

## Masterarbeit (MA)

### AI based optimisation of mortar and concrete containing recycled concrete fines and aggregates

#### Background/Problem:

The construction industry faces growing pressure to reduce its environmental impact, particularly the high CO<sub>2</sub> emissions associated with cement production and the depletion of natural aggregates. At the same time, large volumes of concrete waste are generated from demolition activities, much of which is downcycled or landfilled. Recycled concrete aggregates (RCA) and recycled concrete fines (RCF) offer a promising pathway toward more sustainable mortar and concrete, especially for road pavement applications where large material volumes are required. However, the use of RCA and RCF can negatively affect fresh and hardened properties due to their higher porosity, variability, and weaker interfacial zones. In addition, partial replacement of cement with supplementary materials such as slag, limestone, and RCF of different fineness levels alters hydration and strength development. A systematic optimisation of mix design is therefore needed to achieve acceptable fresh properties and mechanical performance while maximising recycled content and reducing carbon emissions. At KIT-IMB/MPA numerical modelling and digitalization research group, we have developed a novel AI-based framework that can guide experimentalists toward achieving this optimization goal in a systematic and targeted manner



#### Objectives:

- To optimise mortar and concrete mix designs incorporating recycled concrete aggregates, recycled concrete fines, slag, and limestone for compressive and flexural strength using the already developed AI-driven tool.
- To evaluate the fresh concrete properties and mechanical performance of optimised mixes for road pavement applications.

#### Learning and skill development:

The student will gain hands-on experience in the utilization of AI for sustainable concrete mix design, material characterisation, mechanical testing, and performance-based optimisation of recycled construction materials.

#### Kontakt

Für nähere Informationen und weitergehende Fragen wenden Sie sich bitte an:

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