Annual Report 2024 of the OpenRail Association

Text in italics (such like this) is meant as instructions how to fill the sections. It should be removed before finalising the report.

OpenRail Logo

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Executive Summary

Message of the Chair of the Board

The OpenRail Association Board

Pictures of all board members with name, role in the board, organization and title in their organization

For each board members we would like to have a brief quote about the OpenRail Association. Ideally this alltogether tells a story.

For each board member there is an own file where we collect the respective info and text (`05xx.md`)

We leave the chairs of the TC out here as they have their own page later.

Jochen Decker

Frédéric Novello

Jean-Michel Evanghelou

Nicole Göbel

Brede Dammen

Erik Nygren

Fatima Zohra El Ouerkhaoui

Peter Franken

Open Source for the Railway Sector

Tell the story of what the organization is built for. What does it want to achieve and how do the steps we did in 2024 are the beginning of this effort.

Railways are at the heart of sustainable mobility, and digitalization is shaping the future of our sector. Yet, for too long, railway software has been developed in silos - custom-built, proprietary, and difficult to integrate. The OpenRail Association was founded to change that. Our mission is simple but transformative: **unlock the power of open source in the railway sector to accelerate innovation, improve efficiency, and enhance interoperability**.

A Year of Progress

Since its official launch in January 2024, OpenRail has brought together stakeholders from across Europe to collaborate on open software solutions that address shared challenges. We have established a trusted, neutral space where railway operators, infrastructure managers, and developers can work together without commercial barriers. Some key achievements from our first year include:

- **Growing the Community:** We welcomed founding members and early adopters, including major railway operators and infrastructure managers.
- **Launching OpenRail Projects:** Five projects have joined the association, tackling critical challenges in infrastructure simulation, condition monitoring, and network planning.
- **Defining Open Governance:** We have implemented an incubation process that ensures projects follow open-source best practices while addressing sector-specific needs.
- **Connecting the Ecosystem:** Through conferences, working groups, and partnerships, we have built bridges between open-source communities and railway professionals.

Breaking Barriers, Creating Opportunities

A common hesitation in the industry is: *“Railways are special. Open source won’t work for us.”* Yet, in other sectors—automotive, telecom, and energy—open collaboration has already delivered massive benefits. **Shared, open foundations do not mean losing control; they mean gaining flexibility, reducing costs, and driving innovation faster than any single organization could alone.**

We are creating an open house for the railway sector, where expertise is shared, technology evolves collectively, and companies can build upon reliable, transparent solutions. We provide a neutral space to unleash the power of open source and tackle the sector’s unique challenges. **Your projects can be part of this movement.** Whether you aim to improve interoperability, streamline operations, or ensure the long-term sustainability of your software, OpenRail provides the framework and community to make it happen.

Building Momentum

In the coming year, we are focused on helping our projects grow, ensuring they become more mature, robust, and gain adoption. We will support projects in improving quality, strengthening governance, and reaching the next stage in their development through our incubation process. At the same time, we welcome new projects and members addressing key railway challenges. We want to make sure projects don’t exist in isolation but benefit from each other. Our goal is to connect people, facilitate collaboration, and spread good ideas and solutions across the ecosystem.

Join Us

As we look ahead, we invite railway operators, infrastructure managers, and innovators to explore what open source can do for them. The OpenRail Association is your space to collaborate, experiment, and shape the digital railway of the future, **together, openly.**

OpenRail Projects

One-page overview of the projects with brief summary and ideally some icon to visually represent each project.

For each project we will add the incubation stage as a small visiual indicator using the badge.

In the following subsections we have a deep dive for each project (`07xx.md`).

Each project should address the following topics:

- *Which domain, which business requirement does it address*
- *Which functionality*
- *Technology*
- *Adoption, community*
- *Potential, future perspective*
- *Reached milestones*

In 2024 the OpenRail Association accepted the first five open source projects in its incubation process. Dive deeper on each of the projects on the following pages.

Open Source Railway Designer (OSRD)

OpenRail Sandbox

OSRD is an open source web application for railway infrastructure design, capacity analysis, timetabling and simulation and short term path request.

Rail Condition Monitoring (RCM OSS)

OpenRail Sandbox

RCM by SBB comprises a suite of products for rail condition monitoring. Based on the open-source data format RCM-DX (RCM Data eXchange), RCM enables easy accessibility and visualization of railway diagnostic data.

Digital Automated Coupling Migration Decision Support System (DAC Migration DSS)

OpenRail Sandbox

Within the next years around 500 K freight wagons all over Europe owned and operated by various corporations will be converted from screw couplers to digital automatic couplers (DAC). To facilitate the migration process, a decision support system (DSS) is planned under the project.

