

30 LET

15. SLOVENSKI KONGRES

0 PROMETU IN PROMETNI INFRASTRUKTURI



PROTIHRUPNE OGRAJE ZA CESTE IN ŽELEZNICE

TRENDI V EVROPI, CERTIFICIRANJE PO VELJAVNEM EVROPSKEM STANDARDU EN 14388
DOKAZANA TRAJNOST TUDI DO 50 LET PO STANDARDU EN 14389

NOISE BARRIERS FOR ROADS AND RAILWAYS

TRENDS IN EUROPE, CERTIFICATION ACCORDING TO THE VALID EUROPEAN
STANDARD EN 14388 AND PROVEN DURABILITY UP TO 50 YEARS ACCORDING
TO THE EN 14389 STANDARD

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DELTABLOC, varnostne in protihrupne ograje d.o.o.

EN 14388:2005+AC:2008 (EN 14388:2015)

EN 14388:2015

This European Standard specifies requirements for the following road traffic noise reducing devices (as defined in 3.1): - noise barriers (as defined in 3.2); - claddings (as defined in 3.5); - road covers (as defined in 3.6); and - added devices (as defined in 3.7). These devices may include both acoustic and structural elements, where: - an acoustic element is an element whose primary function is to provide a noise reducing device with sound insulation, diffraction and/or sound absorption, it is a part of noise reducing device to be used along roads, and - a structural element is an element whose primary function is to support or hold in place acoustic elements, it is a part of noise reducing device to be used along roads. Depending upon the design of the noise reducing device, structural elements may potentially be tested separately from acoustic elements. They may be made of different materials for which specific standards are to be applied in accordance with the specifications prescribed hereafter. Some of the materials may contain dangerous substances, the reason why all the materials are declared. This European Standard identifies the relevant characteristics of road traffic noise reducing devices, the corresponding methods of evaluation and specifies the provisions on evaluation of conformity and marking. This European Standard covers acoustic, non-acoustic and long term performance, but not aspects such as resistance to vandalism or requirements of visual appearance. This European Standard does not cover road surfaces or the airborne sound insulation of houses.

EN 14388:2005/AC:2008 (EN 14388:2015)

EN 14388:2015

Ta evropski standard določa zahteve za naslednje protihrupne ovire za cestni promet (kot je opredeljeno v 3.1): – protihrupne ovire (kot je opredeljeno v 3.2); – obloge (kot je opredeljeno v 3.5); – cestne pokrove (kot je opredeljeno v 3.6) in – dodane naprave (kot je opredeljeno v 3.7). Te naprave lahko vključujejo tako akustične kot strukturne elemente: – če je glavna naloga zvočnega elementa v napravi zagotoviti zmanjšanje hrupa z zvočno izolacijo, lomom in/ali absorpcijo zvoka, če je zvočni element del naprave za zmanjšanje hrupa, ki se uporablja ob cestah, in – če je glavna naloga zvočnega elementa v napravi podpirati ali združevati akustične elemente, če je zvočni element del naprave za zmanjšanje hrupa, ki se uporablja ob cestah. Odvisno od zasnove naprave za zmanjšanje hrupa se lahko konstrukcijske elemente po potrebi preskuša ločeno od akustičnih elementov. Lahko so izdelani iz različnih materialov, za katere se uporabljajo posebni standardi v skladu s specifikacijami, predpisanimi v nadaljevanju. Nekateri materiali lahko vsebujejo nevarne snovi, zato so vsi deklarirani. Ta evropski standard opredeljuje ustrezne značilnosti naprav za zmanjševanje hrupa cestnega prometa, ustrezne metode vrednotenja in opredeljuje določbe ocenjevanja skladnosti in označevanja. Ta evropski standard zajema akustično, neakustično in dolgoročno zmogljivost, ne pa tudi vidikov odpornosti na vandalizem ali zahteve glede videza. Ta evropski standard ne zajema cestnih površin ali zračne zvočne izolacije hiš.

EN 14388:2005+AC:2008 (EN 14388:2015)

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 14388

December 2021

ICS 93.080.30

Will supersede EN 14388:2015

English Version

Road traffic noise reducing devices - Characteristics

Dispositifs de réduction du bruit du trafic routier -
Caractéristiques

Lärmschutzvorrichtungen an Straßen - Merkmale

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 226.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC

Povezava na standarde

Povezava	Ime	Datum
Nadomešča	SIST EN 14388:2005/AC:2008 - Protihrupne ovire za cestni promet - Specifikacije	01-Dec-2015
Nadomešča	SIST EN 14388:2005 - Protihrupne ovire za cestni promet – Specifikacije	01-Dec-2015
Revidiran	kSIST FprEN 14388:2019 - Protihrupne ovire za cestni promet - Specifikacije	01-Oct-2017
Revidiran	oSIST prEN 14388:2022 - Protihrupne ovire za cestni promet - Značilnosti	29-Jan-2020

• Slovenski standardi SIST s cenovnim razredom AC so popravki standardov in so v večini primerov brezplačni.

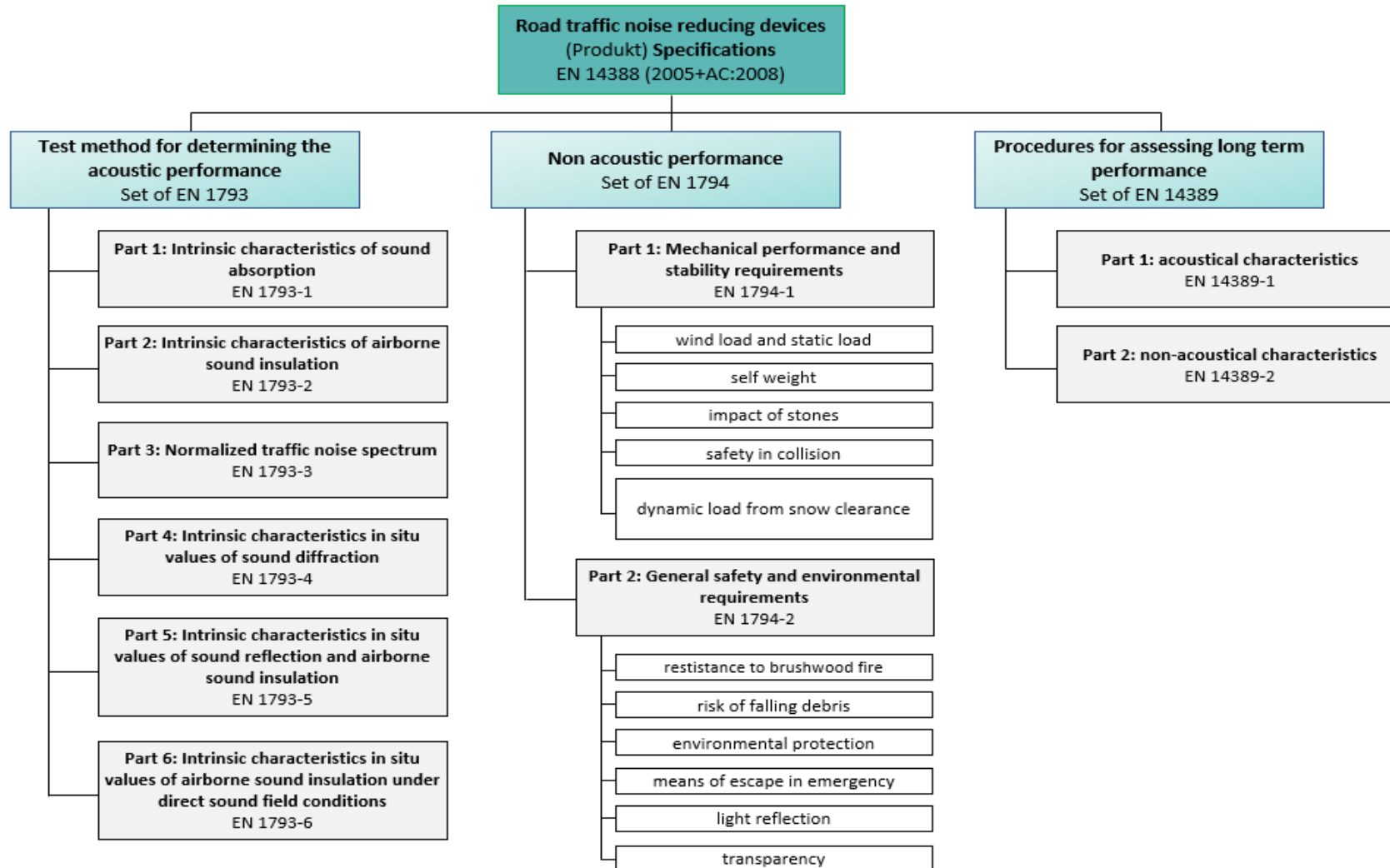
• Slovenski standardi SIST s cenovnim razredom AP so privzeti tuji standardi, katerih sestavni del je izvorni standard, ki ga moramo pridobiti pri izdajatelju v tujini. Naročilo pošljite na: prodaja@sist.si.

Testing procedures

carried out by accredited testing institutes

Acoustic performance	Mechanical performance	Durability and service life	Dynamic performance
Absorption of different Absorber designs	Fire resistance against brushwood fires	Long term efficacy Acoustic properties	Fatigue test lateral force
Airborne sound insulation for NB-systems	Danger from falling wall parts (pendulum impact)	Long term efficacy Non-acoustic properties	Fatigue test Bending force
In-Situ sound-reflection coefficient	Frost and deicing-salt resistance		Torsional characteristics
In-Situ sound-insulation coefficient	Structural analysis test report		

EN 14388:2005+AC:2008



ZTV-LSW 06,...

