TECHNICAL STANDARDS
DETAILED TECHNICAL CONDITIONS FOR THE CONSTRUCTION OF THE RAILWAY INFRASTRUCTURE OF THE SOLIDARITY TRANSPORT HUB – DESIGN GUIDELINES

VOLUME I.4
RAILWAY TRACK – STRUCTURE GAUGE

Version 1.3.0, closed on 05.08.2021

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The list of volumes constituting the detailed technical conditions for the construction of the railway infrastructure of the Solidarity Transport Hub:

Volume A	Introduction to the STH railway standards
Volume I.1	Railway track – layout geometry
Volume I.2	Railway – design of civil structures
Volume I.3	Railway track – drainage of track layout
Volume I.4	**Railway track – gauge** It contains requirements concerning the structure gauge and track centre line spacing on railway tracks, operating control points and railway structures.
Volume I.5	Railway track – geotechnical investigations and design
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Volume II.2	3 kV DC overhead catenary system and traction power supply
Volume III.1	Engineering structures
Volume III.2	Tunnels
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Volume IX	Measures to minimise environmental impact
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Volume XII	Railway line guard
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Volume XVIII	Security, protection and cybersecurity integrity requirements

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Revisions of the document “Detailed technical conditions for the construction of railway infrastructure of the Solidarity Transport Hub; Volume I.4; Railway track – gauge”:

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1 Introduction

This volume I.4 of the Technical Standards – Design Guidelines is one of 30 volumes containing a description of detailed technical conditions for the construction of railway lines up to a speed of $V_{max} \leq$ 350 km/h.

1.1 Technical scope

These guidelines refer to the requirements for the structure gauge of new railway lines on which standard-gauge railway vehicles may run with the loading gauge according to the regulations and standards applicable in Poland, the list of which is given in point 9.

In particular, the guidelines specify:

a) the outline of a uniform structure gauge,
b) track centre line spacing for undeveloped intertrack spaces,
c) the distance from the track centre line to the track-side structures,
d) the free space below the rail head,
e) the distance of the platform and ramp edge from the track centre line.

In matters not regulated by these guidelines, the provisions of the standard **Błąd! Nie można odnaleźć źródła odwołania.**, technical knowledge and arrangements with the Company apply.

1.2 Links to other volumes

The links between this volume of Standards with other volumes are presented in Table 1.

Table 1 Links to other volumes of the Standards

Volume No	Volume title	Relation content
I.1	Railway track – layout geometry	Track centre line spacing
I.2	Railway track – construction of civil structures	Gauge below rail head level
II.1	2 x 25 kV 50 Hz AC overhead catenary system and traction power supply	Overhead catenary system suspension height
II.2	3 kV DC overhead catenary system and traction power supply	Overhead catenary system suspension height
III.1	Engineering structures	Pavements on structures
III.2	Tunnels	Escape routes
VIII.3	Structures	Platforms and ramps

1.3 Definitions of terms used

Structure gauge – it is an outline of a flat figure constituting the basis for determining the minimum distance of railway structures from the axis of the railway track and the upper surface of the rail head, necessary to be kept in the underground and aboveground area of the railway track, in order to ensure traffic and parking of railway vehicles and collision-free operation of machines and equipment during construction and maintenance of railway lines.

Safe zone – a zone on at least one side of the railway track where safety can be maintained for authorised persons working in the area of an operational railway track.

Tunnel escape route – a communication route that is located on the escape sidewalk in a tunnel and enables evacuation of persons from railway vehicles immobilised in the tunnel.

RHL – rail head level

Δb_s – widening caused by the curve radius [mm]
Δb_D – widening caused by the cant impact [mm]
D – track cant [mm]
D_a – outer rail cant [mm]
D_I – inner track cant [mm]
H_B – nominal platform height [mm]
H_{Ba} – designed platform height outside the curve [mm]
H_{Bi} – designed platform height to the inside of the curve [mm]
H_I – structure gauge profile point height above the rail head level [mm]
H_k – height of the furthest point of the structure gauge outline [mm]
TCE – transition curve end
HCE – horizontal curve end
ERE – elevation runoff end
TCS – transition curve start
CS – curve start
ERS – elevation runoff start
R – curve radius [mm]
X_B – nominal distance of platform edges from the track axis [mm]
X_{Ba} – designed distance of platform edges from the track axis outside the curve [mm]
X_{Bi} – designed distance of platform edges from the track axis to the inside of the curve [mm]

2 Essential, basic and general requirements for the STH railway infrastructure

Błąd! Nie można odnaleźć źródła odwołania. defines the link between the detailed technical conditions and the essential, basic and general requirements for the STH infrastructure.

