

A7 Operating Regulations for the Railway Field Laboratory

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Preamble

Railway noise – in this context, rolling noise – is the result of complex interactions between the vehicle and the track. The degrees of roughness of the two contact partners – the running surfaces of the wheel and the rail – result in non-stationary excitation forces which act on the vehicle side as well as the track side. Excitation forces of this sort cause structure-borne sound in (for example) both the rail and the wheel, which in turn is radiated as audible airborne sound that nearby residents may perceive as noise. The vibrations in the railway superstructure caused by the excitation force may also damage the components of the superstructure, or may lead to accelerated ageing. Moreover, there is a risk that the vibrational energy caused could be propagated into the ground and might lead to tremor problems.

Attempts are made to counteract these problems by means of targeted product development. For example: insertion of a soft intermediate pad between the rail and the sleeper increases the structural-dynamic decoupling of the rail. This results in less energy being transferred into the subjacent components. As the result of this measure, sleepers and ballast experience a reduced dynamic load, which positively impacts their lifetimes. It has nevertheless been proven that this results in the radiation of more energy into the rails as potentially disturbing airborne sound.

Ongoing development and optimisation of the railway infrastructure by means of newly developed components calls for an approach based on a consideration of the overall superstructure-vehicle system and which gives equal consideration to the aspects of noise reduction, safety and security, operation, and lifecycle costs, etc. Thanks to this approach, an in-depth understanding of the physical phenomena – as the key to targeted future developments – should be obtained from the close linkage of physics-based modelling and long-term measurements in a continuously operated field laboratory, along a section with railway operation. This test track should be used to trial new or optimised components in real operation, and thus to acquire knowledge about the influence of environmental conditions (temperature, air humidity, etc.) and ageing effects. Parallel operation of multiple measurement cross-sections with corresponding sensor positions should enable direct comparisons of the characteristics of various superstructure installations. This direct comparability of the acquired data should also allow identification of small differences in behaviour with a high degree of certainty.

At the same time, the continuous acquisition of measurement data from various sensors should form a data base that will help to enable the testing of different superstructure models and the determination of transfer functions. The measurement data should also help to allow rapid assessments of the influence of new vehicles and to determine their transfer functions.

The objective is to develop a Competence Centre for noise, vibration and LCC in the railway environment from which as many research groups and rail-related enterprises as possible will be able to benefit.

These Operating Regulations for the Railway Field Laboratory govern the operation of the test track and the use of the laboratory by third parties. The installation and operation of the measurement technology are defined by the Tender Specifications for the Railway Field Laboratory.

Publication details

Project participants:	Swiss Confederation; the Swiss Federal Office for the Environment (FOEN) and the Swiss Federal Office of Transport (FOT) Swiss Federal Railways (SBB) Swiss Federal Laboratories for Materials Science and Technology (Empa) Allianz Fahrweg ("Swiss Permanent Way Alliance")
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1. General prerequisites

1.1. General

The measurement equipment for the test track is paid for by special funding from the Federal Department of the Environment, Transport, Energy and Communications (DETEC). The funding provider is therefore concerned to ensure that access to the test track is generally available to research groups and enterprises in the railway environment.

1.2. Priority of use

¹The Sempach test track is part of the SBB's operational network, for whose safety, security and maintenance SBB Infrastructure is responsible. Safety, security and operational running shall therefore always take precedence over any use of the track for test purposes.

²SBB may at any time refuse access to and/or use of the test track if operational activities are disproportionately impaired, or if the safety and/or security of operations is no longer guaranteed. SBB may, moreover, demand immediate dismantling and/or correction of any installations, or may implement a substitute measure, if the safety, security or stability of operational activities are no longer maintained.

