

Monthly report

Railway Field Laboratory

August 2025

Client: Swiss confederation; Federal Offices for the Environment (FOEN) and Transport (FOT), CH-3003 Bern
The FOEN and the FOT are offices of the Federal Department of the Environment, Transport, Energy and Communications (DETEC).

Consultant: Müller-BBM Rail Technologies GmbH
Helmut-A.-Müller-Straße 1 - 5
82152 Planegg
www.MuellerBBM-Rail.com

Author: Markus Naumann, Nathan Isert, Stefan Lutzenberger

Supervision BAFU / BAV: Philipp Huber, Fredy Fischer
Franz Kuster, Christoph Dürig

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Version: V1

Date: 17.9.2025

1. Status railway field laboratory

Construction work on the tracks:

- Rail grinding during the night of 11.8.2025 to 12.8.2025

Downtimes of the measurement systems:

- MQ 21, MQ 22, MQ 23: from 27.8.2025 at 6:00 to 9.9.2025 at 15:00

Downtimes of the sensors:

- MQ 21: a-mq21-5-lx/y/z and a-mq21-5-ux/y/z (as of 11.9.2024 cable probably cut during mowing work)

Maintenance and sensor exchange:

- Removal of all acceleration sensors between 11.8.2025 at 8:00 and 13.8.2025 at 12:00 due to rail grinding during the night of 11.8.2025 to 12.8.2025
- Verification of the calibration of all acceleration sensors and microphones on 12.8.2025 and 13.8.2025

Modifications to the data, database, or analysis:

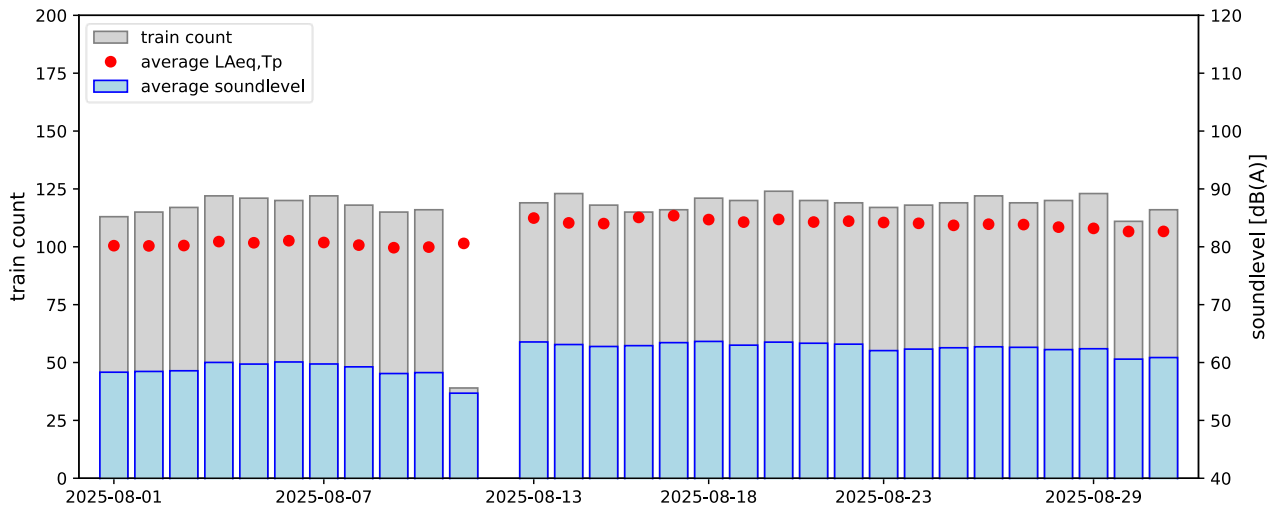
- none

Monthly data volume collected:

