

Monthly report

Railway Field Laboratory

May 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).

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Version: V1

Date: 17.6.2025

1. Status railway field laboratory

Construction work on the tracks:

- none

Downtimes of the measurement systems:

- none

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:

- none

Modifications to the data, database, or analysis:

- none

Monthly data volume collected:

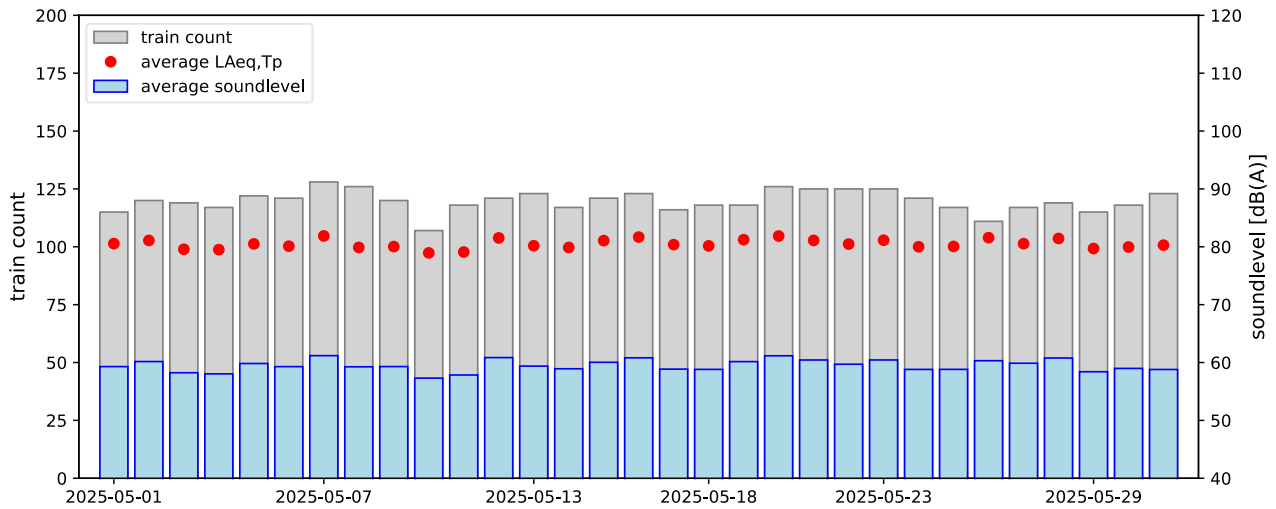
- 661 GB

Other:

- Additional geophones at MQ11, MQ13, MQ21, MQ23, REF in operation as of 1.5.2025
- Geophone MQ22 (vx/vy/vz) dismantled on 28.05.2025 from 10:21 to 14:25 due to SBB field test
- Geophone MQ22 (vx/vy/vz): mounting modified from 28.05.2025 at 14:25 to 2.6.2025 at 11:15 due to SBB field test