2. Organisation of the Railway Field Laboratory

The Railway Field Laboratory consists of the following entities:

- a) The Steering Committee, referred to as "SC" below
- b) The Operator of the Measurement Technology and the Central Data Platform, referred to below as "OMD"

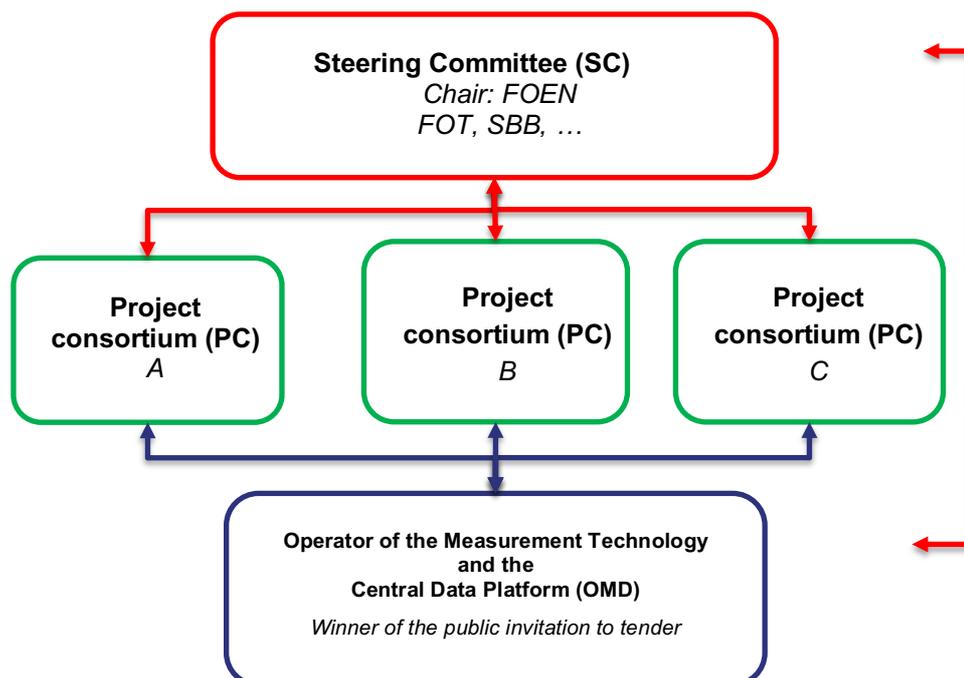


Figure 1: Organisation of the Railway Field Laboratory

2.1. Steering Committee (SC)

¹The SC is an "ordinary partnership" ("einfache Gesellschaft") which (as the minimum) consists of representatives of SBB Infrastructure as the Infrastructure Operator (ISO), and of the FOT and the FOEN as representatives of the authorities. The SC is self-constituting and it may also invite additional members.

²The SC:

- a) defines the strategic objectives of the test laboratory;
- b) is the owner of the Tender Specifications for the Railway Field Laboratory and the Operating Regulations for the Railway Field Laboratory, and shall decide on adaptations thereof,
- c) defines the process for using the test track,
- d) monitors the Operator of the Measurement Technology and the Central Data Platform,
- e) defines the evaluation and management of data,
- f) regulates access to the central data platform for third parties,
- g) appraises the applications for use and issues final approval. The SC is authorised to impose project conditions which do not relate to the railway infrastructure. Conditions relating to the railway infrastructure are stipulated by SBB.
- h) meets regularly with the OMD and/or the Project Consortiums, and obtains information about the progress of the projects,
- i) plans the time sequence and duration of the various projects, and monitors them.

³The SC may also delegate tasks to third parties.

⁴Decisions by the SC are reached unanimously by SBB, the FOT and the FOEN.

2.2. Operator of the Measurement Technology and the Central Data Platform (OMD)

¹The OMD is responsible for operating and maintaining the standard measurement technology, and for secure storage/backup and initial processing of the raw data on a central data platform. The OMD is furthermore responsible for standardised data evaluation, and shall operate a laboratory server via which third parties can access the test laboratory's data.

²A public invitation to tender for the OMD position is issued by the FOEN. The OMD may comprise different enterprises which contribute different skills and expertise.

³Details of the tasks and duties of the OMD are defined in the Tender Specifications for the Railway Field Laboratory.

2.3. Project Consortiums (PCs)

¹The Project Consortiums (referred to as PC or PCs below) are not governing bodies of the test laboratory; rather, they consist of one or more interested parties who wish to carry out research projects at the Railway Field Laboratory. For this purpose, the PC submits its applications to the SC in accordance with the latter's specified requirements.