Netzgrafik-Editor (NGE)

OpenRail Sandbox

Netzgrafik-Editor is now a mature tool for creating and analyzing regular-interval timetables. It's versatile for logistics planning in various domains. Features include interactive editing, graphic timetables, trainrun editing, and logistics analysis.

Library for Linear Reference Systems (libLRS)

OpenRail Sandbox

The goal of the library is to have a flexible, high performance and easy to integrate linear referencing systems (LRS) library that can be used in any system to manipulate LRSs.

Open Source Railway Designer

Rail Condition Monitoring

RCM by SBB comprises a suite of products for Rail Condition Monitoring. Based on the data format RCM-DX (RCM Data eXchange), RCM enables easy accessibility and visualisation of railway diagnostic data. The aim of RCM OSS (open-source software) is to make rail condition data easy to access, store and visualise. Therefore, RCM OSS is beneficial to railway companies as well as suppliers of measurement system.

The RCM-DX file format is available open-source. With RCM-DX we step away from proprietary data formats which require specialised software and know-how, towards a self-contained and open format. RCM-DX can be accessed through standard HDF5 tools. We recently added an open-source MATLAB function to facilitate more specific reading of RCM-DX files. The accompanying visualisation software, RCM-DX Viewer, is available as freeware.

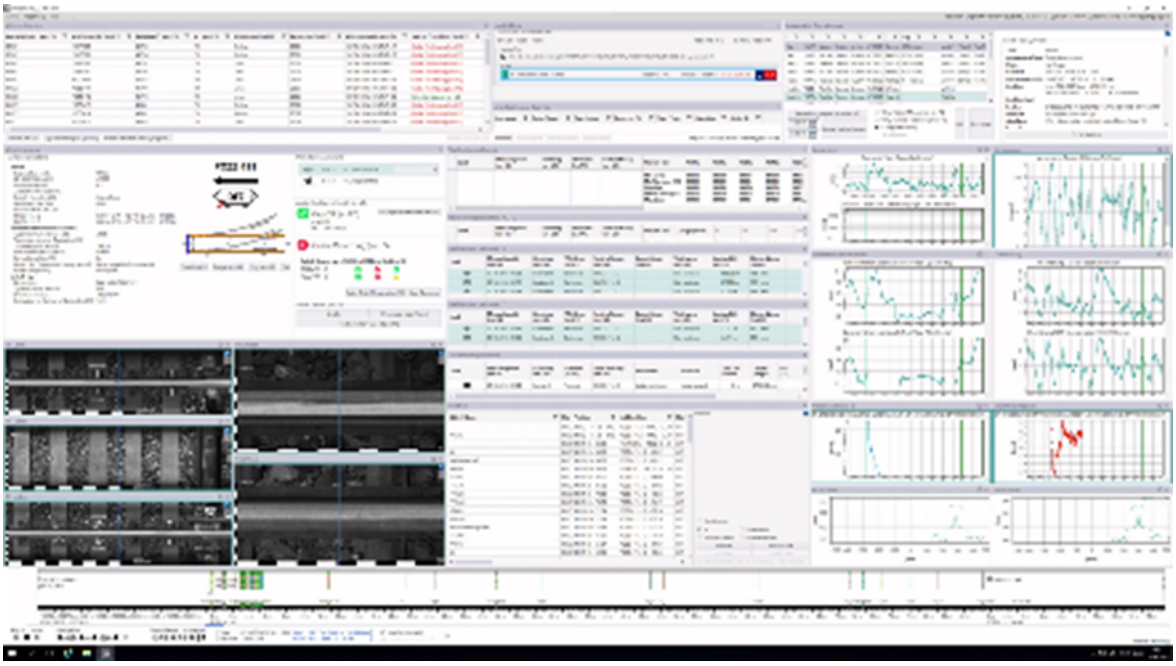
RCM-DX is used by SBB to store, manage and exchange diagnostic data. SBB exchanges with and delivers diagnostic data to other Swiss railway companies and universities. Infrabel and SNCF réseau are in the process of establishing RCM-DX for storing diagnostic data in future. In the ERC project Europe's rail, RCM-DX is being evaluated as a candidate for a European data format to store and exchange railway diagnostic data. Its properties bear great potential for every railway company to be independent of proprietary software and therefore in full control of their data as well as to facilitate data exchange across companies and countries. The full potential of RCM OSS will be released with the publication of an open-source Read/Write library and the open-source RCM-DX Viewer in future.