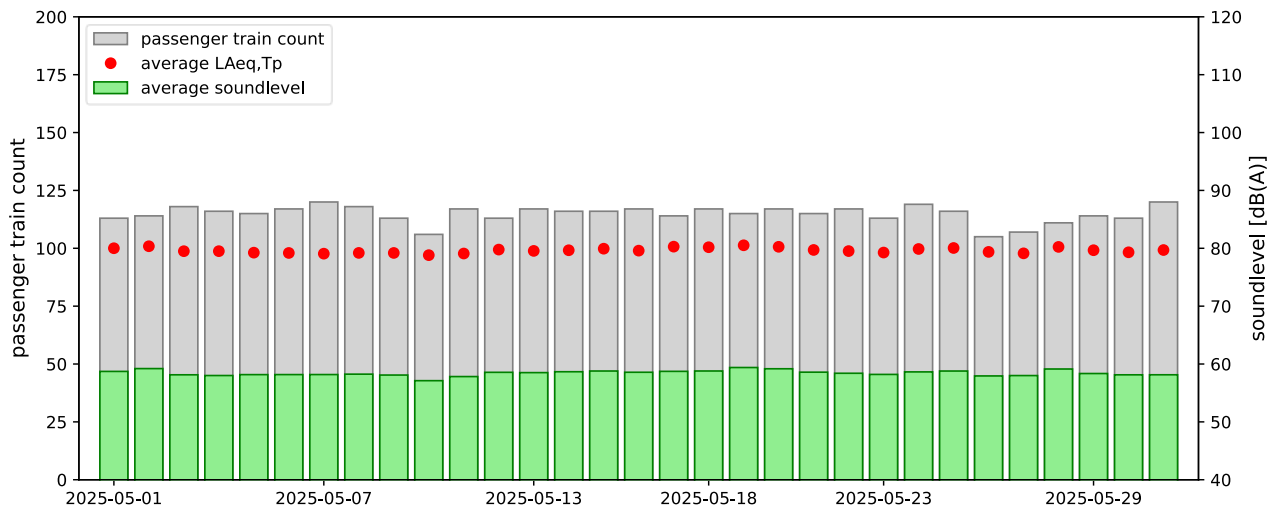
2. Measurement data

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



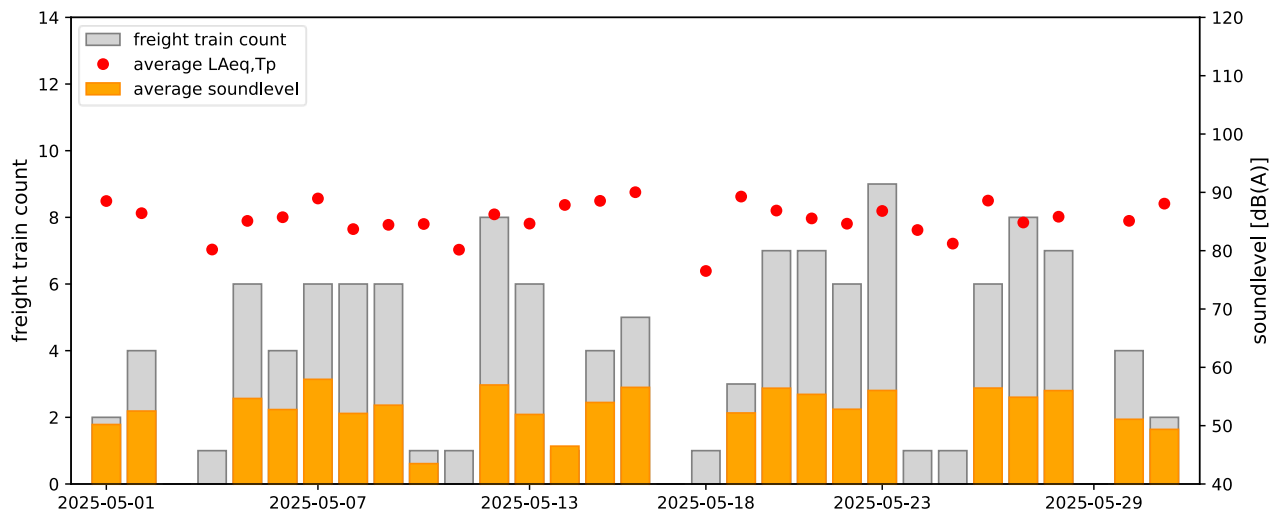
date	location	train count	passenger train count	freight train count	service train count	average LAeqTp	average soundlevel
01.05.2025	REF	115	113	2	0	80,5	59,3
02.05.2025	REF	120	114	4	2	81,1	60,2
03.05.2025	REF	119	118	0	1	79,6	58,2
04.05.2025	REF	117	116	1	0	79,5	58,0
05.05.2025	REF	122	115	6	1	80,5	59,8
06.05.2025	REF	121	117	4	0	80,1	59,3
07.05.2025	REF	128	120	6	2	81,9	61,2
08.05.2025	REF	126	118	6	2	79,9	59,3
09.05.2025	REF	120	113	6	1	80,0	59,3
10.05.2025	REF	107	106	1	0	78,9	57,3
11.05.2025	REF	118	117	1	0	79,1	57,8
12.05.2025	REF	121	113	8	0	81,5	60,9
13.05.2025	REF	123	117	6	0	80,2	59,4
14.05.2025	REF	117	116	1	0	79,9	58,9
15.05.2025	REF	121	116	4	1	81,1	60,0
16.05.2025	REF	123	117	5	1	81,7	60,8
17.05.2025	REF	116	114	0	2	80,4	58,9
18.05.2025	REF	118	117	1	0	80,2	58,8
19.05.2025	REF	118	115	3	0	81,2	60,2
20.05.2025	REF	126	117	7	2	81,9	61,2
21.05.2025	REF	125	115	7	3	81,1	60,4
22.05.2025	REF	125	117	6	2	80,5	59,7
23.05.2025	REF	125	113	9	3	81,1	60,4
24.05.2025	REF	121	119	1	1	80,0	58,8
25.05.2025	REF	117	116	1	0	80,1	58,8
26.05.2025	REF	111	105	6	0	81,6	60,3
27.05.2025	REF	117	107	8	2	80,5	59,9
28.05.2025	REF	119	111	7	1	81,4	60,8
29.05.2025	REF	115	114	0	1	79,7	58,4
30.05.2025	REF	118	113	4	1	80,0	59,0
31.05.2025	REF	123	120	2	1	80,3	58,8
month	REF	3712	3559	123	30	80,6	59,6

