# Mathematical programming approaches for optimizing horizontal collaboration in the freight transport sector

**Scientific context**

The logistics sector contributes significantly to greenhouse gas emissions. The ACME project aims to reduce these emissions by promoting horizontal collaboration among industry stakeholders. For instance, companies with insufficient individual freight volumes can collaborate to jointly reserve and operate regular rail freight services, optimizing resources and lowering environmental impact.

In this internship, we study these cooperations from a mathematical programming perspective.

**Expected work**

The objective of the internship is twofold. First, the aim is to identify an appropriate mechanism for allocating benefits across the members of a given coalition. Second, based on this mechanism, it aims to provide mathematical programming-based methods for solving large-scale instances of mutualized scheduled service network design.

The internship can be a step toward a PhD thesis (funded by the project).

**Keywords:** operations research, mixed-integer linear programming, decomposition methods, large-scale combinatorial problems, heuristics, game theory

**Duration:** six months

**Location:** Bordeaux

**Supervisors**: François Clautiaux (Université de Bordeaux), Axel Parmentier (École Nationale des Ponts et Chaussées)

**Skills:** integer linear programming, combinatorial optimization, programming

**Project ACME**

The internship takes place within the ACME project, funded by the France 2030 program, PEPR MOBIDEC. This project is a collaboration between École des Ponts, the University of Bordeaux, Inria Grenoble, and Toulouse School of Economics.

**Bibliography**

T. G. Crainic and W. Rei, 50 years of Operations Research for the tactical planning of consolidation-based freight transportation, *EURO Journal on Transportation and Logistics* 14 (2025), 100157

M. Hewitt, T. G. Crainic, M. Nowak, and W. Rei, Scheduled service network design with resource acquisition and management under uncertainty, *Transportation Research Part B: Methodological* 128 (2019), 324–343.

S. Lozano, P. Moreno, B. Adenso-Diaz, and E. Algaba, Cooperative game theory approach to allocating benefits of horizontal cooperation, *European Journal of Operational Research* 229 (2013), no. 2, 444–452.