Research Topics 2025

The SBB – EPFL Research Initiative offers a broad variety of research topics and questions for projects.
The focus of this research Initiative consists of the following subjects:

- Increasing the flexibility and resilience of the railway system.
- Ensuring the robustness of the railway infrastructure and increasing efficiency and productivity.
- Exploiting the potential of technology and digitalization for integrated mobility.
- Sustainability and circular economy along the entire value chain.

We aim on creating a framework allowing project teams to bring together knowledge and expertise from academia and business. Therefore, we address SBB's needs for research in the list of possible research questions. Whenever a project idea, an expression of interest or proposal is submitted, it should relate to these subjects and create value for both parties equally.

The overview below serves as an inspiration and shall give research teams insights on our current fields of interest as well as challenges we'd like to work on in joint research projects.

Flexible offers and production models

- How to make timetables more robust (resilience, dynamic management)?
- How to design more agile delivery systems to enable real-time demand-driven operations, allowing for example conflict prediction and resolution?
- Methods or approaches to cope with the population and demand growth given capacity restrictions in the future (for example trade-off of building new tracks vs. robustness/quality of existing infrastructure).
- Given the increasing costs of building new infrastructure: novel methods and concepts to develop and improve the rail access and offer, increasing customer's benefit and modal share of public transport.

Resilience and Efficiency

- New service concepts for new assets and how to use automatization to drive maintenance speed up and costs down (data of entire rail asset life cycle, IoT...). Different network types and service model.
- How to reduce/cope with network capacity losses due to construction works or unplanned disruptions?
- What are the effects of climate change and extreme weather events on transport infrastructure and operations, and how can they be adapted to mitigate these effects?
- What is the potential of Artificial Intelligence (large language models to graphic models) to increase resilience and efficiency?

Long-term strengthening of SBB

- How to secure or retain implicit knowledge in a generation change of employees? Especially in the context of artificial intelligence.
- Future investments in infrastructure lead to higher maintenance requirements and costs. How can SBB prepare for increasing maintenance efforts with regard to network stability, punctuality and resource allocation.
- What are alternative financing models for public transport?

Sustainability

- Potentials and Framework conditions to promote the implementation of CO2 capture and storage technologies?
- Achieving improved efficiency and increasing the capacity of energy storage systems?
    - Optimizations and use of the life cycle of various forms of energy storage with new, intelligent systems and models.
- Which existing circular business models (CBMs) from other resource-intense industries can be applied to the challenges at SBB (building construction and civil engineering)?
- How to leverage new technologies and alternative materials to improve the transparency and circularity of SBB assets?

Market Development: Exploring New Potentials and Increasing Modal Split

- Identifying and Exploiting New Market Potentials
    - How can SBB uncover and capitalize on new market potential within the transportation industry?
- Increasing Modal Split for SBB/public transport
- What measures can be implemented to increase the share of sustainable transportation modes (e.g., rail, public transport) in the overall transportation mix?
- Attracting New Customer Segments
- Which untapped customer segments present the greatest growth opportunities for SBB?
- How do demographic changes impact mobility needs in the context of door-to-door mobility?

Customer Experience & Customer Centricity

- Improving Customer Experience; Which new technologies and innovations can be integrated into SBB's operations to enhance the overall customer experience?
- New Methods to measure customer experience and customer satisfaction.
- Enhancing Customer Focus: What organizational changes and cultural shifts are necessary to make SBB more customer-centric?
- Building Stronger Customer Relationships; What strategies can be implemented to build and maintain stronger relationships with customers?

Digitalization and cyber security

- How can we strengthen the security architecture/system to prevent cyber-attacks and ensure customer trust?

Artificial Intelligence

- Coping with real-world data: How can AI algorithms deal successfully with inherently ambiguous, incomplete, redundant or contradictory data sets?
- AI in safety-relevant processes: how can probabilistic methods be applied in safety-relevant processes at the example of SBB's greatest risks?
- AI in public services: what opportunities, risks and strategies arise from the use of AI in public services (service public) in terms of image, trust and perception at the example of public transport?
- What are potential uses of AI along the value chain in public transport?

In case of questions regarding the process or academic aspects please contact: s.lavanchy@epfl.ch
If you wish to **get in touch with SBB** to discuss potential project ideas, please contact forschung@sbb.ch