

# Post-doctoral OR research Engineer position – 12 months extendable to 24 months

**Title** Study and Evaluation of the Contribution of Generative AI Tools to the Analysis of Railway Safety Assessment Cases

**Location** Univ-Eiffel – Lille Campus – COSYS/ESTAS, France

**Online subject** <https://estas.univ-gustave-eiffel.fr/nous-rejoindre>

## Information

- The application (resume, cover letter) has to be addressed by e-mail as soon as possible to : [mohamed.ghazel@univ-eiffel.fr](mailto:mohamed.ghazel@univ-eiffel.fr), [abderraouf.boussif@univ.eiffel](mailto:abderraouf.boussif@univ.eiffel), [jorge.mariano@univ-eiffel.fr](mailto:jorge.mariano@univ-eiffel.fr)
- Type of contract : fixed-term contract of 12 months extendable to 24 months
- Gross salary : 2 500 € / months
- Starting date : as soon as possible

## Host laboratory

Université Gustave Eiffel is a French multidisciplinary university of national importance. Since the 1st of January 2020 this new institution has brought together a university (UPEM), a research institute (Ifsttar), a school of architecture (Éav&t) and three engineering schools (EIVP, ENSG and ESIEE Paris).

The ESTAS laboratory (Evaluation and Safety of Automated Transport Systems) of the COSYS department (Components and Systems) develops methods, techniques and tools intended to help analysing the safety of guided transport systems. The finalized research, which is one of the main features of ESTAS, finds its foundations in the synergy between applied research and feedback from expertise and technical assistance activities in the field of guided transport systems.

## Details

This position is part of the "Safety Assessment of Railway Systems" axis of the "Safety of Railway Systems" Chair. The latter is supported by CERTIFER Association and GAPAVE, a grouping that includes several actors in the railway field : operators, manufacturers and independent safety assessors.

## Context and objectives

Generative AI (GenAI), leveraging techniques like Large Language Models (LLMs), shows interesting capability in analysing and generating coherent content from extensive datasets, driving advancements in managing complex documents. These technologies intend to automate tasks such as document review, quality assessment, and compliance analysis, etc. By simplifying regulatory compliance and improving efficiency, GenAI may significantly enhance the handling of large and complex documentation processes. The safety engineering community has shown increasing interest in integrating GenAI/LLM into processes for analysing, evaluating, and demonstrating system safety. Indeed, GenAI/LLM tools have the potential to help automating some complex safety tasks such as analysing hazards, generating safety models (e.g., fault trees or cause-and-effect diagrams), by leveraging historical data and normative knowledge bases. Furthermore, GenAI/LLM tools can facilitates the creation of safety assurance models, such as Goal Structuring Notation (GSN) frameworks.

Motivated by recent advances in research and practical applications of GenAI/LLMs, we propose in this position to explore the potential of these tools for possible integration into the evaluation processes of railway safety documents and cases, as well as railway certification activities conducted by Certifer. Specifically, the primary objective of the work is to assess to what extent GenAI/LLMs methods and tools can be integrated into railway safety evaluation processes. This involves identifying tasks that could benefit from automation and determining how these technologies can assist inspectors and evaluators in their work.

## Work description

In collaboration with the project team members, the selected candidate will be involved in the following tasks :

### State of the Art

This task involves conducting a literature review to identify existing GenAI/LLM methods and tools, specifically those related to the automation of document evaluation processes, compliance assessment, as well as requirements management and verification. The main objective is to catalog the most suitable tools, methodologies, and features for the analysis and evaluation of railway safety documents and cases, drawing on examples from related sectors such as aviation or automotive.

### Needs Analysis

This task involves analyzing the regulatory framework for railway safety, as well as the evaluation and certification processes used by Certifer, to identify activities and tasks where GenAI could be effectively integrated. The objective is to determine whether certain tasks can be fully automated or if GenAI can serve as an interactive support for evaluators. This analysis will also include a survey of Certifer's specific needs for integrating generative AI tools into their internal practices to ensure efficient and relevant adoption of these technologies.

### Case Study

This final task is a feasibility study on the practical use of GenAI tools in the analysis of railway safety assessment documents. In this context, tools dedicated to document review will be evaluated on a set of safety assessment documents to measure their real contribution to this process. This work will be conducted in collaboration with a qualified railway safety evaluator, whose feedback will be essential for assessing the relevance and effectiveness of the results produced by generative AI. This task will validate the applicability of these tools in real-world situations and gather feedback on their practical application in real certification contexts.

## References

Some references indicating potential directions for currently identified work.

- S. BHATIA et al., *Verified Code Transpilation with LLMs*, 5 juin 2024. DOI : [10.48550/arXiv.2406.03003](https://doi.org/10.48550/arXiv.2406.03003). arXiv : [2406.03003](https://arxiv.org/abs/2406.03003) [cs]
- M. S. PATIL, G. UNG et M. NYBERG, *Towards specification-driven LLM-based generation of embedded automotive software*, 20 nov. 2024. DOI : [10.48550/arXiv.2411.13269](https://doi.org/10.48550/arXiv.2411.13269). arXiv : [2411.13269](https://arxiv.org/abs/2411.13269)
- T. VIGER et al., « Supporting assurance case development using generative AI, » **presented at SAFE-COMP 2023**, Position Paper, 19 sept. 2023
- H. CHENG et al., *Generative AI for requirements engineering : A systematic literature review*, 10 sept. 2024. DOI : [10.48550/arXiv.2409.06741](https://doi.org/10.48550/arXiv.2409.06741). arXiv : [2409.06741](https://arxiv.org/abs/2409.06741) [cs]

## Candidate profil

### Preferred Qualifications

- Engineering degree or Ph.D. in artificial intelligence, systems engineering, or a related field.
- Experience or knowledge in the railway sector or transportation field (aviation, automotive).
- Publications or projects demonstrating the ability to use AI to solve practical problems.

### Required Qualities

- Analyzing existing work, identify gaps, evaluate opportunities, and propose suitable solutions.
- Following strict research protocols, especially in critical fields like railway safety.
- Willingness to explore new technologies and related domains (aviation, automotive, etc.).
- Designing pragmatic solutions to integrate AI tools into existing processes.

### Technical and Scientific Skills

- Familiarity with generative AI tools and platforms (e.g., GPT, BERT).
- Knowledge of rapid prototyping tools to test AI-based solutions.
- Use of programming libraries for AI and data management (Python, PyTorch, TensorFlow).