ZTV-Lsw 06

Zusätzliche Technische Vertragsbedingungen und Richtlinien für die Ausführung von Lärmschutzwänden an Straßen

Zusätzliche Technische Vertragsbedingungen und Richtlinien für die Ausführung von Lärmschutzwänden an Straßen (ZTV-Lsw 06)

Bekanntmachung des Bayerischen Staatsministeriums des Innern
vom 28. Februar 2007, Az. IID9-43813-004/92

(AllmBl. S. 209)

Zitiervorschlag: Bekanntmachung des Bayerischen Staatsministeriums des Innern über Zusätzliche Technische Vertragsbedingungen und Richtlinien für die Ausführung von Lärmschutzwänden an Straßen (ZTV-Lsw 06) vom 28. Februar 2007 (AllmBl. S. 209)

An die Regierungen

- die Autobahndirektionen
- die Staatlichen Bauämter

nachrichtlich an:

- die Landkreise
- die Städte
- die Gemeinden

1. Allgemeines

Das Bundesministerium für Verkehr, Bau und Stadtentwicklung hat mit Allgemeinem Rundschreiben Straßenbau (ARS) Nr. 25/2006 mitgeteilt, dass auf Grund der seit 1997 vorangeschrittenen europäischen Normung zu akustischen und nicht akustischen Eigenschaften von Lärmschutzwänden sowie technischer Weiterentwicklungen die mit ARS Nr. 8/1988 eingeführten ZTV-Lsw 88 von der Forschungsgesellschaft für Straßen- und Verkehrswesen als „Zusätzliche Technische Vertragsbedingungen und Richtlinien für die Ausführung von Lärmschutzwänden an Straßen, Ausgabe 2006 (ZTV-Lsw 06)“ fortgeschrieben wurden.



2. Anwendung

Die ZTV-Lsw 06 werden hiermit bekannt gegeben. Sie sind beim Bau von Lärmschutzwänden an Bundesfernstraßen ab sofort in allen neuen Bauverträgen aufzunehmen.

Initial performance declaration for absorbers & noise protection panels

Summary of all relevant test reports in the initial performance declaration.

- Absorption test report of each absorber design
- Airborne sound insulation test for noise protection system
- Measurements of the sound reflection index
- Measurements of the sound insulation index
- Test report fire resistance against brushwood fires
- Danger from falling wall parts
- Frost-thaw resistance test
- Structural analysis test report

	Bericht	
Zahl: 24850/2015	Zeichen: Zk	Datum: 25.08.2015
<u>Auftrag:</u>		
Leistungsfeststellung der Lärmschutzwände		
PHONOBLOC® HB einseitig- und beidseitig hochabsorbierend		
der Fa. MABA Fertigteilmontage GmbH, Werk Micheldorf nach ÖNORM EN 14388:2008-10-01 und DIN EN 14388:2005-10 und Berichtigung 1:2008-09		
<u>Auftraggeber:</u>		
Kirchdorfer Fertigteilmontage GmbH Kirchdorfer Platz 1 A 2752 Wollersdorf		
<u>Hersteller:</u>		
Absorberstein: Fa. Thermo-Span Baustoffwerk Harm-Quehenberger GmbH in St. Johann im Pongau im Auftrag der Fa. DELTA BLOC International GmbH		
<u>Prüfdatum:</u> 20.07.2015 bis 25.08.2015		
Dieser Bericht umfasst 7 Textseiten und 41 Beilagen (30 Zeichnungen, 7 Prüfberichte MA39, 3 BTI Prüfberichte und die Statik von FCP).		
<small>FN 401514m Sitz Puchenuau FB-Gericht Linz</small>		
<small>AÖR AUSTRIAN COOPERATIVE RESEARCH KOOPERATION MIT KOMPETENZ</small>		
BTI Bautechnisches Institut GmbH A 4048 Puchenuau bei Linz, Karl Leitl-Straße 2, Austria		
<small>VERSUCHS- UND FORSCHUNGSANSTALT FÜR BAUTECHNIK UND BAUSTRUKTUREN</small> T +43 732 221515 F +43 732 221690 e-mail: office@bti.at		
<small>Informationen über die Akkreditierung der BTI Bautechnisches Institut GmbH als Prüf- und Inspektionsstelle sind auf der Website www.bti.at abrufbar. Die BTI Bautechnisches Institut GmbH ist notifizerte Stelle (Nr. 1269). Die im Rahmen der Akkreditierung ausgearbeiteten Prüfberichte gelten als öffentliche Urkunden. Eine auszugsweise Wiedergabe bedarf der Zustimmung des Leiters des BTI. Die ausgeführten Untersuchungen gelten nur für den beschriebenen Untersuchungsgegenstand.</small>		


Declaration of Performance (DoP) = Iol - Izjava o Lastnostih for absorbers & noise protection panels

Issued by DELTABLOC

Content based on the initial performance declaration.

Separate DoP for each product series

- HB Absorber Series
- Whisper® Absorber Series
- BHB Panel Series
- AHB Panel Series
- WV Series Series
- AL Paneel series
- DB NBF Series
- Quie@Rail

DECLARATION OF PERFORMANCE		DELTABLOC®
PHONOBLOC® HB Absorber Series		CE
NO. EN		
Unique identification code of the product-type		
Noise reduction absorber "PHONOBLOC® HB Absorber Series"		
Identification mark		
Type, batch or serial number		
Acoustic types of absorbers made of wood-chip concrete: highly absorbent or absorbent		
Use or Uses of the product		
Reduction of traffic noise or other noise sources along roads, rails and industry.		
Manufacturer		
Registered trade name and contact address		
Thermo-Span Bauststoffwerk HarmI-Quehenberger GmbH		
Maschl 28		
5600 St. Johann im Pongau		
Österreich		
System Evaluation and Verification Process		
System for the assessment and verification of the performance in accordance with Annex V of the Construction Products Regulation: System 3		
Harmonised standard		
Applicable standard: EN 14388:2005+AC:2008		
On the basis of the initial type test, carried out by the notified body "BTI Bautechnisches Institut GmbH, Karl Leitl-Strasse 2, 4048 Puchenu, Austria", the manufacturer has determined the declared performance according to System 3 and issued the certificate of conformity.		
		1 4

Sound absorption vs. airborne sound insulation

Sound absorption		Airborne sound insulation	
Absorption groups	Sound absorption	Insulation group	Airborne sound insulation value
A1	Up to 4dB	B1	< 15dB
A2	4-7dB	B2	15-24dB
A3	8-11dB	B3	25-34dB
A4	12-15dB	B4	> 34dB
A5	> 15dB		



Acoustic tests

in laboratory/reverberation room

Test setup sound absorption acc. to EN 1793 / EN 16272-1 (Diffuse sound field)

Measurement of the difference in the reverberation times (before-without absorber / after-with absorber material)



Measurement without absorbers



Measurement with absorbers

Acoustic tests in laboratory/reverberation room

Test setup airborne sound insulation acc. to EN 1793-2 / EN 16272-2

Measurement of the sound transmission value

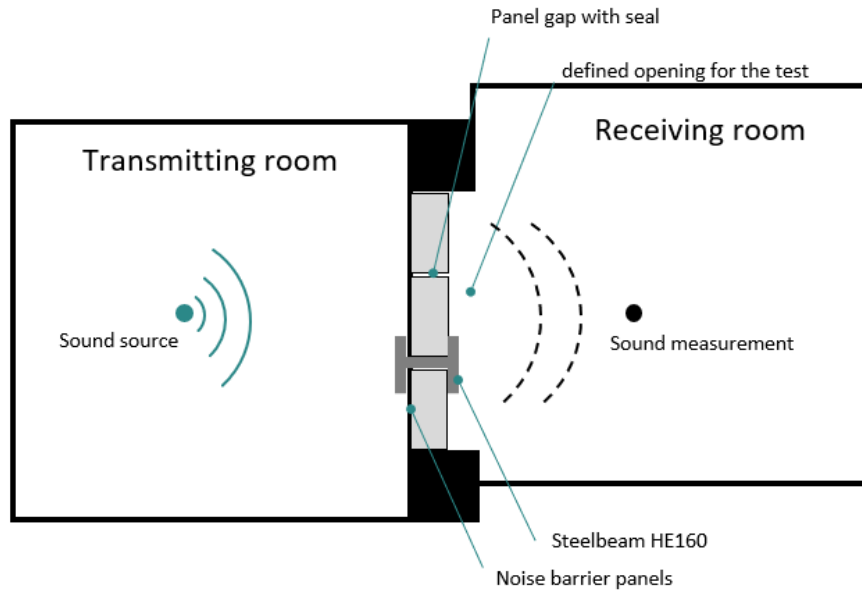
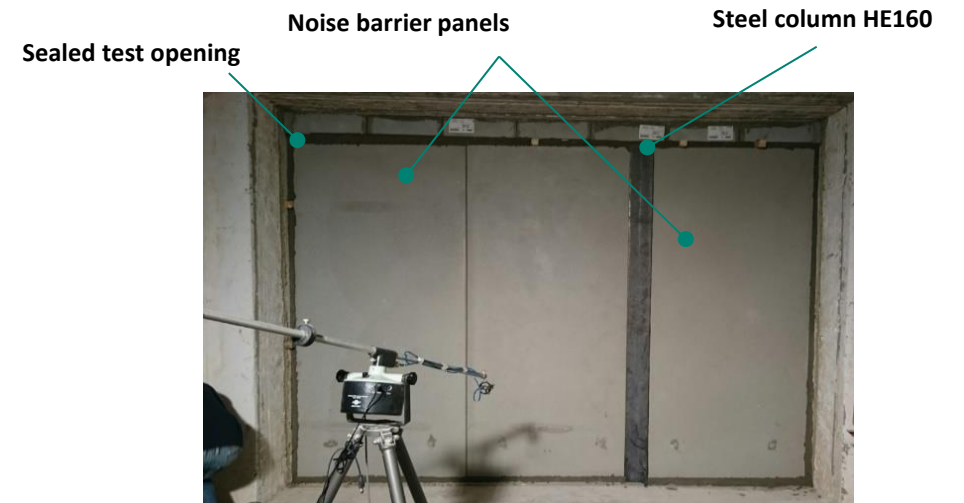