²The following institutions may submit applications as a member of a PC:

- Railway Undertakings (RUs) and Infrastructure Operators (ISOs), including SBB;
- Public and private institutions and organisations
- Governmental authorities, cantonal authorities and Federal agencies including the FOT and the FOEN
- Companies and enterprises

³The PC:

- a) is obliged to meet all costs for project-related measures before, during and after the project. An appropriate financial guarantee must be submitted. This shall cover, in particular, the expenses of SBB and the OMD, but not the SC's expenses.
- b) is obliged to coordinate the work with the OMD and to reimburse the OMD's additional expenses in accordance with specified rates,
- c) must not jeopardise the safety, security and operational running of the railway at any time,
- d) is responsible for the necessary approvals and authorisations,
- e) shall be liable for loss and damage occurring due to the project,

- f) shall obtain access to the data platform,
- g) shall undertake its own data analyses,
- h) shall inform the SC about the progress and results of the project(s),
- i) shall cite support from the Swiss Federal Office of Transport (FOT) and the Swiss Federal Office for the Environment (FOEN) in connection with publications.

3. Installations of the Railway Field Laboratory

The test laboratory consists of the following installations:

3.1. Sempach test track

The Railway Field Laboratory's actual test track is the following railway installation: Line 500, Track 281 (direction of traffic: south -> north), right-hand track in the direction of the kilometre marking) between km 80 and km 81, on the section between Sempach-Neuenkirch and Rothenburg. Structural changes to the railway installation are possible in compliance with the conditions stated in Article 5.

3.2. Permanent measuring installation

¹The permanent measuring installation comprises basic equipment consisting of measurement sensors and measurement technology; this equipment is permanently installed on the Sempach test track, and its data is made available to third parties. The permanent measurement installation also includes a central data platform for secure storage/backup of the raw data and a laboratory server for third-party access to the measurement data.

²The permanent measuring installation is operated and maintained by the OMD. The Tender Specifications for the Railway Field Laboratory govern the design/development and operation of the permanent measuring installation by the OMD.

3.3. Data

As a general rule, the data is publicly accessible. The Federal government is the owner of the data and it regulates the use thereof. Data management and data analysis, including data management for projects, are described in detail in the Tender Specifications for the Railway Field Laboratory.

3.4. Temporary installations

¹Within the scope of approved projects, temporary installations or changes may be implemented in respect of the railway installation as well as the measuring equipment. Article 5 stipulates the conditions required for temporary installations on the railway installation. The Tender Specifications for the Railway Field Laboratory stipulate the requirements for temporary installations on the measuring equipment and their integration into the permanent measurement technology.

²All costs incurred due to temporary installations shall be borne by the PC.

³Project-related data from the permanent measuring installation and from the measurement sensor technology installed for specific projects is equated to the raw data from the permanent measuring installation.

⁴In consultation with the PC, the SC may decide that project-related data shall not be publicly accessible.

4. Projects

4.1. Standardised evaluation

¹The measurement technology continuously supplies data relating to operational running which is evaluated and backed up on a regular and standardised basis. This data is made available to the general public on the laboratory server.

²Users of the standardised evaluation are not required to submit a project application. Instead of a specific contract, General Terms and Conditions (GTC Laboratory) stipulated by the SC shall be applicable. The Tender Specifications for the Railway Field Laboratory govern the standardised evaluation.

4.2. Project-related installations and measuring runs

¹Project partners may carry out their own project-related measurements on the test track. The details are stipulated in the Tender Specifications for the Railway Field Laboratory.

²After consultation with the PC, the project-related measurements and data evaluations shall also be made available to third parties.

4.2.1. Additional measurement technology

¹The installation of additional measurement technology is possible on request, but this must be approved by the SC. Data from the additionally installed measurement technology shall also be integrated into the data flow as described in Article 3.3 and/or in accordance with the provisions stated in the Tender Specifications for the Railway Field Laboratory, insofar as possible.

4.2.2. Measuring runs

Regularly scheduled services operate on the test track. Special measurement runs and any required section closures on the test track are possible. However, these must be announced in good time and requested in the normal manner from the responsible authorities (at least 90 days in advance). There is no entitlement to special measuring runs.