- 542 GB

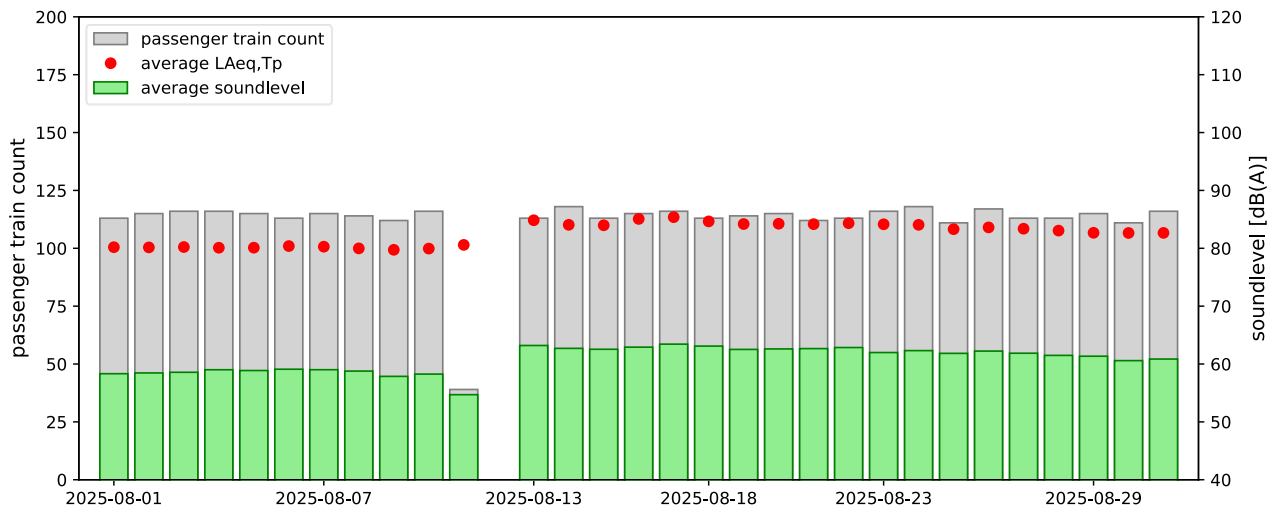
2. Measurement data

Daytime averages (24h) for all train passages at reference section (REF)