Illustration of the test rooms



Test testup – Receiving room

Acoustic reference tests in laboratory/reverberation room



Test setup - sound reflection - acc. to
EN 1793-5 or EN 16272-3-2



Test setup - airborne sound insulation -
acc. to EN 1793-6 or EN 16272-3-2

Fire resistance against brushwood fire acc. to EN 1794-2



Before fire

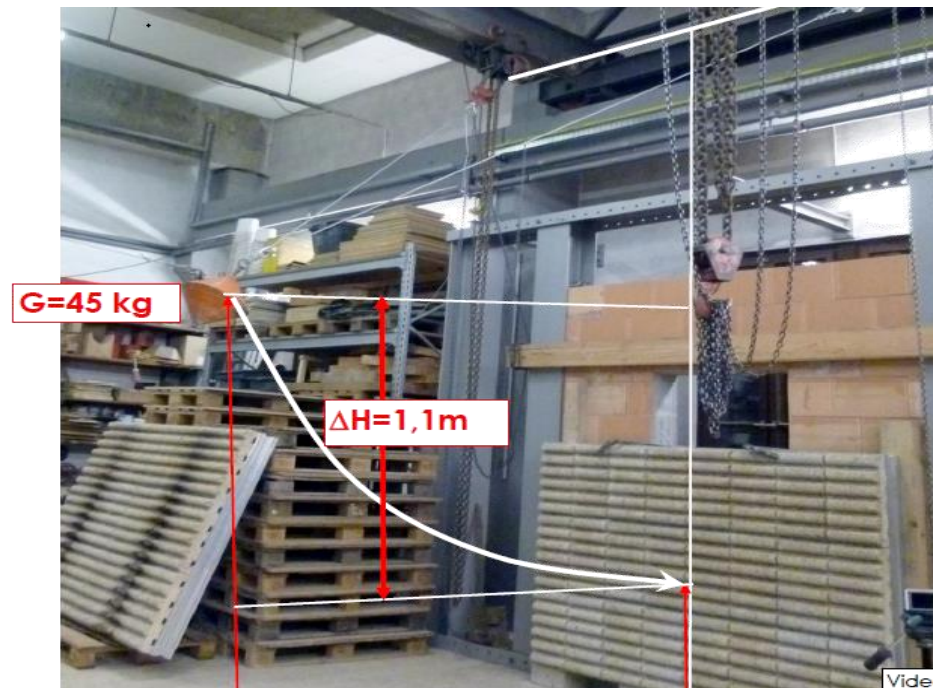


During fire



After fire

Danger from falling wall parts (pendulum impact) acc. to EN 1794-2



Structural analysis acc. to EN 1794-1


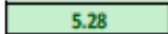

Structural analysis – Loading conditions:

- Weight
- Wind
- Dynamic impact by vehicles
- Dynamic loads due to snow clearance
- Temperature
- On transport conditions

BEWEHRUNGSMATRIX - PHONOBLOC TYP HB 10 einseitig und PHONOBLOC HB 10 beidseitig, Paneellänge L = 4,96 m - STRASSE

Paneelhöhe		H = 1,0m	H = 2,0m	H = 3,0m	H = 4,0m	H = 5,0m	H = 6,0m	H = 7,0m	H = 8,0m	H = 9,0m	H = 10,0m
1. Paneel (4,96m lang) (= Anfang der LSW)	M _{max} [kNm]	6.45	8.65	8.99	9.08	9.21	9.36	9.55	9.76	9.98	10.20
	aserf [cm ² /m]	4.24	4.80	5.02	5.08	5.15	5.25	5.37	5.50	5.65	5.77
2. Paneel	M _{max} [kNm]		4.89	5.66	7.79	8.86	8.86	8.86	8.86	8.86	8.86
	aserf [cm ² /m]		4.02	3.91	4.28	4.94	4.94	4.94	4.94	4.94	4.94
3. Paneel	M _{max} [kNm]				5.38	5.38	6.54	8.59	8.86	8.86	8.86
	aserf [cm ² /m]				3.73	3.73	4.25	4.77	4.94	4.94	4.94
4. Paneel	M _{max} [kNm]					5.38	5.38	5.38	5.64	7.78	8.86
	aserf [cm ² /m]					3.73	3.73	3.73	3.83	4.27	4.94
5. Paneel	M _{max} [kNm]						5.26	5.38	5.37	5.38	5.38
	aserf [cm ² /m]						3.65	3.73	3.72	3.72	3.73
6. Paneel	M _{max} [kNm]							4.88	5.38	5.38	5.38
	aserf [cm ² /m]							3.62	3.72	3.72	3.73
7. Paneel	M _{max} [kNm]								4.31	5.38	5.38
	aserf [cm ² /m]								3.55	3.72	3.73
8. Paneel	M _{max} [kNm]									3.92	5.38
	aserf [cm ² /m]									3.32	3.73
9. Paneel	M _{max} [kNm]										
	aserf [cm ² /m]										

Legende:

	6.36	Abgedeckt mit 6.36cm ² (AQ90)	Erforderliche Bewehrung Scheeräumung <6m = 4.83cm ² Erforderliche Bewehrung Scheeräumung >6m = 4.45cm ²
	5.28	Abgedeckt mit 5.28cm ² (A82)	
	4.85	Abgedeckt mit 4.85cm ² (A70 + 2Φ8)	

Für die Standardpaneele wird eine Bewehrungsmatte gewählt.

Für die Randpaneele, welche eine maximale Bewehrung aufweisen, wird eine Bewehrungsmatte AQ90 (6,36 cm²/m) gewählt.

Durability and service life acc. to EN 14389-1/2

Approved service life of 50 (100) years, accomplished in a certified climate chamber

- UV resistance
- Freeze-thaw alternation from -30 °C to + 40 °C
- Rain
- Spray mist with caustic soda lye
- Air pollution
- 48 hours of climatic chamber correspond to 1 year of aging



Durability and service life acc. to EN 14389-1 (acoustic performance)

In-situ testing according to EN 1793-5 in new condition (on the right) and always 1m² after being aged another period in the climatic chamber (on the left).



Static and dynamic tests

Fatigue acc. to bending force, lateral force , torisonal analysis

National requirement for high-speed rail approval (e.g. ÖBB, DB,...)



Static and dynamic tests Fatigue acc. to bending force (AL Series)

- National requirement for high-speed rail approval (e.g. Deutsche Bahn)





KIRCHDORFER
INDUSTRIES

Diapozitiv 2
CTRL + klik – sledi povezavi

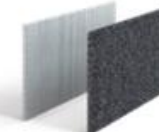
Company presentation & partnership models