RCM OSS has been accepted as a project at the OpenRail Association in 2024. RCM-DX, accompanied by a facilitating MATLAB function are available as open-source. The RCM-DX Viewer including sample data are available as freeware. The publication of an RCM-DX R/W library is aimed for in 2027.

Links and references:

- https://bahninfrastruktur.sbb.ch/en/products-and-services/bahninformatiksysteme/anlagenmanagement/rail-condition-monitoring.html
- https://github.com/OpenRailAssociation/rcm-dx
- https://github.com/OpenRailAssociation/rcm-dx-examples
- https://archive.fosdem.org/2023/schedule/event/rot_rcmdx/

RCM DX Logo



RCMDX_Viewer

Digital Automating Coupling Migration Decision Support System

The Digital Automatic Coupling (DAC) will be the major move towards competitive and digital rail traffic. There is widespread consensus that the roll-out of the DAC should be supported. But how to migrate about 500 K freight wagons as well as locomotives and maintenance vehicles from the current screw-coupler to the modern DAC? This is where the DAC Migration DSS comes into play. DSS stands for Decision Support System.

The goal: A DSS for all stages of migration planing

This system aims at supporting all planning stages of DAC Migration. Three stages have been identified:

- **Strategic Planning:** In this phase a pan-European rough-cut plan for migration is set up. At this point in time data available is not detailed and not reliable. There is a high degree of freedom and many properties of the migration process can still be formed. Therefore, many scenarios have to be computed. Only few people which are especially trained are working with the DSS, therefore the user interface can be low-level.
- **Detailed Planning:** In this phase rail undertakings and wagon keepers as well as other organizations have to conduct the planning. The plans on corporate level are detailed and accurate data is available. The corporate plans have to be but together on European level by an organization in charge e.g. the DAC Deployment Manager. Thus, the DSS has to provide a comfortable user-interface and support coordination and collaboration. In this phase corporations also apply for grants and funding for the DAC retrofit, therefore a direct interface from the DAC Migration DSS to the funding entities has to be set up.
- Monitoring: Once the migration started, progress has to be monitored on corporate as well as on centralized level. Interfaces to legacy maintenance systems have to be set up and data has to be visualized for decision makers. If there is a deviation from the original plan quickly scenarios on how to catch up have to be set up.

The current status of the DAC Migration DSS

- Whitepaper: Contains concepts for DAC Migration DSS including functional and non-functional requirements.
- Mathematical Model: Linear Model formulated
- Drei-Länderhack: Offering a challenge for the “3-Länderhack” which took place in Berlin from 30.09. to 02.10.2024. The team working on this challenge produced the “PopupSim”-Tool which is a protype of simulation tool for special aspects of DAC Migration. It won the 3rd price.
- DACFIT-project started: Research project funded by Europe’s rail (Call: HORIZON-JU-ER-2023-01, Project 101178150) which will enable the first steps of implementation.The first minimal viable implementation of the DAC Migration DSS is forseen for Mid-October 2025. Until Mid-October 2026 the first plan has to be generated by the DSS.

Current challenges

Although the first step is funded by DACFIT the further implementation of the DAC Migration DSS requires additional funding. The signs for funding the overall DAC Migration are promising. It will be important to promote the DAC Migration DSS as a fundamental part of the roll-out.

Netzgrafik-Editor

Netzgrafik-Editor (NGE) is a mature tool used in long-term planning for creating and analyzing regular-interval timetables at a macroscopic level of detail. It's versatile for timetable planning in various modes of transport. Features include interactive editing, graphic timetables, train run editing, and analysis.

NGE is used daily by Swiss Federal Railways (SBB) planners for developing macroscopic long-term timetable concepts. It enables quick creation of new ideas as variants, their analysis, and decision-making on their feasibility. NGE offers the user functionality to enhance the efficiency and optimization of traffic in a network.

As a user-friendly and interactive graphical editor, the software allows for the creation and editing of regular-interval timetables through a visual interface. This interface makes it easy to visualize and adjust the network. Lines (train runs) in the Netzgrafik can be transferred into a graphical timetable (time–distance diagram) representation. Planners can manually draw and edit the train runs as if arranging pearls on a string. This feature enables them to define crucial aspects of the traffic network and tailor it to specific requirements and constraints. The software allows planners to extract important information, such as departure and destination stations, departure and arrival times, and train frequency.

Based on the network and the timetables, the software provides insights into connection and transfer times. This facilitates optimization and efficiency improvement in a transport system. Additionally, infrastructure requirements can be estimated, aiding in infrastructure planning and decision-making.

