

## RESEARCH INTERNSHIP - MASTER

Academic year 2024-2025

<b>Title</b>	<b>Use of treated recycled concrete fines in the formulation of printable low-carbon inks</b>
<b>Description and Objectives</b>	<p>3D printing is an increasingly popular construction technique. The process, a type of additive manufacturing, involves extruding multiple layers of cementitious material on top of each other until the design is made. Architectural innovation, design flexibility, adaptability to site constraints, speed and efficiency, are the main advantages that can be cited for this process. However, a basic type of printable cementitious material is basically Portland cement. Although this cement has suitable properties both in the fresh and hardened state, it has a significant environmental impact when used in large quantities. To minimize this impact, mineral additives and industrial by-products are used to replace Portland cement. Among these additions that can be used are recycled concrete fines. These fines influence the properties of the cementitious material in the fresh and hardened state as well as the rheological properties. They have high absorption due to the porosity of the adherent hardened old mortar content. The new standard NF EN 197-6 authorizes the use of recycled fines in the cement composition.</p> <p>In this study, the cement will be partially replaced by recycled fines. In order to improve the properties of these fines, they will be treated by grinding and/or thermally before their use in inks. The influence of the treated fines on the properties of the printable ink will be investigated by varying the substitution rate as well as their hydraulic reactivation.</p>
<b>Required skills</b>	Bac + 5, knowledge in materials sciences in Civil Engineering and construction, skills in physico-chemistry of construction materials, preferably with knowledge of cementitious materials and a strong interest in additive manufacturing will be a plus. Taste for experimentation and interpersonal skills allowing him to work in a team.
<b>Internship supervisors</b>	<p>Eliane Khoury (ESTP Paris) <a href="mailto:ekhoury@estp.fr">ekhoury@estp.fr</a></p> <p>Céline Florence (ESTP Paris)</p> <p>Sébastien Rémond (Lamé Polytech Orléans) <a href="mailto:sebastien.remond@univ-orleans.fr">sebastien.remond@univ-orleans.fr</a></p>
<b>Laboratories</b>	The internship will take place at ESTP in Cachan as part of the Concrete Engineering Chair and at Polytech d'Orléans-Laboratoire LaMé in Orléans.
<b>Duration</b>	6 months from January/February 2025
<b>Gratification</b>	800 € net/month + reimbursement 65% transport tickets and restaurant tickets
<b>Application file</b>	<ul style="list-style-type: none"> <li>- File to be sent by email to one of the internship supervisors indicated above under the reference "ESTP LaMé internship"</li> <li>- Creation of the application file: CV, academic results and any other element likely to enhance your application</li> </ul>