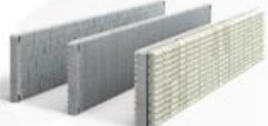
EN standards & test certificates



HB Absorber Series



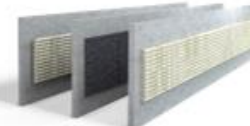
Whisper® Absorber Series



BHB Panel Series



AHB Panel Series



WV Series



AL Panel Series



DB NBF Series



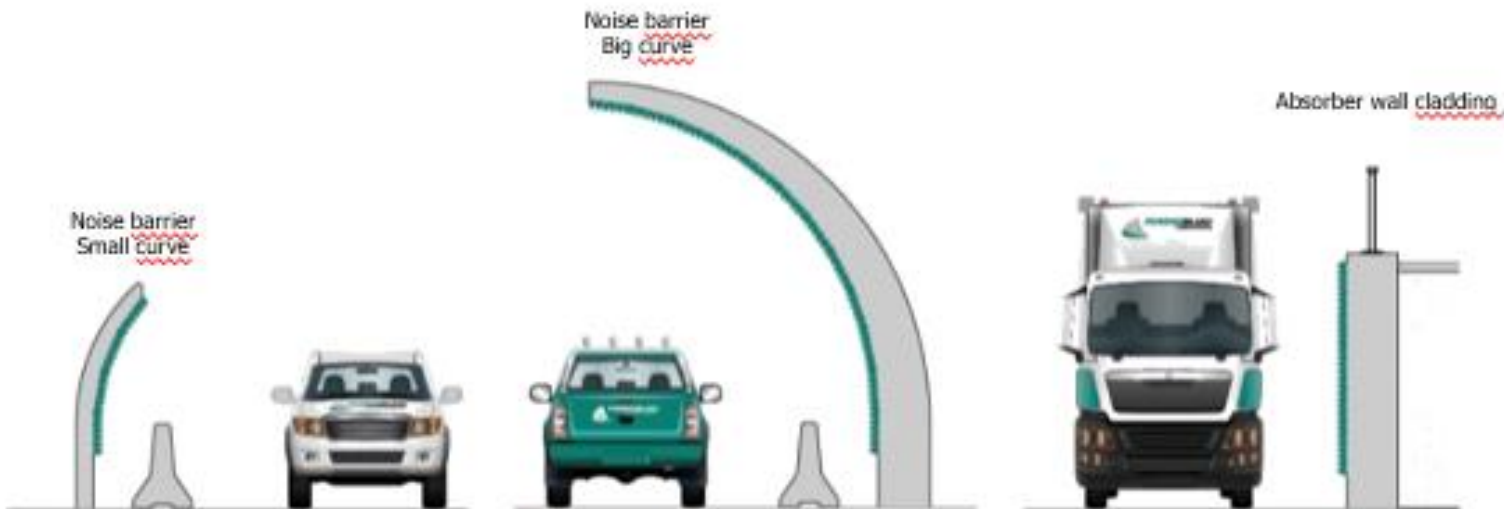
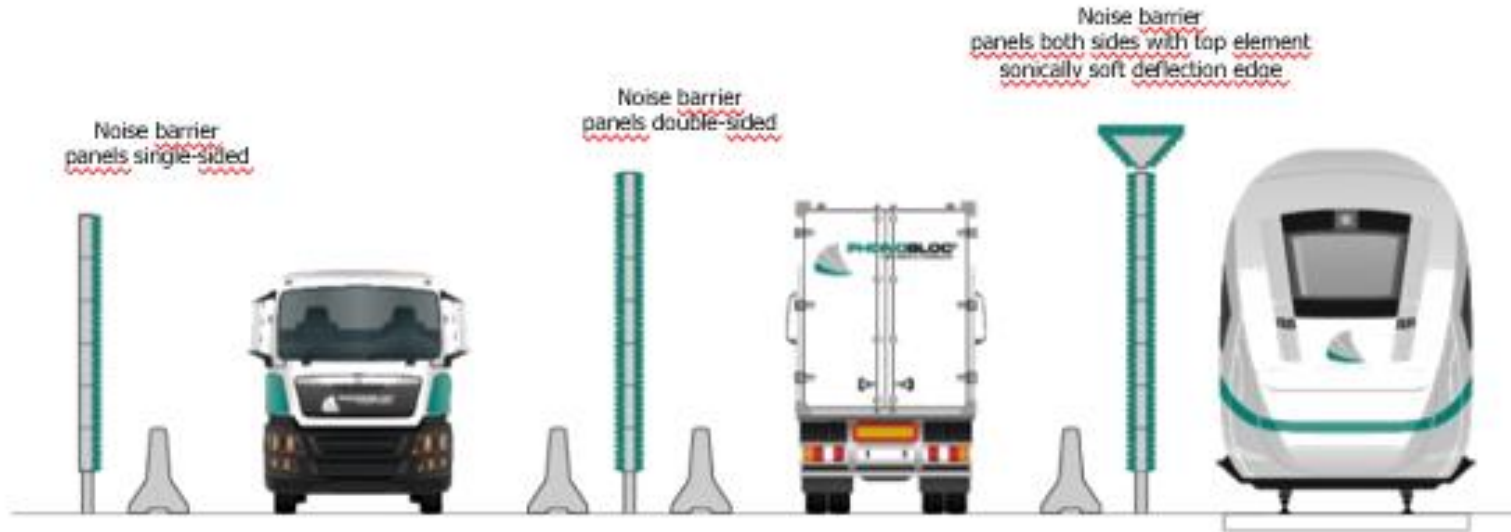
Special Rail Series



Construction of a noise barrier with deep foundation



Construction of a HBX noise barrier





Acoustic properties

PHONOBLOC HB Absorber

	ROAD		RAIL	
	Absorption DL α EN 1793-1	Reflexion In-Situ DLRI EN 1793-5	Absorption DL α EN 16727-1	Reflexion In-Situ DLRI EN 16727-3-2
HB 10/3,5 WAVEline	9dB	5dB	10dB	6dB
HB 10/5 WAVEline	15dB	5dB	20dB	6dB
HB 12 CONEline	20dB	6dB	20dB	6dB
HB 12 TRAPline	15dB	7dB	20dB	8dB
HB 5 FLATline	6dB	n.g.	6dB	n.g.
HB 9 FLATline	6dB	n.g.	7dB	n.g.
HB 12 FLATline	9dB	3dB	10dB	3dB
HB 5/9 FLATline *	9dB	3dB	9dB	3dB

PHONOBLOC® HB ABSORBER SERIES

ABSORBER TYPES	INDEX GRAPHIC	DIMENSIONS ¹⁾ L×B×H	A-DRAW.	ART. NO.	DRY WEIGHT	TRANSPORT WEIGHT ²⁾	MODE OF OPERATION	ROAD		RAIL		FIRE RESISTANCE ACC. TO EN 1794-2	PEN-DULUM SWING ACC. TO EN 1794-2	STONE THROWING RESISTANCE ACC. TO EN 1794-1	STATIC EVIDENCE	FROST AND DE-ICING SALT RESISTANCE ACC. TO EN 14474	LONG-TERM EFFECTIVENESS ACC. TO EN 14389-1/2	CE ACC. TO EN 14388	
								SOUND ABSORPTION DL _w ACC. TO EN 1793-1	SOUND-REFLECTION DL _w ACC. TO EN 1793-5	SOUND ABSORPTION DL _w ACC. TO EN 16272-1	SOUND REFLECTION DL _w ACC. TO EN 16272-3-2								
HB 10/3.5 WAVEline	A	50×25×10cm	A702616	139482	50 kg/m ²	62 kg/m ²	Absorbent/ highly absorbent, depending on absorber type	9 dB	A3	5 dB	10 dB 11 dB ³⁾	6 dB	Class 3	Class 2	Fulfilled	Evidence for each application through corresponding statics (e.g. panel statics)	Fulfilled	Acoustic and non- acoustic properties 50 years	Class 3
HB 10/5 WAVEline	B	50×25×10cm	A739353	188232	50 kg/m ²	62 kg/m ²		15 dB	A4	6 dB	20 dB	6 dB							
HB 12 CONEline	C	50×25×12cm	A706280	120678	59 kg/m ²	69 kg/m ²		20 dB	A5	6 dB	20 dB	6 dB							
HB 12 TRAPline	D	50×25×12cm	A706282	120677	61 kg/m ²	72 kg/m ²		15 dB 20 dB ³⁾	A4 A5 ³⁾	7 dB	15 dB 20 dB ³⁾	8 dB							
HB 5 FLATline	E	50×25×5cm	A706300	132336	28 kg/m ²	37 kg/m ²		6 dB	A2	Not tested	6 dB	Not tested							
HB 9 FLATline	F	50×25×9cm	A706731	132337	54 kg/m ²	71 kg/m ²		6 dB 7 dB ³⁾	A2	Not tested	7 dB	Not tested							
HB 12 FLATline	G	50×25×12cm	A706268	120675	73 kg/m ²	85 kg/m ²		9 dB 10 dB ³⁾	A3	3 dB	10 dB	3 dB							
HB 5/9 FLATline Mix 1:1		50×25×5/9cm	A739316	132336 132337	41 kg/m ²	50 kg/m ²		9 dB	A3	3 dB	9 dB	3 dB							



1) Dimensional tolerance length, width due to swelling and shrinking behaviour +/- 5 mm
 2) Immediately after production (containing 30 % water)
 3) With steel post cladding

BHB Panel Series (Beton Holz Beton)



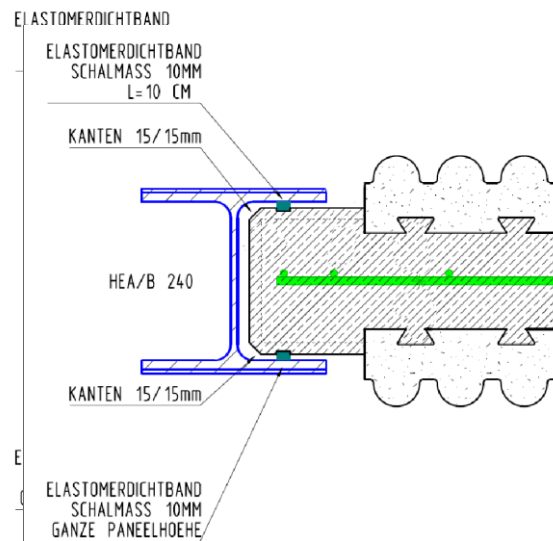
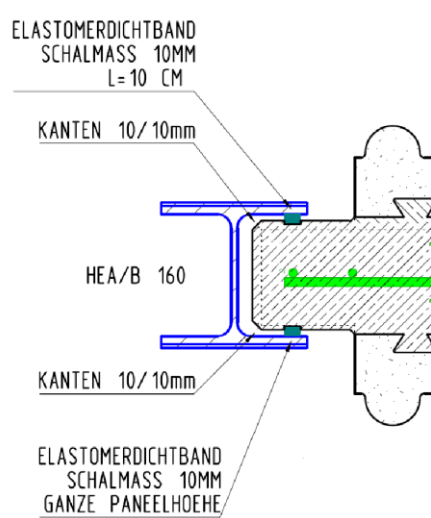
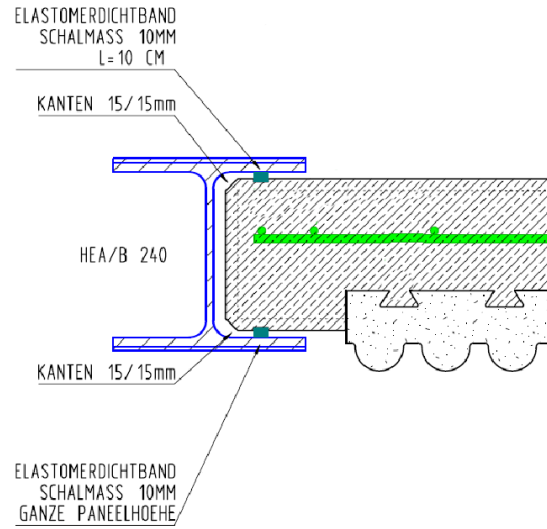
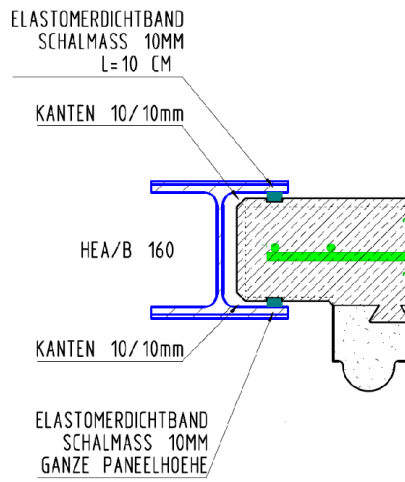
Standard dimensions