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



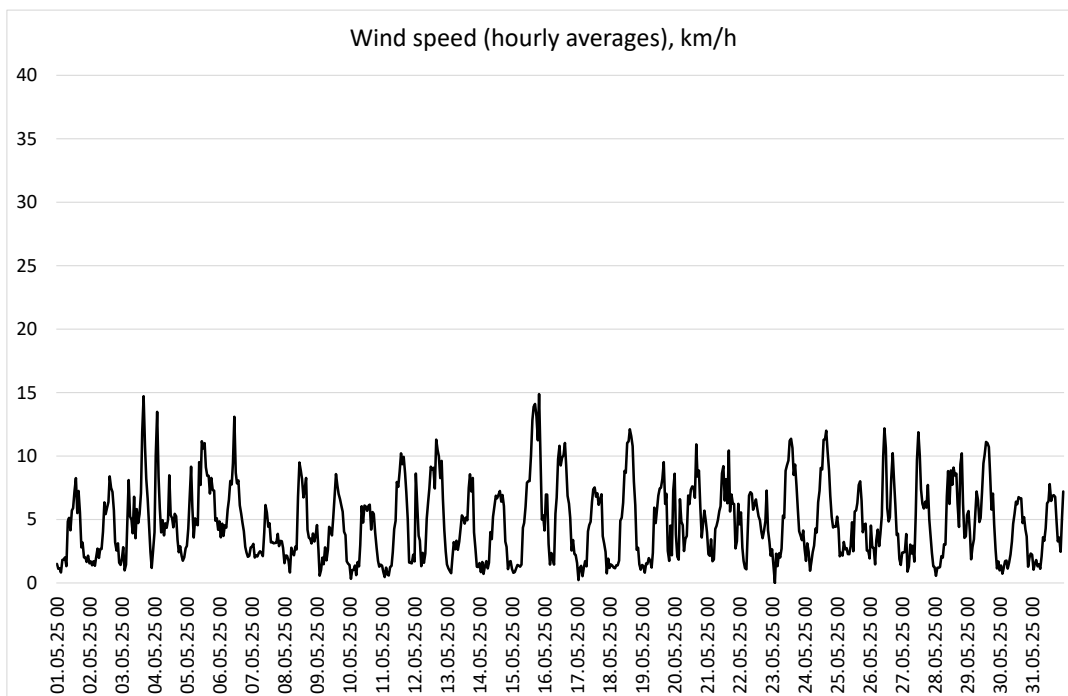
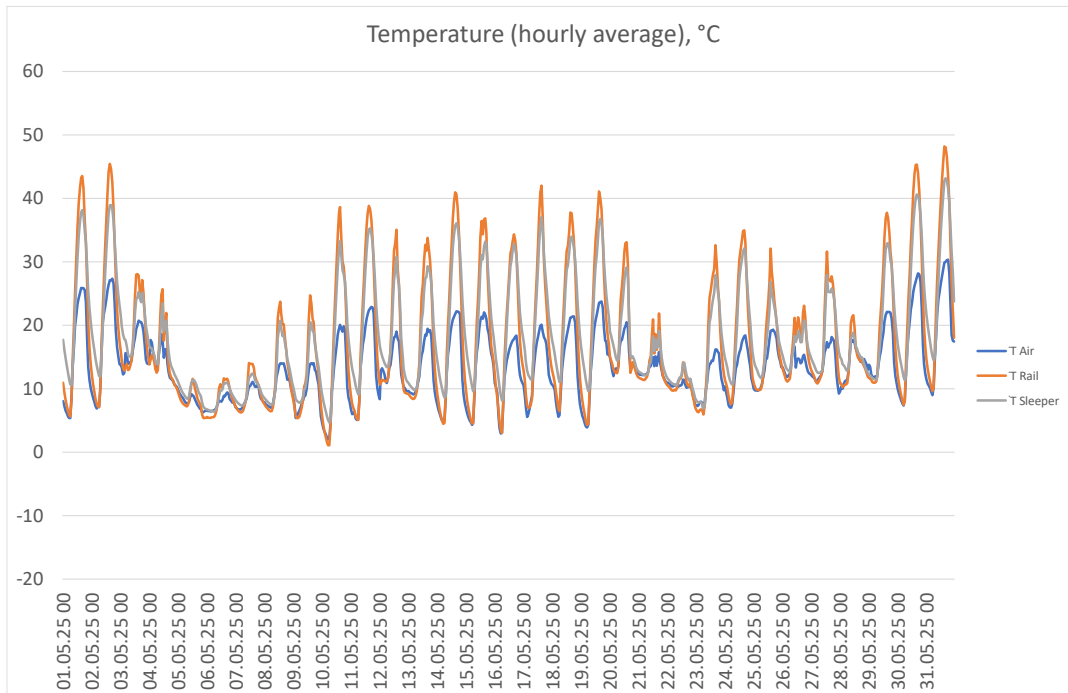
date	location	freight train count	average speed	average length	average axle count	average LAeqTp	average soundlevel
01.05.2025	REF	113	113,9	162,2	23,8	80,0	58,7
02.05.2025	REF	114	114,0	169,2	24,9	80,4	59,2
03.05.2025	REF	118	112,0	151,0	22,3	79,5	58,1
04.05.2025	REF	116	112,3	147,1	21,9	79,5	58,0
05.05.2025	REF	115	112,2	160,9	23,7	79,2	58,2
06.05.2025	REF	117	111,9	164,7	24,4	79,2	58,2
07.05.2025	REF	120	112,5	163,3	24,2	79,1	58,2
08.05.2025	REF	118	113,3	164,6	24,3	79,2	58,2
09.05.2025	REF	113	115,2	172,4	25,4	79,2	58,1
10.05.2025	REF	106	113,4	154,7	23,2	78,8	57,1
11.05.2025	REF	117	111,6	151,4	22,7	79,1	57,8
12.05.2025	REF	113	112,9	164,5	24,2	79,8	58,6
13.05.2025	REF	117	113,1	165,9	24,5	79,5	58,5