4.2.3. Changes to the railway installation

¹Changes to the superstructure of the test track may be made if:

- a) safety, security and operational running are guaranteed at all times;
- b) the costs of the conversion and of any dismantling that may be required (including emergency dismantling) are covered;
- c) the required approvals are available, and
- d) the corresponding periods specified for construction activities, etc. are respected.

²All changes to the superstructure must be approved by the SC. Pursuant to Article 1.2, SBB AG may refuse any change to the railway installation at any time.

³Article 5 stipulates the detailed requirements for changes to the superstructure.

4.2.4. Project application and contracts

¹Project-related measurements and the use of non-standardised data shall require a project application to the SC in accordance with the latter's specified requirements. The SC shall then take the final decision.

²In case of changes to the railway installation, the PC must conclude a separate contract with SBB Infrastructure.

³As a general rule, project applications must be submitted in German; likewise, contracts are normally written in German; French, Italian or English are also permitted.

5. Prerequisites for changes to the rail installation

5.1. General

¹The safety and security of the railway installation and the stability of railway operations shall always take precedence.

²Testing of parts or components must not result in a reduction of speed during operation.

³Intervals and/or closures that require a track replacement must be avoided.

⁴The PC and SBB Infrastructure shall conclude a separate contract which governs changes to the superstructure.

5.2. Safety and security

The PC itself is responsible for obtaining the approval from the FOT that is required in order to install components which do not have an existing type approval. The following FOT guideline shall apply: Guideline on "Type approval for elements of railway installations" (RL TZL). The operator's consent required in section 3.7 of the Guideline shall be issued by SBB I-NAT-FW-TAFB on a non-discriminatory basis for all test objects. However, this is only a formally necessary requirement for the approval process. It does not, as such, constitute consent by SBB that the test can actually be carried out.

5.3. Availability for installation of test components

The Operator's consent does not automatically mean that the components are actually installed. The SC handles the prioritisation of upcoming tests. Effective installation requires intervals for which applications must be made in the correct manner. In respect of the interval planning, the installation of test components has no relevance to safety and security, nor to availability; the installation of test components is nevertheless awarded on a "best effort" basis.

5.4. Stipulated periods

5.4.1. General

¹Every required interval and/or every closure or every interruption to a section of track must be notified as early as possible. All work on the superstructure must be coordinated with the responsible units at SBB Infrastructure (I-NAT-FW).

²It is advantageous to schedule work on and around the track during the night, between 1 a.m. and 5 a.m., and especially during the night from Sunday to Monday.

³The precise specifications for defined periods and the documents to be submitted are based on the requirements stipulated by SBB Infrastructure.

5.4.2. Periods to be respected: major conversion

¹A "major conversion" is defined as all work involving a continuous closure of between 60 hours and 1 month.

²For a major conversion on the superstructure in year X which impacts operation, the following periods must be respected:

- a) March, year X-3: notification of requirement – rough planning
- b) 15 Sept., year X-3: notification of requirement – detailed planning
- c) 30.11, year X-3: end of notification of requirement (timetable)
- d) 30.6, year X-1: the building production schedule is frozen.
- e) 6 months before start of construction: intervals are ordered, with train traffic measures.
- f) 3 months before start of construction: confirmation of execution of intervals.

5.4.3. Periods to be respected: medium-size conversion

¹A "medium-sized conversion" is defined as all work involving a continuous closure of between 8 hours and 60 hours.

² For a medium-size conversion on the superstructure in year X which impacts operation, the following periods must be respected:

- a) March, year X-2: notification of requirement – rough planning
- b) 15 Sept., year X-2: notification of requirement – detailed planning

- c) 30.11, year X-2: end of notification of requirement (timetable)
- d) 30.6, year X-1: the building production schedule is frozen.
- e) 6 months before start of construction: intervals are ordered, with train traffic measures.
- f) 3 months before start of construction: confirmation of execution of intervals.

5.4.4. *Periods to be respected: minor conversion*

¹A "minor conversion" is defined as all work that can be undertaken within the residual capacity, and/or which has the character of maintenance work.