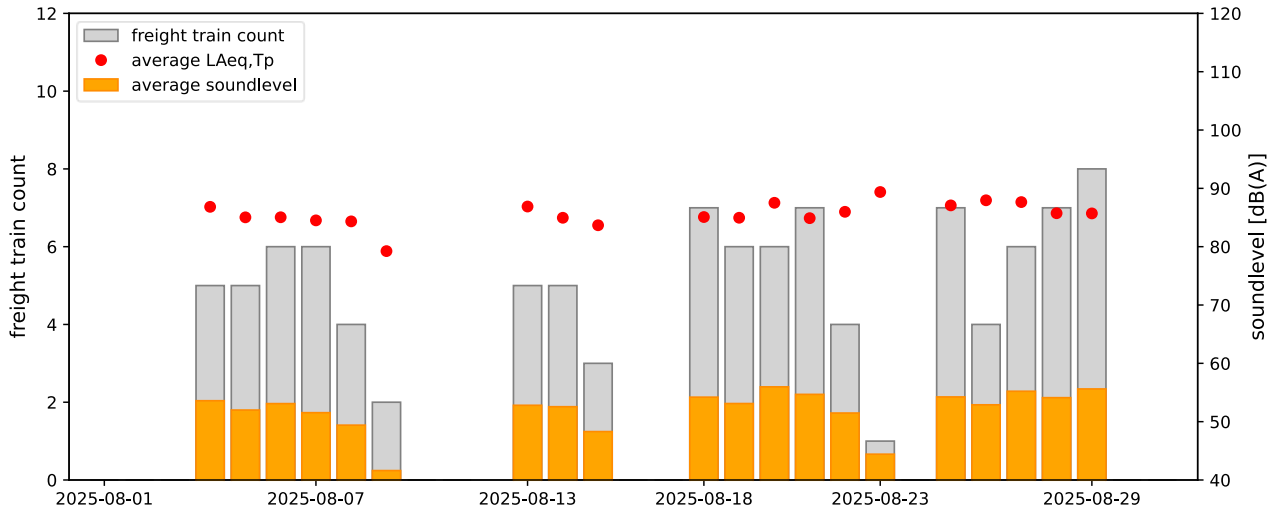


date	location	train count	passenger train count	freight train count	service train count	average LAeqTp	average soundlevel
01.08.2024	REF	113	113	0	0	80,2	58,3
02.08.2024	REF	115	115	0	0	80,2	58,5
03.08.2024	REF	117	116	0	1	80,2	58,6
04.08.2024	REF	122	116	5	1	80,9	60
05.08.2024	REF	121	115	5	1	80,7	59,7
06.08.2024	REF	120	113	6	1	81	60,1
07.08.2024	REF	122	115	6	1	80,7	59,7
08.08.2024	REF	118	114	4	0	80,3	59,3
09.08.2024	REF	115	112	2	1	79,8	58,1
10.08.2024	REF	116	116	0	0	79,9	58,3
11.08.2024	REF	39	39	0	0	80,6	54,7
12.08.2024	REF						
13.08.2024	REF	119	113	5	1	85	63,6
14.08.2024	REF	123	118	5	0	84,1	63,1
15.08.2024	REF	118	113	3	2	84	62,8
16.08.2024	REF	115	115	0	0	85,1	62,9
17.08.2024	REF	116	116	0	0	85,4	63,4
18.08.2024	REF	121	113	7	1	84,7	63,6
19.08.2024	REF	120	114	6	0	84,3	63
20.08.2024	REF	124	115	6	3	84,7	63,5
21.08.2024	REF	120	112	7	1	84,3	63,3
22.08.2024	REF	119	113	4	2	84,4	63,2
23.08.2024	REF	117	116	1	0	84,2	62,1
24.08.2024	REF	118	118	0	0	84,1	62,3
25.08.2024	REF	119	111	7	1	83,7	62,6
26.08.2024	REF	122	117	4	1	83,9	62,7
27.08.2024	REF	119	113	6	0	83,8	62,6
28.08.2024	REF	120	113	7	0	83,4	62,2
29.08.2024	REF	123	115	8	0	83,2	62,4
30.08.2024	REF	111	111	0	0	82,6	60,6
31.08.2024	REF	116	116	0	0	82,7	60,9
month	REF	3478	3356	104	18	83,2	61,5

Daytime averages (24h) for all passenger train passages at reference section (REF)