	BHB Panel
Panel length	Up to 596cm (6m axial distance)
Panel height	50cm, 100cm, 150cm
Panel thickness	12,5cm concrete core (Standard) + absorber thickness

Special dimensions and formats possible

Weight: from 390kg / m²

■ BHB-E panels in HEA/B 160 & 240



HADAGLI Standard

HADAGLI Standard Plus

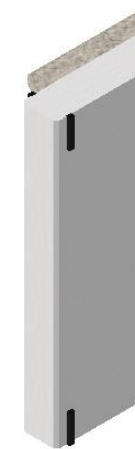
Front



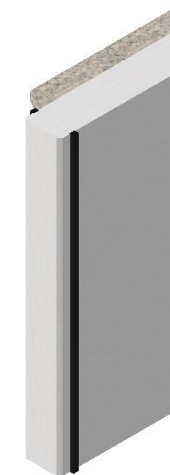
Front



Rear



Rear



Acoustic properties on tested reference panels

mit PHONOBLOC® HB 10/3,5 WAVEline Absorber

- EN 1793-1 ... Absorption DL_{α} 9 dB
- EN 1793-5 ... Reflection In Situ DL_{RI} 5 dB
- EN 1793-2 ... Sound insulation DL_R 41 dB
- EN 1793-6 ... Sound insulation In Situ DL_{SI} 42 dB



mit PHONOBLOC® HB 10/5 WAVEline Absorber

- EN 1793-1 ... Absorption DL_{α} 15 dB
- EN 1793-5 ... Reflection In Situ DL_{RI} 5 dB
- EN 1793-2 ... Sound insulation DL_R 41 dB
- EN 1793-6 ... Sound insulation In Situ DL_{SI} 42 dB



mit PHONOBLOC® HB 5/9/12 FLATline Absorber

- EN 1793-1 ... Absorption DL_{α} 6 / 6 / 9 dB
- EN 1793-5 ... Reflection In Situ DL_{RI} n.g./n.g./ 3 dB
- EN 1793-2 ... Sound insulation DL_R 41 dB
- EN 1793-6 ... Sound insulation In Situ DL_{SI} 38 dB



Acoustic properties on tested reference panels

mit PHONOBLOC® HB 12 TRAPline Absorber

- EN 1793-1 ... Absorption DL_{α} 15 dB
- EN 1793-5 ... Reflection In Situ DL_{RI} 7 dB
- EN 1793-2 ... Sound insulation DL_R 41 dB
- EN 1793-6 ... Sound insulation In Situ DL_{SI} n.g.



mit PHONOBLOC® HB 12 CONEline Absorber

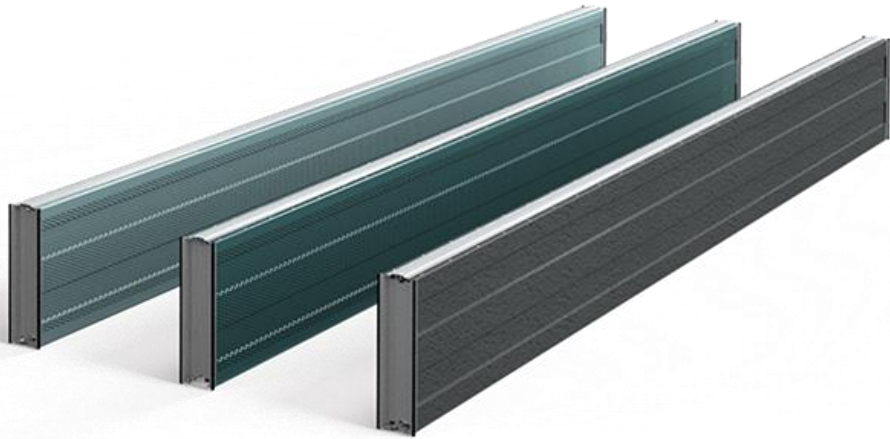
- EN 1793-1 ... Absorption DL_{α} 20 dB
- EN 1793-5 ... Reflection In Situ DL_{RI} 6 dB
- EN 1793-2 ... Sound insulation DL_R 41 dB
- EN 1793-6 ... Sound insulation In Situ DL_{SI} n.g.



AL Panel Series

Standard dimensions

AL-E/B/R panels

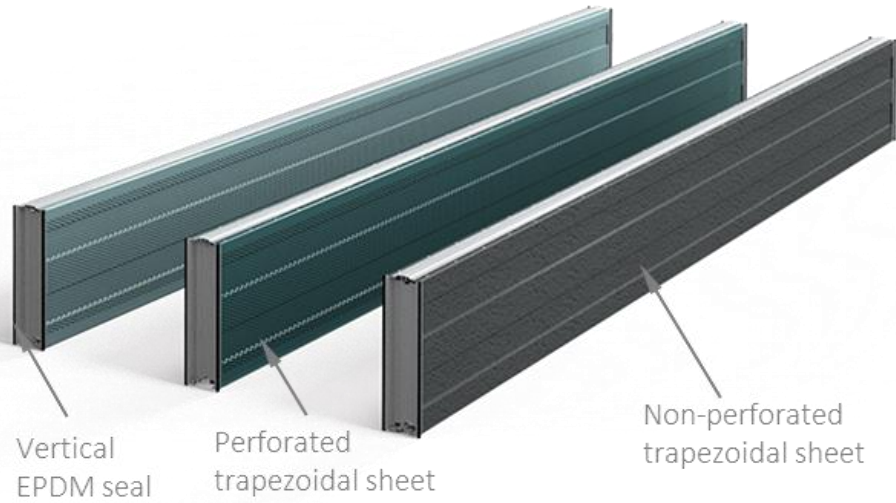


Standard AL-E/B/R	
Panel length	Up to 596cm
Panel height	50cm
Panel thickness	12,5cm

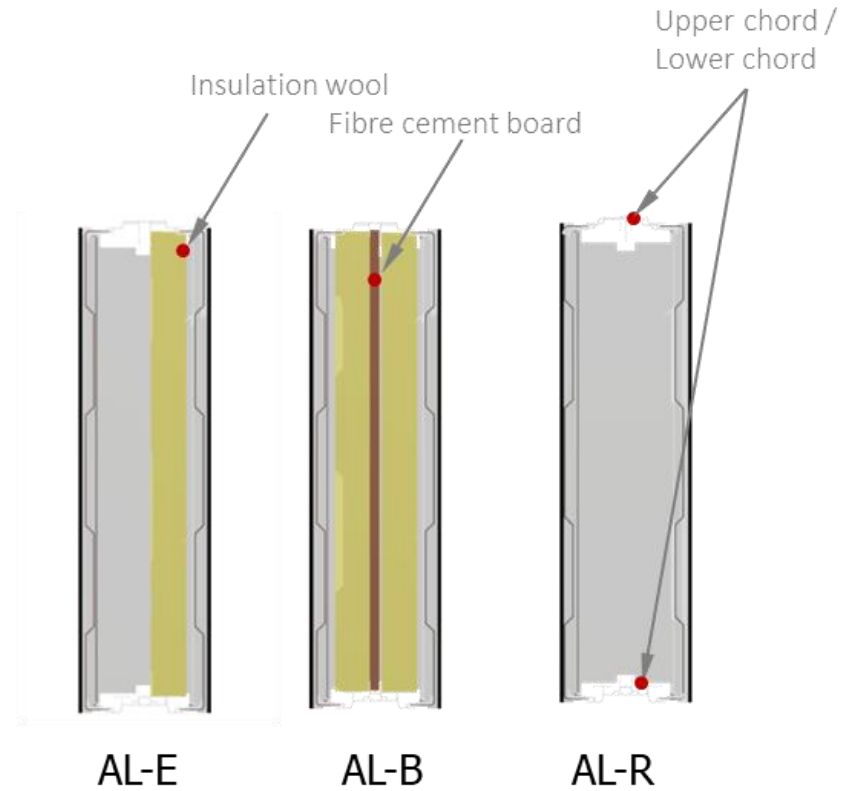
- Special dimensions and shapes available
- Weight: 8-30 kg/m²

AL Panel Series

Panel construction AL-E/B/R panels



- AL-E....Single-sided highly absorbent
- AL-B....Double-sided highly absorbent
- AL-R....Reflective



AL Panel Series

Standard dimensions

AL-T panels (T = Transparent)