NGE is a web-based tool with a frontend developed using SBB open source Angular components, providing an interactive graphical interface accessible through a web browser. Much of the logic is implemented in TypeScript on the frontend to ensure performance and interactivity with low latency and maximum responsiveness. The backend, implemented with the Spring Framework and Spring Boot mainly persists the data.

NGE, initially developed internally at SBB, became open source in 2024. Similarly, the SNCF's Open Source Railway Designer (OSRD) focuses on microscopic medium and short-term timetabling, capacity analysis, and simulation. In 2024, a productive collaboration began between the two development teams. This collaboration led to contributions from the OSRD team to the NGE project. In return, the OSRD team integrated NGE components into their software. Such a fruitful collaboration would have been unlikely without the OpenRail Association. In an independent project, an open source converter was developed to export data from NGE into timetables for the entire service day in different formats, such as GTFS static or MATSim transit schedules.

To build a broad community and develop its full potential, the Netzgrafik-Editor needs additional users within transport companies, public administrations, and educational institutions. For timetable planners or students in transport planning, opening the source code is insufficient. To bridge the gap between software developers and end-users, the application was made freely accessible online in 2024 to ensure that it reaches a broader audience. Open-source success relies not just on code availability but also on user engagement and accessibility.

In 2025, the focus is strengthening the community to attract more users and active developers on developing functionalities. The roadmap outlines the strategic goals to improve the Netzgrafik-Editor's business value.

Further information:

- Netzgrafik-Editor Frontend on GitHub
- Netzgrafik-Editor Backend on GitHub
- Netzgrafik-Editor Converter on GitHub
- Online Demo Instance operated in the cloud of the Flatland Association
- Open SBB Design System on GitHub
- Netzgrafik-Editor at FOSDEM 2025
- Open Source Railway Designer (OSRD
- MATSim for large-scale agent-based transport simulations

Library for Linear Reference Systems

libLRS is a library to manipulate linear coordinates and convert them from and to geographical coordinates. It helps to localize objects along curves (e.g. signals on a train track).

The library started as a need for a clean sheet design and a library that focuses on those type of coordinates. There are multiple ad-hoc implementation at SNCF. However there are many little edge cases that those implementation handle differently, which made the integration painful.

The core is written in rust for soundness and performance reasons. Bindings in python and javascript allow to use the library in data processing pipelines and web applications.

So far the library is used on the OSRD project in the data preparation pipeline (converting infrastructure elements such as switches, signals, reference points… from milestone+offset to geographical coordinates that will be displayed on a map), but also to hold the topology of the rail network for a display on a webpage.

We had some initial discussions with other teams from the railway world (display the exact position of a train car on the platform, help emergency services to reach by car the spot where an intervention is required), but also outside of rail: libLRS could be used to localize amenities (camping sites, shops…) along cycle roads where a distance in kilometers is very relatable to cyclists. However, so far we didn't hear of an actual adoption of libLRS.

We expect that libLRS will be continue to be used in OSRD for more tasks. We hope also to hear about an adoption by other business units of SNCF. We would be very happy to learn about the integration of libLRS in non-railway related projects.

Further information:

- libLRS on github
- documentation for rust
- documentation for python
- example how to build the LRS with swiss rail opendata

Message of the Chairs of the Technical Committee

Message from the Technical Committee, highlighting beginning collaboration (example OSRD/NGE).

Members

One-page overview of members. Grouped by membership category.

Building the Organization

2024 has been the year of building up the organization. Tell the story, significant milestones, use it to mention the important organizational parts, link to where to find more information, such as governance documents.

The OpenRail Association was officially incorporated as an international non-profit organization (AISBL) under Belgian law by royal decree on **January 7, 2024**.

Operations formally began with the **first meeting of the Board of Directors in Paris on January 29**. The initial board consisted of the directors appointed by the founding members: **SBB, DB, SNCF, and UIC**. Over the course of the year, we established a rhythm of **quarterly board meetings**, held as hybrid or virtual sessions. A milestone was reached in September when we managed to bring everyone together in person for a board meeting at **InnoTrans, the major railway trade show in Berlin**. With new members joining throughout the year, participation expanded, and by the end of 2024, **all membership categories were represented on the board**.

Board of Directors

In **June**, we held our **first General Assembly**, bringing together all members of the OpenRail Association. At this early stage, all members were also represented on the board, making this first assembly largely a formal step. However, as membership grows, the General Assembly will take on a more significant role as the **ultimate decision-making body of the association**.

To handle operational and administrative work, we established the **OpenRail Team** as a working body by board decision at the January meeting. This **small group, currently composed of representatives from the founding members**, manages the practical work necessary to run the association. Their responsibilities include **preparing board and general assembly meetings, handling member applications, and discussing strategic direction and activities**.