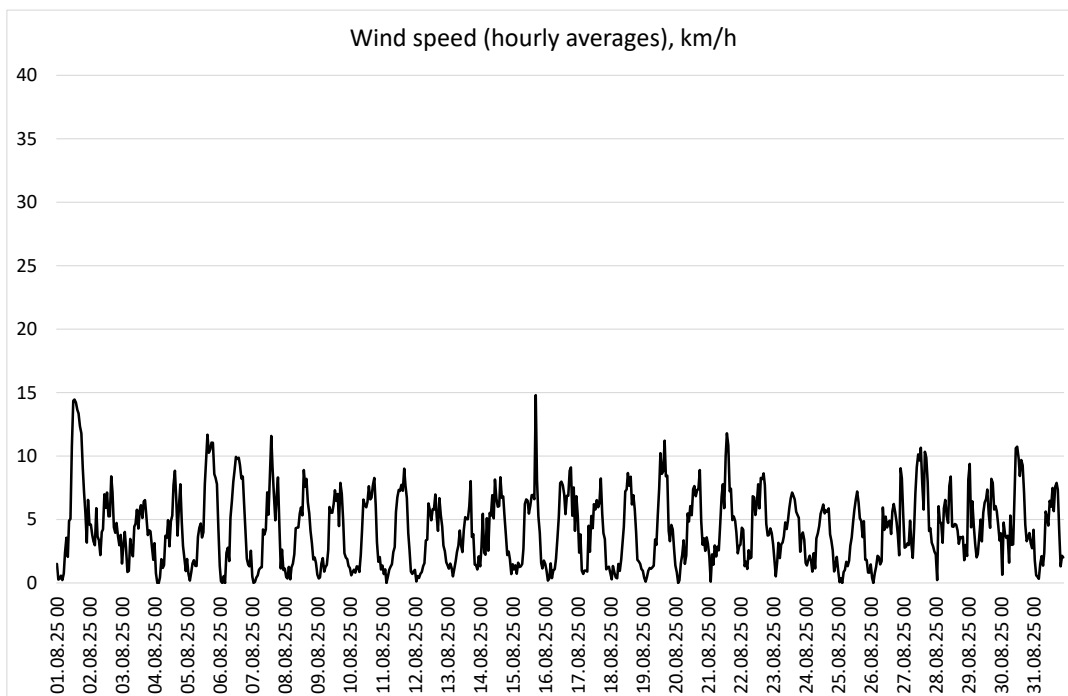
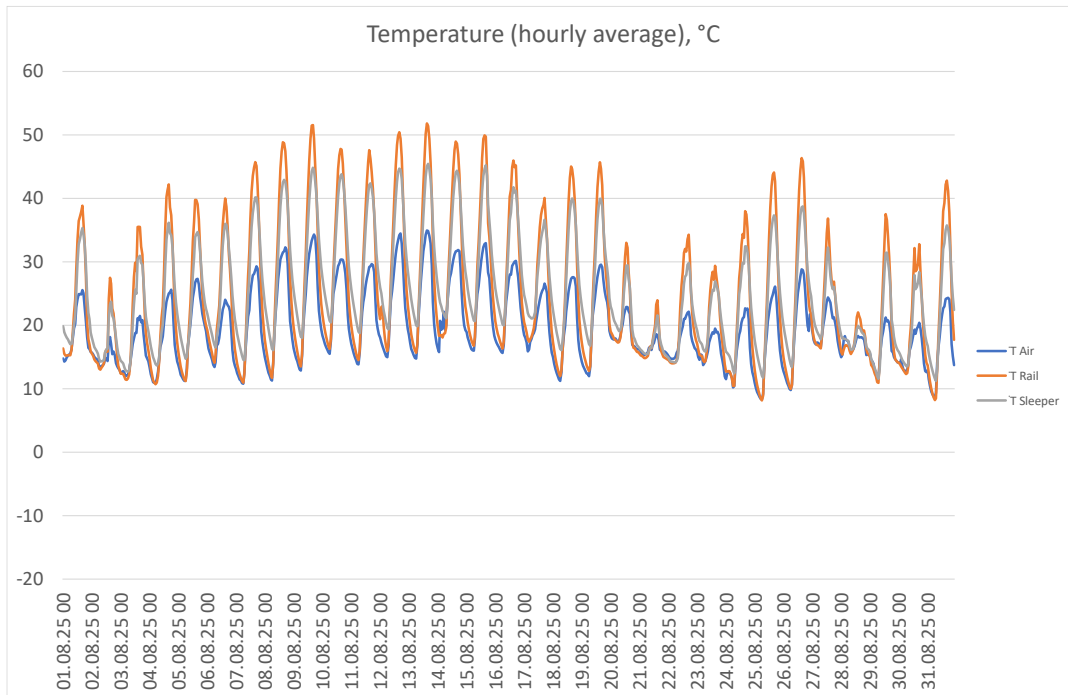


Daytime averages (24h) for all freight train passages at reference section (REF)



date	location	freight train count	average speed	average length	average axle count	average LAeqTp	average soundlevel
01.08.2024	REF						
02.08.2024	REF						
03.08.2024	REF						
04.08.2024	REF	5	98,7	218,4	39,5	86,8	53,6
05.08.2024	REF	5	87,4	199,5	35,6	85,0	52,0
06.08.2024	REF	6	89,9	209,6	41,7	85,0	53,1
07.08.2024	REF	6	84,6	166,1	30,3	84,5	51,5
08.08.2024	REF	4	85,5	153,0	22,5	84,3	49,4
09.08.2024	REF	2	52,6	83,9	17,0	79,2	41,6
10.08.2024	REF						
11.08.2024	REF						
12.08.2024	REF						
13.08.2024	REF	5	95,2	176,7	25,5	86,9	52,8
14.08.2024	REF	5	77,8	195,5	35,2	85,0	52,6
15.08.2024	REF	3	79,6	171,5	28,0	83,7	48,3
16.08.2024	REF						
17.08.2024	REF						
18.08.2024	REF	7	88,5	215,6	44,3	85,1	54,2
19.08.2024	REF	6	83,5	208,4	41,0	85,0	53,1
20.08.2024	REF	6	83,0	221,2	46,7	87,5	56,0
21.08.2024	REF	7	84,8	266,8	57,1	84,9	54,7
22.08.2024	REF	4	81,6	161,1	24,0	86,0	51,5
23.08.2024	REF	1	96,9	71,0	18,0	89,4	44,4
24.08.2024	REF						
25.08.2024	REF	7	94,2	161,6	25,7	87,1	54,2
26.08.2024	REF	4	97,3	170,1	25,5	88,0	52,9
27.08.2024	REF	6	88,9	197,3	36,0	87,6	55,2
28.08.2024	REF	7	89,9	199,4	40,6	85,7	54,1
29.08.2024	REF	8	76,2	219,3	44,0	85,7	55,6
30.08.2024	REF						
31.08.2024	REF						
month	REF	104	86,2	195,3	36,7	85,8	51,1