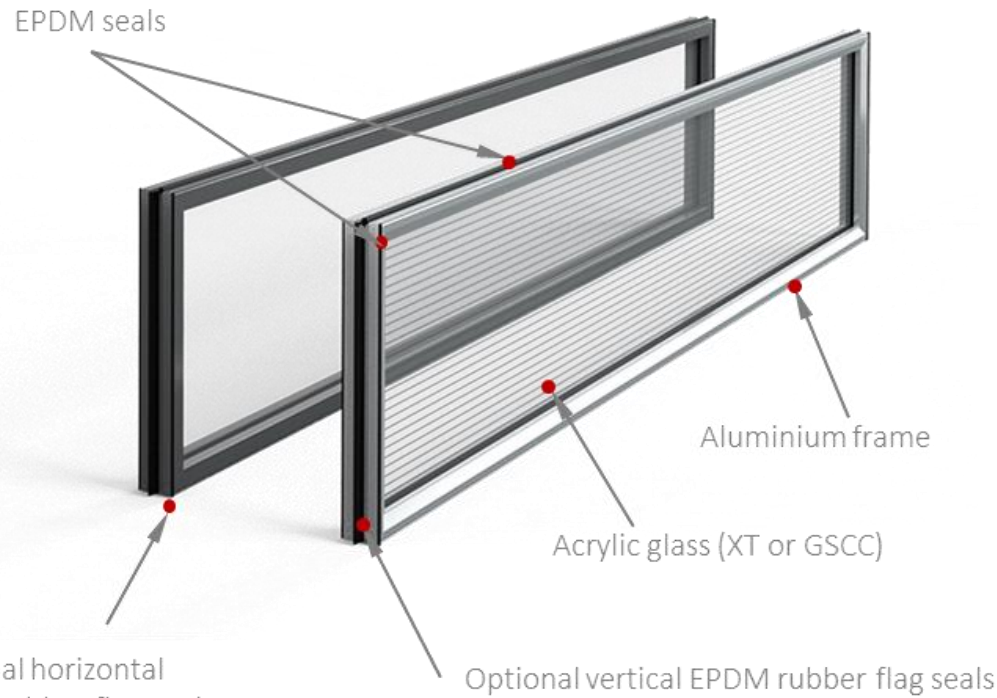
Standard AL-T	
Panel length	Up to 596cm
Panel height	50cm, 100cm, 200cm
Panel thickness	12,6cm

- Special dimensions and shapes available
- Weight: 20-40kg/m²

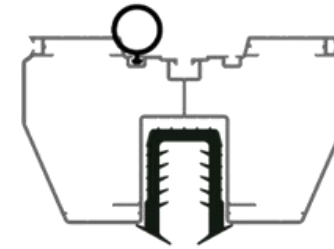
AL Panel Series

Panel structure

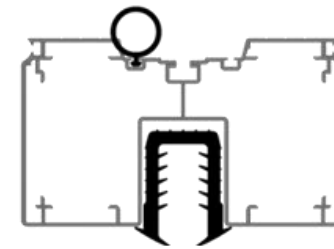
AL-T panels



Standard frame
Extruded aluminium



Strengthened frame (acc. statics)
Extruded aluminium



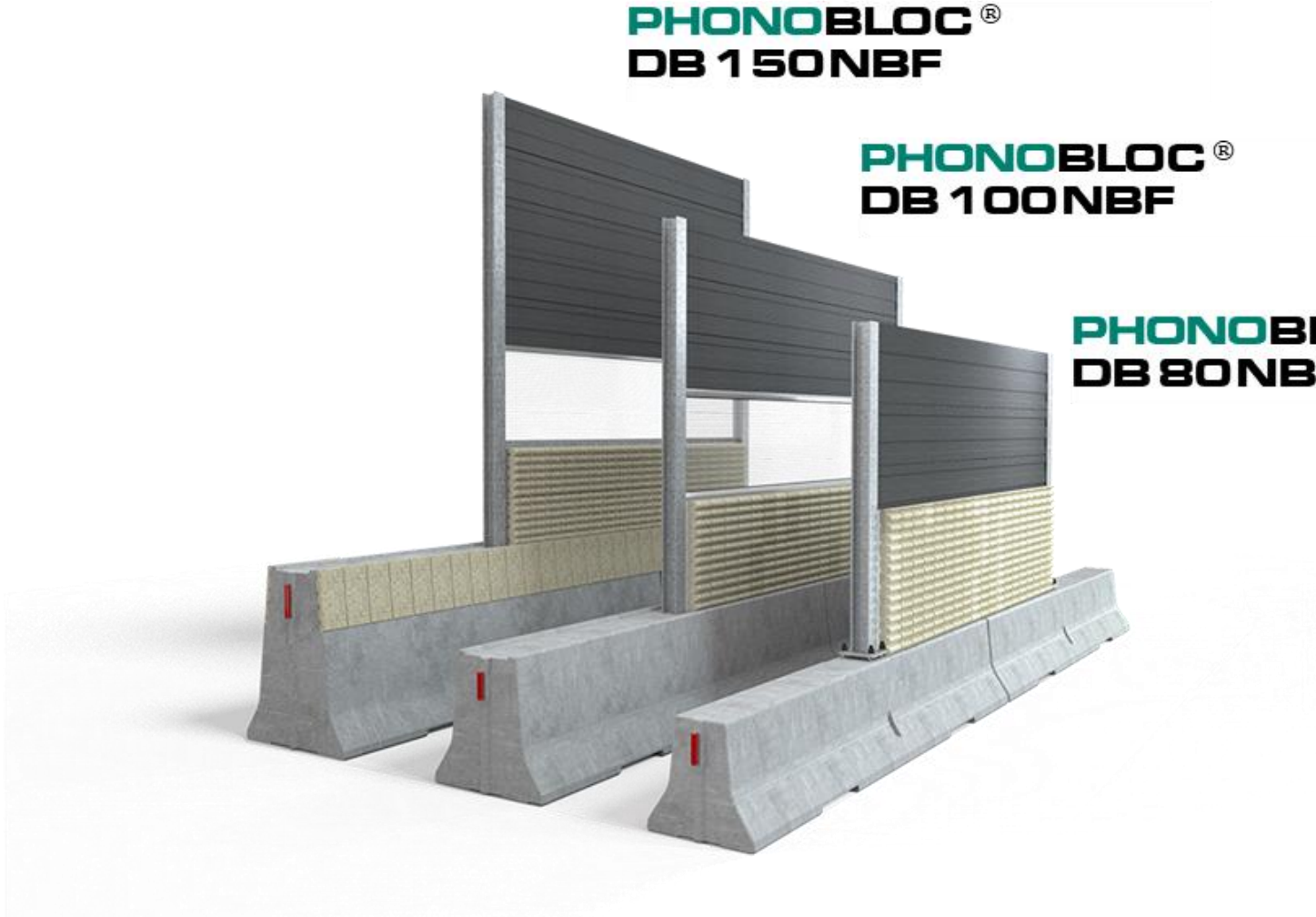
DB NBF Series

Combined restraint and noise protection system

PHONOBLOC®
DB 150NBF

PHONOBLOC®
DB 100NBF

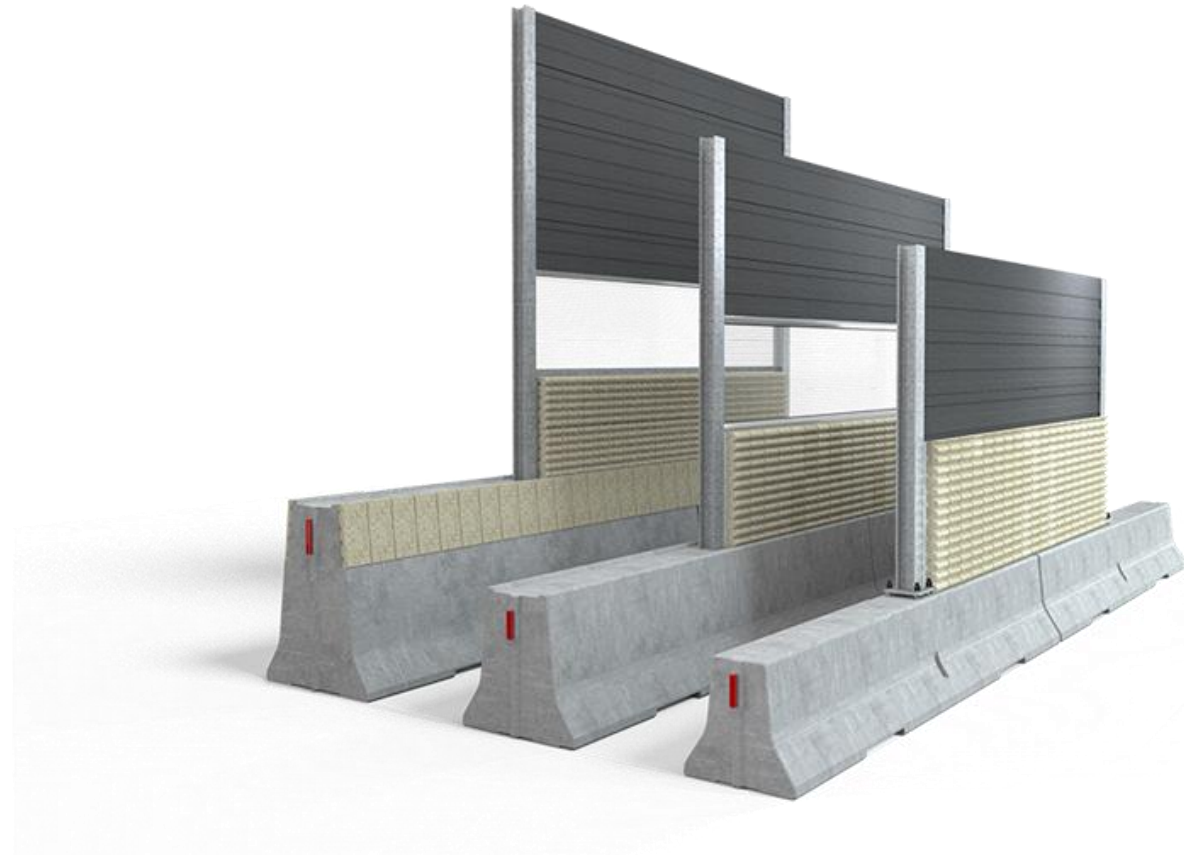
PHONOBLOC®
DB 80NBF



Functional design

System consisting of 3 different product groups

- Base element
 - DB 80 NBF
 - DB 100 NBF
 - DB 150 NBF
- Steel columns
 - HE 160 (DB 80 NBF** and DB 100 NBF)
 - HE 200 (DB 150 NBF)
- Noise protection panels*
 - BHB panels
 - AHB panels
 - AL E/B/R/T panels
 - ...



