluviale et aménagement des cours d'eau | B | | | E | 3 |
| Ondes de crue et de rupture de barrage | | | | E | 3 |
| Urban hydraulic systems | | | | E | 3 |
| Économie hydraulique | | | | E | 2 |
| Modélisation des systèmes énergétiques | | C | | E | 3 |
| Planification intégrée des infrastructures d'énergie | | | | E | 3 |
| Thermodynamics of comfort in buildings | | | | E | 3 |
| Decision-aid methodologies in transportation | | C | | | 4 |
| Deep Learning for self-driving cars and beyond | | C | | | 4 |
| Infrastructures de transport I | B | C | | | 3 |
| Infrastructures de transport II | B | C | | | 3 |
| Transport economics | | C | | | 3 |
| Villes et transports | | C | | | 3 |
| Analyse et gestion de risques | B | | D | E | 3 |
| Analyse et management des risques industriels | | | | | 3 |
| Droit de la construction pour ingénieurs I | B | | D | E | 2 |
| Droit de la construction pour ingénieurs II | B | | D | E | 2 |
| Esthétique des ouvrages de génie civil | | | D | | 2 |
| Études d'impact | B | | | E | 3 |
| Indoor air quality and ventilation | | | | | 4 |
| Management de projet et analyse du risque | | C | | | 4 |
| Sustainable Logistics Systems | | C | | | 3 |
| Public Transportation Systems | | C | | | 3 |
| **Human and social sciences** | | | | | **6** |
| Project in human and social sciences | | | | | 6 |
| **Practical project work** | | | | | **16** |
| Laboratoire GC | | | | | 4 |
| Projet ENAC ou UE architecture | | | | | 4 |
| Projet de construction | | | | | 4 |
| Projet de systèmes civils | | | | | 4 |
| Summer Workshop | | | | | 4 |
| UE génie civil: Construction durable | | | | | 4 |
| **Master's thesis pre-study** | | | | | **3** |
| Pré-étude projet de master | | | | | 3 |