14.05.2025	REF	116	112,6	167,3	24,6	79,7	58,7
15.05.2025	REF	116	113,0	164,2	24,2	79,9	58,8
16.05.2025	REF	117	114,7	170,2	25,0	79,6	58,6
17.05.2025	REF	114	112,4	148,4	21,7	80,3	58,7
18.05.2025	REF	117	111,8	146,6	21,8	80,2	58,8
19.05.2025	REF	115	112,9	162,3	23,8	80,5	59,4
20.05.2025	REF	117	113,5	163,7	24,2	80,3	59,2
21.05.2025	REF	115	114,3	167,4	24,7	79,7	58,6
22.05.2025	REF	117	114,0	162,3	24,0	79,5	58,4
23.05.2025	REF	113	115,6	172,9	25,3	79,3	58,2
24.05.2025	REF	119	113,6	154,5	23,1	79,9	58,6
25.05.2025	REF	116	112,2	154,7	23,3	80,1	58,8
26.05.2025	REF	105	112,8	166,2	24,7	79,4	57,9
27.05.2025	REF	107	113,1	171,1	25,3	79,1	58,0
28.05.2025	REF	111	113,5	172,8	25,6	80,2	59,1
29.05.2025	REF	114	112,4	153,2	22,7	79,7	58,4
30.05.2025	REF	113	111,8	160,6	23,6	79,3	58,1
31.05.2025	REF	120	113,1	140,0	20,7	79,7	58,1
month	REF	3559	113,1	160,9	23,8	79,7	58,5