*...If containment level is required → first meter above the base element has to be a concrete panel (at DB 80 NBF first 1,20m)

**.... DB 80 NBF only in TA

DB NBF Series

Product characteristics

	DB 80 NBF	DB 100 NBF	DB 150 NBF
Containment levels	H2	H2	H4b
Working width	W3	W4	W5
Impact severity	ASI B	ASI B	ASI B
Tensions bars	T180	T180	T280
System lengths of the basic element - coupling included	500cm (200cm)	500cm (200cm)	500cm (200cm)
Width base element	83cm	105cm	125cm
Height base element (without nose)	80cm	100cm	150cm
Weight 5m base element	3940kg / 4500kg / 4950kg	8140kg	12500kg
Tested system height	350cm	450cm	600cm
Contact surface	Base layer of asphalt or concrete	Unbound base layer of gravel, asphalt or concrete	
Installation type	Surface mounted and pinned in asphalt or concrete		Surface mounted
Functionality	double-sided (Verge- and central reserve)		



DB 150 NBF – Crash test TB 81

Video: original speed, front view

- Speed: 65 km/h
- Impact angle: 20°
- Weight Truck: 38 to
- Containment level: H4b
- Working width: W5 ($\leq 1,7\text{m}$)
- Impact severity: ASI B





Versuch Nr. 229
DB 150 NBF600_5m_T280_TB81

Special Rail Series

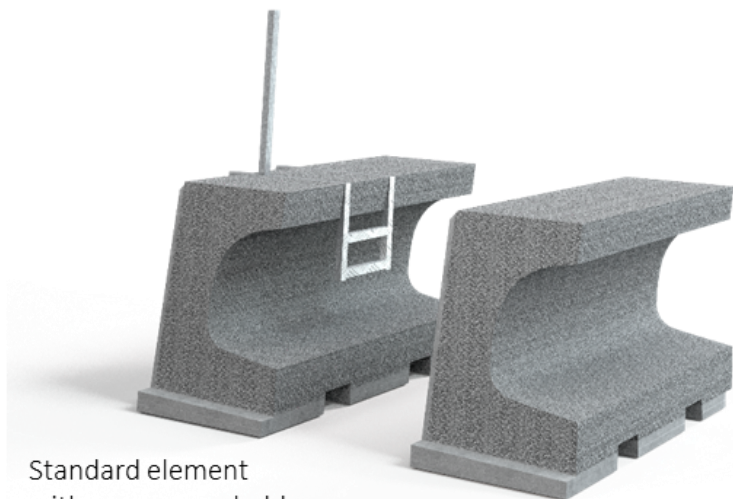
Quie@Rail

near-track noise protection



Special Rail Series

Properties and dimensions

Standard element
with emergency ladder

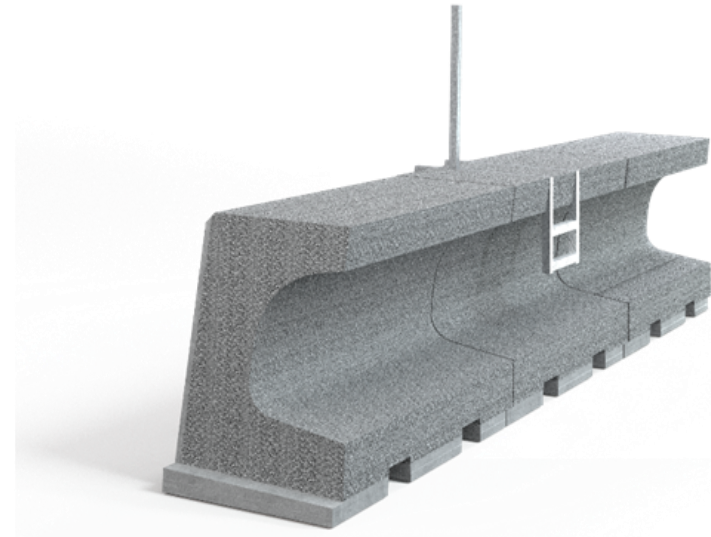
Standard element

	Standard elements
System length	2,0m (2,10m incl. Tongue and groove)
Element height	1,28m (0,5m above the top edge of the rail)
Element width bottom side	0,92m
Element width top side	0,75m
Element weight	2.930kg
Product material	Single-grain concrete

Special Rail Series

Advantages

- No concrete foundation is required (surface mounted on gravel)
- No earthing required (no reinforcement mesh)
- 2 drainage openings
- Tested up to a train speed of 160km/h
- Integrated emergency ladders – on request colour-coated
- Maintenance free
- Closed concrete surface on the outer side with brush stroke structure (insulation)



Special Rail Series

Acoustic properties

<p>Sound level reduction In-Situ Distance measuring point to track axis 7,50m 1,20m above track top edge Wall distance to the track axis 2,10m</p>	<p>up to 5,5dB</p>
<p>Sound level reduction In-Situ Distance measuring point to track axis 25m 3,50m above track top edge Wall distance to the track axis 2,10m</p>	<p>up to 5,3dB</p>
<p>Airborne sound insulation acc. RIL 804.5501 of the Deutschen Bahn AG</p>	<p>Fulfilled</p>
<p>Sound absorption acc. RIL 804.5501 of the Deutschen Bahn AG</p>	<p>Fulfilled</p>

Acoustic tests at DB (Deutsche Bahn AG)



Special Rail Series

Reference Slovenia

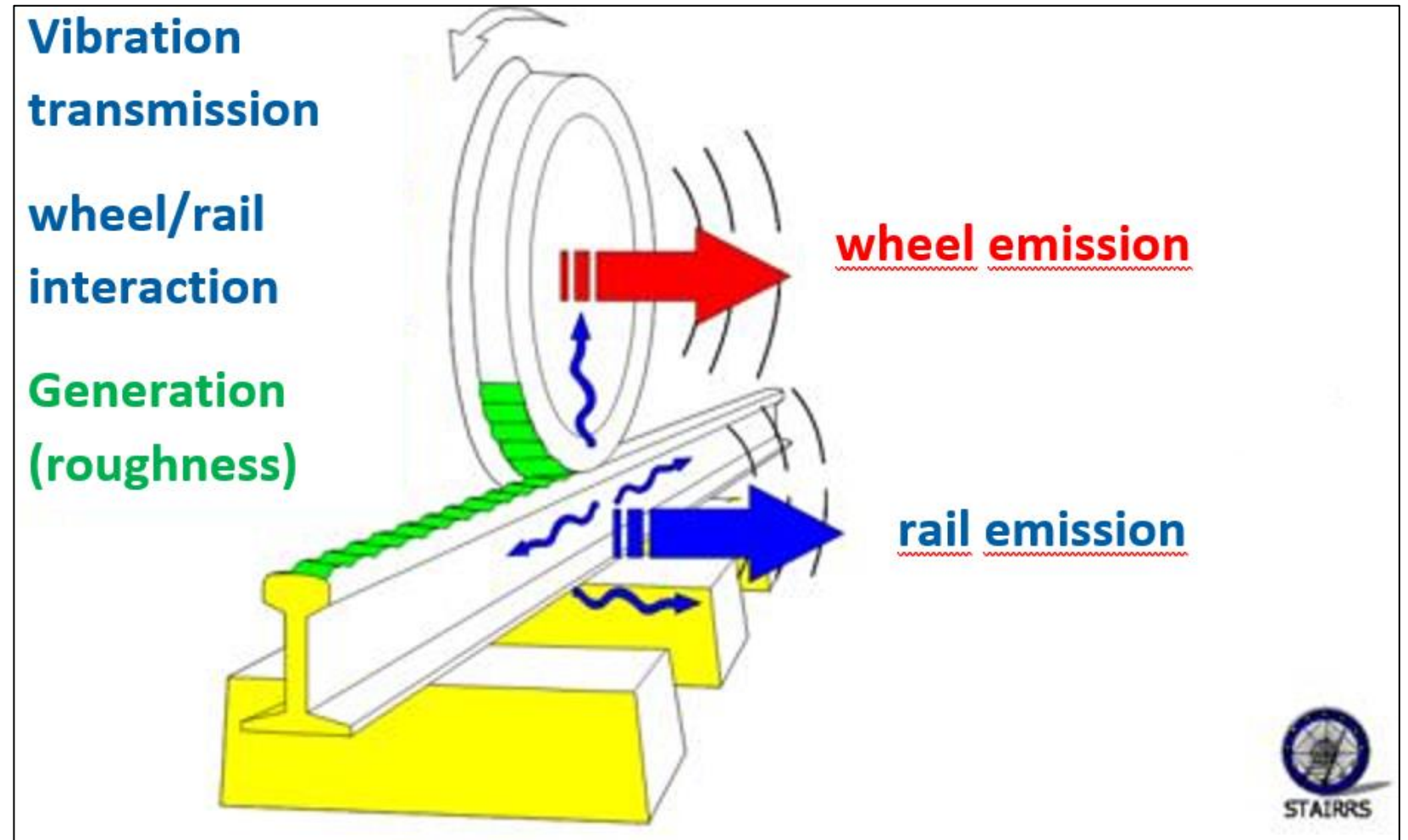


Insulation surface
(closed standard concrete with brush-stroke structure)

