

# Master's Project Opportunity: Parametric Optimization of Ribbed Slab Systems

EPFL, Structural Concrete Laboratory (CONSTRUCT)

## Supervisors

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## Project Overview

The Structural Concrete Laboratory (CONSTRUCT) at EPFL is offering an exciting master's project. This project focuses on optimizing the design of reinforced concrete (RC) ribbed slab systems. The goal is to find the best design parameters to reduce CO<sub>2</sub> emissions while maintaining strong and reliable structures under various conditions.

## Project Goals

### 1. Parametric Optimization

Explore and refine various design parameters, such as:

- Rib width and depth, topping layer thickness, and rib spacing
- Reinforcement ratio, configuration, and detailing
- Rib orientation and alignment
- Dimensions of main beams, etc.

### 2. Boundary Conditions and Load Scenarios

- Study how different boundary conditions and load configurations affect the performance of ribbed slabs.
- Develop simulation models to mimic real-world conditions and their impact on slab design.

### 3. Minimizing CO<sub>2</sub> Emissions

- Implement strategies to reduce CO<sub>2</sub> emissions through optimized design practices.
- Ensure a balance between thorough analysis and practical feasibility for sustainable and effective design solutions.

# Methodological Approach

## Literature Review

Conduct a thorough review of current research on ribbed slab systems, optimization techniques, and sustainability.

## Model Development

Create parametric models that include various design parameters, boundary conditions, and load configurations.

## Optimization Techniques

Use different optimization methods, like Genetic Algorithms (GA) or Particle Swarm Optimization (PSO), to find the best design solutions.

## Simulation and Analysis

Perform simulations to evaluate the performance of optimized slab designs under different conditions. Assess both the structural performance and CO<sub>2</sub> emissions of these designs.

## Environmental Impact Assessment

Conduct detailed assessments to measure the CO<sub>2</sub> emissions of various slab designs.

## Validation

Validate the optimized designs using analytical methods and, if possible, experimental tests.

## Expected Deliverables

- Optimized design parameters for RC ribbed slab systems that reduce CO<sub>2</sub> emissions while ensuring structural integrity.
- Insights into how different boundary conditions and load scenarios affect ribbed slab optimization.
- Robust optimization models and algorithms for real-world construction applications.
- Guidelines for sustainable design practices in reinforced concrete ribbed slabs.

## Candidate Profile

- Strong background in structural engineering and concrete design.
- Proficiency in programming languages like Python or MATLAB.

- Interest in optimization algorithms and environmental impact assessments.
- Strong analytical and problem-solving skills.
- Passion for sustainability and reducing the environmental impact of construction.

## **How to Apply**

To apply, please send a short cover letter and your academic transcripts to Ahmad Majdoub at:

Email: [ahmad.majdoub@epfl.ch](mailto:ahmad.majdoub@epfl.ch)

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