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
01.05.2025	REF	2	95,8	165,6	24,0	88,5	50,2
02.05.2025	REF	4	91,6	220,3	50,0	86,4	52,5
03.05.2025	REF	0					
04.05.2025	REF	1	99,9	96,8	20,0	80,2	36,5
05.05.2025	REF	6	84,4	282,8	66,7	85,1	54,7
06.05.2025	REF	4	94,1	279,5	67,5	85,7	52,8
07.05.2025	REF	6	93,0	284,2	63,0	88,9	57,9
08.05.2025	REF	6	86,3	210,4	49,3	83,7	52,1
09.05.2025	REF	6	82,6	252,4	58,8	84,4	53,5
10.05.2025	REF	1	90,3	146,5	30,0	84,6	43,5
11.05.2025	REF	1	77,2	32,4	6,0	80,2	33,2
12.05.2025	REF	8	85,8	284,3	66,5	86,2	57,0
13.05.2025	REF	6	79,8	174,7	33,0	84,6	51,9
14.05.2025	REF	1	109,9	175,6	26,0	87,8	46,5
15.05.2025	REF	4	90,6	180,0	29,5	88,5	54,0
16.05.2025	REF	5	96,3	203,4	38,0	90,0	56,6
17.05.2025	REF	0					
18.05.2025	REF	1	119,9	200,1	24,0	76,5	35,1
19.05.2025	REF	3	106,4	158,7	30,7	89,3	52,2
20.05.2025	REF	7	87,1	247,9	52,0	86,9	56,4
21.05.2025	REF	7	84,1	266,8	63,4	85,5	55,4
22.05.2025	REF	6	87,4	200,4	43,3	84,6	52,8
23.05.2025	REF	9	93,9	205,0	44,4	86,8	56,0
24.05.2025	REF	1	109,5	37,4	8,0	83,5	35,3
25.05.2025	REF	1	78,8	66,9	12,0	81,2	37,0
26.05.2025	REF	6	101,9	245,7	58,3	88,6	56,4
27.05.2025	REF	8	81,8	227,5	52,3	84,8	54,9
28.05.2025	REF	7	83,1	287,1	67,0	85,8	56,0
29.05.2025	REF	0					
30.05.2025	REF	4	82,2	176,3	32,5	85,1	51,1
31.05.2025	REF	2	78,6	146,9	22,0	88,1	49,4
month	REF	123	88,9	224,9	49,2	86,5	53,0

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