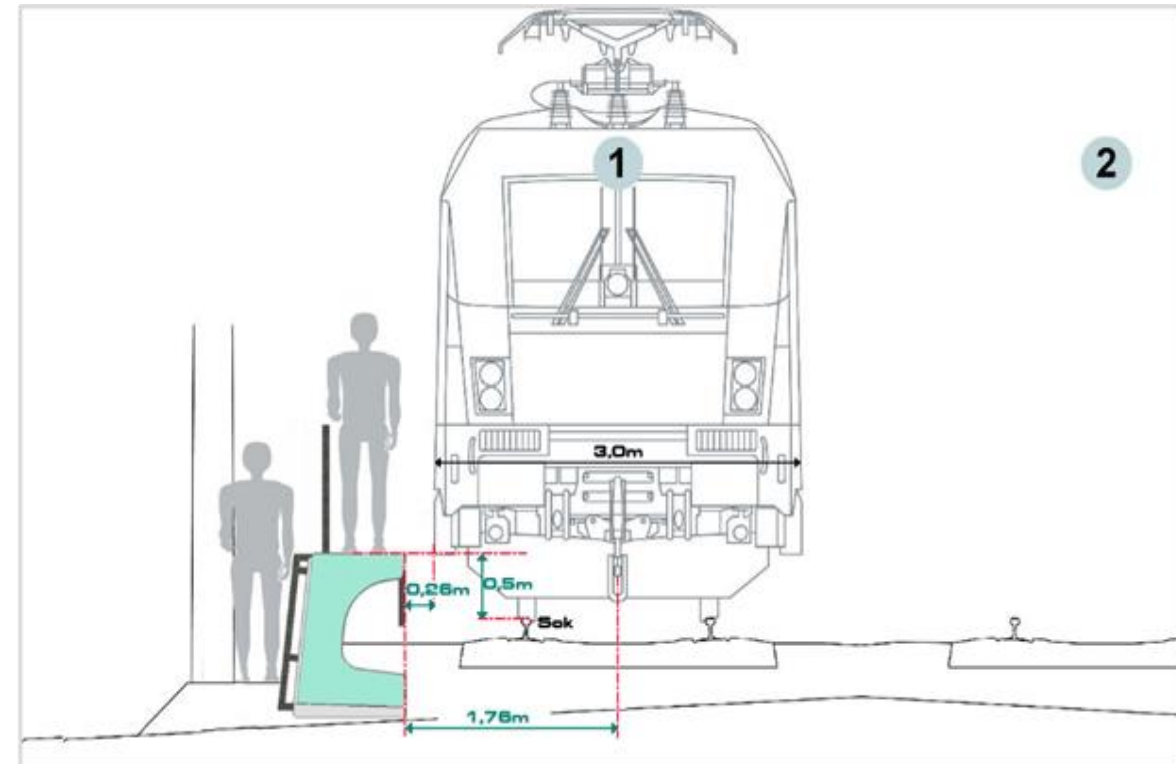
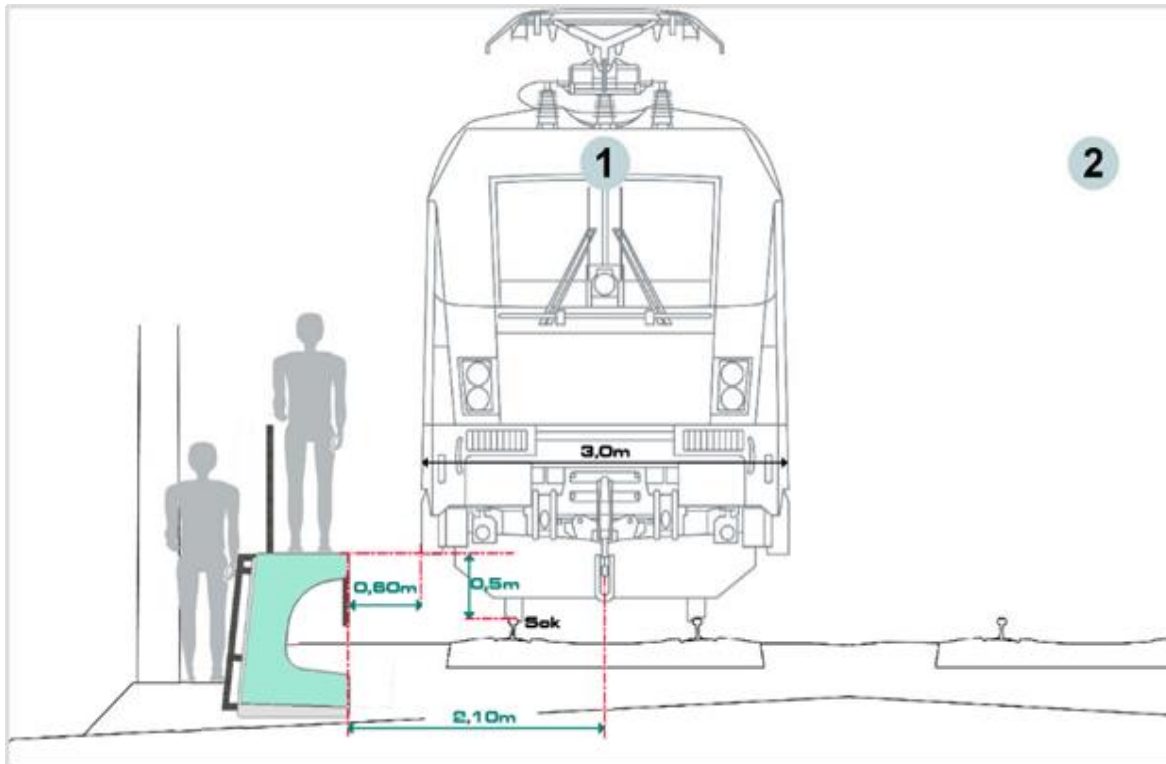


Absorbing surface (single-grain concrete)

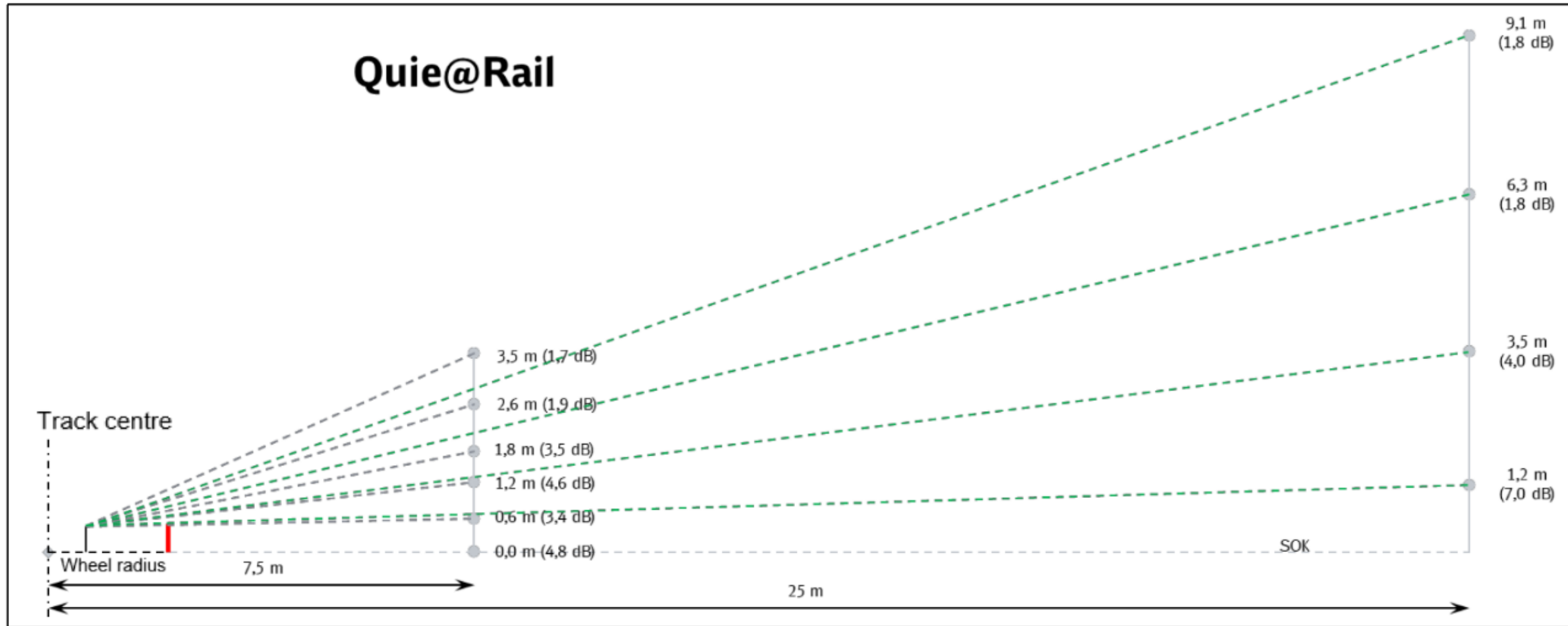
Acoustic properties



Installation variants – track axis 1,76m or 2,10m



The dimensions of the test setup are true-to-scale.





ŽP Šentilj Pesnica
BHB – Beton/Lesobeton
20.000m²



ŽP Hoče Rače
BHB – Beton/lesobeton
20.000m²











Thank you for your attention!

Miran Klemar