All of these structures serve a single purpose: **to enable successful open-source projects in the railway sector**. A crucial role in this is played by the **Technical Committee**, which acts as the bridge between the association and the projects.

In its first year, OpenRail developed a **productive and transparent working mode**. **Weekly meetings of the OpenRail Team and the Technical Committee serve as the heartbeat of the organization.** We are committed to openness—our projects are publicly available on **GitHub**, and the **Technical Committee publishes all meeting notes and works collaboratively on incubation processes, project support, and other deliverables**.

Looking ahead to **2025**, we will continue to **scale and iteratively improve** how we work. Our approach remains **hands-on, driven by the active engagement of the individuals present in working groups and projects**. True to the open source spirit, **“Those who do the work decide.”**

Participating in Events for Building a Railway Open Source Community

Events play a crucial role in strengthening our community internally while also generating interest in railways and open source among a broader audience, further expanding our reach. In 2024, we extensively used existing events to promote the intersection of railways and open source to the world. Our FOSDEM Devroom demonstrated that open source software developers are enthusiastic about railways. A future challenge will be engaging the railway industry in the open source movement. Our visit to InnoTrans in 2024 highlighted that InnoTrans 2026 presents an excellent opportunity to draw attention to the OpenRail Association — a chance we cannot afford to miss.

FOSDEM is Europe's largest gathering of Free and Open Source Software developers and enthusiasts, attracting over 8,000 participants each year. The event took place on the weekend of February 3-4, 2024, at the ULB University in Brussels. For the second consecutive year, members of the OpenRail Association coordinated the Railways and Open Transport devroom at FOSDEM. From a large number of submissions, we selected ten presentations by experts from diverse backgrounds for this four-hour track. It was a perfect opportunity for the wider OpenRail community to connect, learn, and engage, with over 100 participants, many of whom were railway fans and active members of related communities. For 2025, the FOSDEM organizers have confirmed that we will hold the Railways and Open Transport devroom for a third consecutive year. The preparations, including the challenging selection process from numerous proposals, were completed in December 2024.

In May 2024, OpenRail was featured in a presentation by Max Mehl at Open Source @ Siemens, and it was also mentioned independently in two other talks. In June, Cornelius Schumacher represented the OpenRail Association at the Open Transport Meetup, a community focused on open data and mobility, particularly in public transport. He discussed the organization's operations, the initial projects it has onboarded, and the OpenRail Association's future aspirations.

Between September 30 and October 2, 2024, approximately 150 creative minds from DB, ÖBB, and SBB, along with guests from SNCF, collaborated on improving cross-border rail travel and operation, utilizing open source solutions. The OpenRail projects DAC Migration DSS, OSRD, and Network Graphic Editor introduced their own challenges, which mixed teams worked to address. Some teams, like the winning team BUS'TED!, used the public repositories provided by the OpenRail Association to develop their solution directly as open source software. This traditional event, known as "Dreiländerhack" in 2024, will return in 2025 under the new name "Hack 4 Rail," with even greater collaborative support from the OpenRail Association.

Our associated member, the Flatland Association, provided Cornelius Schumacher with the opportunity to speak at their November Flatland Symposium on "Open Source in Railways" and to participate in the workshop. This event clearly demonstrated how open source software and open innovation support each other.

Finally, on December 13, 2024, Jochen Decker, our Chair, presented the topic of open source and the activities of the OpenRail Association at the General Assembly of the UIC (International union of railways). The questions asked demonstrated the great interest of the participants and allowed to establish further contacts.

Join us

Text from our one-pager. To be adapted.

OpenRail Association – Open Source for the Railway Sector

We create an open, autonomous and collaborative space to work together on rail-specific software initiatives.

Our goal is to: - Unlock the benefits of open source for the sector - Accelerate innovation - Increase efficiency - Improve interoperability

Contribute to our projects to collaboratively create solutions for the challenges of digital transformation within the railway sector: https://github.com/OpenRailAssociation

Topics – Active Open Source Projects:

- Maintenance *e.g.* *RCM-DX*
- Timetable Planning *e.g.* *OSRD*
- Netdesign *e.g.* *Netzgrafik Editor*

Established in 2024 by: - DB - SBB - SNCF - UIC

Join us as a member to support an open-source ecosystem for the railway sector: https://openrailassociation.org/about

Endnotes

Website

Find more information on the OpenRail Association at https://openrailassociation.org.

Contact

To contact the OpenRail Association send us an email at contact@openrailassociation.org.

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