3. Weather data



Appendix: measurement quantities

Transit Exposure Level *TEL*

A-weighted sound pressure level of a single train pass-by as energetic average over the entire exposure duration T and averaged over the pass-by duration T_p .

$$TEL = 10 \log \left(\frac{1}{T_p} \int_0^T \frac{p_A^2(t)}{p_0^2} dt \right) \quad (1)$$

Where

$p_A(t)$ = the A-weighted sound pressure, [Pa]

$p_0 = 20 \mu Pa$ (reference pressure), [Pa]

$T_p = T_2 - T_1$ = pass-by duration of the train, time interval during which a train is within the measurement cross-section and which starts with the entry time T_1 into the measurement cross-section and ends with the exit time T_2 , [s]

T = time interval which starts when the smoothed sound pressure level (sound pressure level smoothed as a function of time with the frequency weighting A and a time weighting F („fast“) or averaging over a duration period of time, e.g. 100 ms) is for the last time 10 dB below that prevailing at the time of entering the measurement cross-section and which ends when the smoothed sound pressure level is for the first time 10 dB below the one at the time of leaving the measurement cross-section. [s]

A-weighted equivalent sound pressure level of the train pass-by $L_{Aeq,Tp}$

The A-weighted equivalent sound pressure level equals the (energetic) average of the sound pressure level over the train pass-by time T_p according to the following equation:

$$L_{Aeq,Tp} = 10 \log \left(\frac{1}{T_p} \int_{T_1}^{T_2} \frac{p_A^2(t)}{p_0^2} dt \right) \quad (2)$$

where

$p_A(t)$ = the A-weighted sound pressure, [Pa]

$p_0 = 20 \mu Pa$ (reference sound pressure), [Pa]

$T_p = T_2 - T_1$ = pass-by duration of the train, [s]

Sound Exposure Level *SEL*

The sound exposure level *SEL* references the acoustic energy of the entire pass-by event to one second. The *SEL* is used in calculating average sound level contributions from trains over longer periods of time (i.e. days/months/year). The *SEL* is related to the transit exposure level *TEL* through:

$$SEL = TEL - 10 \log (T_0 / T_p) \quad (3)$$

where

$$T_0 = 1 \text{ [s]}$$

T_p = pass-by duration of the train, [s]

Average sound level (period)

Average (energetic) A-weighted sound pressure level measured over a given period of time.

For the average sound level contributions from train pass-byes this equals the sum (energetic) of all sound exposure levels during the period for a given measurement position:

$$average \text{ soundlevel} = 10 \cdot \log_{10} \left(\sum 10^{\frac{SEL}{10}} \right) - A1 \quad (4)$$

where

$$A1 = 10 \cdot \log_{10}(n \cdot 24 \cdot 3600) \text{ for a 24-hour period}$$

SEL (see equation 3) taken from measurement data

n = number of days being averaged over

Average $L_{Aeq,Tp}$

Average (energetic) sound level of all the A-weighted sound pressure levels from the individual equivalent sound level of all train pass-byes in a given period of time (day/month/year).

Calculated per train category and per period day/night, month, year, etc. and per measurement location:

$$average L_{Aeq,Tp} = 10 \cdot \log_{10} \left(\sum T_p \cdot 10^{\frac{L_{Aeq,Tp}}{10}} \right) + 10 \cdot \log_{10} \left(\frac{1}{\sum T_p} \right) \quad (5)$$

where

T_p = pass-by duration of the train [s]

$L_{Aeq,Tp}$ (see equation 2) is calculated directly from the measurement data