² For a minor conversion to the superstructure without prior notification of the requirement pursuant to clause 5.4.2. and/or 5.4.3., a defined period of 6 months prior to the start of construction shall apply. Only the residual capacities are available.

³Jobs having the character of maintenance work must always be notified at the start of the year for the following year. The notification of requirements for the following year is finalised each March.

5.5. **Availability of railway operation in case of irregularities, and liability**

¹Operational malfunctions and disruptions caused by the test components may be rectified immediately by SBB, without consulting the PC, and any test components involved may be removed. The PC shall be liable for loss and/or damage incurred and for all costs directly incurred by SBB.

²SBB Infrastructure may require a bank guarantee in the relevant contract.

5.6. **Services to be provided by SBB Infrastructure**

¹As the operator of the track, SBB shall issue a confirmation in respect of each test component, stating that the test track is available as a testing location and that SBB gives its consent for such tests as may be performed.

²This consent shall be valid solely for the test track that exhibits the following characteristics:

- a) straight track
- b) 60E2 rails
- c) section speed: 120 km/h
- d) B91 concrete sleepers, unpadded and rigidly padded
- e) load: approx. 45,000 trains per year, mixed traffic

³The consent shall not apply to other track sections, even if such sections would meet the same criteria.

⁴The consent cannot be used as a reference installation at SBB.

⁵The consent is granted on the basis of technical criteria, and is not made dependent on lifecycle criteria (LCC).

⁶On request, SBB shall make the results of its own monitoring activities available to the project partners. Results shall only be disclosed if they are directly related to the object under test.

5.7. **Services to be provided by the PC**

¹The PC shall organise and pay for the installation, including ordering of the required intervals, in accordance with the stipulated periods.

²The PC shall issue a bank guarantee to cover the case of unplanned removal of the components (emergency dismantling).

³A monitoring concept going beyond the scope of SBB's normal monitoring must be developed and implemented by the PC in accordance with RL TZL.

5.8. Access to the test track

¹Any physical access to the railway system for installation purposes must take place in compliance with the applicable regulations (RTE 20100). SBB does not offer any safety or security services of its own accord; the PC is solely responsible in this regard.

²The approval for the installation of the test components shall be valid for the duration of the test, as authorisation to enter railway installations in the non-public area on behalf of SBB Infrastructure, in accordance with R I-03310.

5.9. Operative implementation of the tests

¹During test phases, SBB shall (on request) provide the PC with the results of periodic monitoring, such as additional information on regularly scheduled operations, insofar as such results are related to the project.

²The PC shall itself be responsible for the implementation of any required monitoring concepts arising from conditions imposed by the FOT.

³Operational malfunctions and disruptions caused by the test components shall be rectified immediately by SBB, without consulting the PC, and any test components involved shall be removed as appropriate.

⁴SBB may unilaterally require the immediate termination of the tests and the removal of the components.

5.10. Liability

The PC shall be liable for loss and/or damage incurred in connection with project-related changes to the railway installation, and shall bear the costs incurred by SBB.

5.11. End of tests

Following the end of the agreed duration for testing the components, there are several scenarios:

- a) The components are removed when the next test component is installed.
- b) The components also remain in the track after the end of the tests; the test continues until a new component is installed.
- c) SBB may require the component to be removed and replaced with SBB standard components at the project partner's expense. For this optional removal, a bank guarantee and a letter of intent from a suitable construction company must be submitted with the application.
- d) Provision for removal shall be made by all participants; the appropriate intervals required for the execution of the work shall be requested by the PC in accordance with the defined periods.

The objective is to make the most appropriate possible use of the conversions, and to combine tests where appropriate.

6. Final provisions

¹The SC is the owner of the present Operating Regulations for the Railway Field Laboratory. If safety and security are not guaranteed, SBB (as the infrastructure owner) may override the Operating Regulations.

²Amendments to the Operating Regulations must always be recorded in writing.

³If any articles of the Operating Regulations for the Railway Field Laboratory are invalid due to statutory provisions, the remaining articles of the Operating Regulations for the Railway Field Laboratory shall retain their validity. The invalid articles should be replaced as quickly as possible by appropriate legally compliant articles.