Table 2 Links between the detailed technical conditions and the essential requirements

sub-chapter of this volume defining detailed technical conditions	essential requirements (Directive on the interoperability of the rail system)						basic requirements	general requirements for the STH railway infrastructure			
	security	reliability and availability	health	environmental protection	technical compliance	availability	2.1. mechanical resistance and stability 2.2. safety in case of fire 2.3. hygiene, health and the environment 2.4. safety and accessibility in use 2.5. protection against noise 2.6. energy economy and heat retention 2.7. sustainable use of natural resources	3.1. focus on the needs of economy	3.2. orientation towards the needs of passengers	3.3. orientation towards the needs of carriers	3.4. compatibility with the railway infrastructure connected with the STH railway infrastructure
3	1.1.1	-	-	-	1.5.1	-	-	3.1.1	-	-	3.4.1
4	1.1.1	-	-	-	1.5.1	-	-	3.1.1	-	-	3.4.1
5	1.1.1	1.2.4	1.3.3	-	1.5.1	1.6.1	2.1.1 2.2.1 2.3.1 2.4.1	3.1.1	-	-	3.4.1
6	1.1.1	-	-	-	1.5.1	-	-	3.1.1	-	-	3.4.1
7	1.1.1	1.2.4	1.3.3	-	1.5.1	1.6.1	2.1.1 2.2.1 2.3.1 2.4.1	3.1.1	-	-	3.4.1

Cybersecurity

Technical solutions which collect, store, process, make available or transmit data ensuring the compliance with essential safety requirements (requirements from 1.1.1. to 1.1.11. specified in Volume A of the STH Railway Standards) and general requirements for the STH railway infrastructure concerning security (requirements 1.1.12. and 1.1.13 specified in Volume A of the STH Railway Standards) should be designed taking into account cybersecurity, i.e. “security of network and information systems”, defined in the Directive concerning measures for a high common level of security of network and information systems across the Union, as follows:

“security of network and information systems” means the ability of network and information systems to resist, at a given level of confidence, any action that compromises the availability, authenticity, integrity or confidentiality of stored or transmitted or processed data or the related services offered by, or accessible via, those network and information systems;

[as defined in Article 4 of Directive 2016/1148]

Cybersecurity includes two types of threats resulting from unauthorised access to the systems/equipment/networks that collect, store, process, make available or transmit data:

1) physical security threats

It is necessary to secure systems/equipment/networks against direct access which could enable causing (intentionally or unintentionally) threats to functional safety.

2) IT security threats

It is necessary to secure systems/equipment/networks against logical access via IT systems/equipment/networks, which could enable causing (intentionally or unintentionally) threats to functional safety.

Cybersecurity defined this way applies both to information systems used for rail transport purposes and to operational systems used for rail transport purposes, but the STH railway standards do not include requirements for information systems, e.g. timetabling systems.
Physical security threats and IT security threats for operational systems for which requirements are defined in the STH railway standards should be addressed by railway operators as part of the risk assessment and by design engineers/manufacturers/contractors as part of threat control. Additionally, it is required for the applied protections to be documented and verified in accordance with the requirements included in Volume XVIII of the STH railway standards.

Cybersecurity within the scope of this volume of the STH railway standards

Currently, in the area covered by this volume of standards, there are no networks and information systems whose security could be endangered. However, it is possible that such networks and information systems or technical solutions that collect, store, process, make available or transmit data may arise. For example, a system of sensors may be used that, through wired or wireless networks, public or non-public networks or directly, will connect to, for instance, an infrastructure manager's system. Then, they should be protected against physical security and IT security threats in a manner compliant with the requirements of the Information Safety Management System (ISMS) implemented by the STH company.
At the same time, it should be kept in mind that the ISMS will be subject to changes because maintaining the required level of cybersecurity is not possible by meeting requirements of the standards once since cybersecurity is a process rather than a state. In order to minimise the number and size of cyber threats, the requirements (obligations) included in the Act of 5 July 2018 on the national cybersecurity system in Chapter 3 for operators of key services, in Chapter 5 for public entities should be continuously observed in operational processes and only digital service providers fulfilling the obligations described in Chapter 4 of that Act should be used.

3 Structure gauge unified on STH railway lines

When constructing sections of railway lines, the structure gauge should be assumed as in **Błąd! Nie można odnaleźć źródła odwołania.**, which is based on the gauge GC outline according to the standard **Błąd! Nie można odnaleźć źródła odwołania.** and as in **Błąd! Nie można odnaleźć źródła odwołania.**, including widenings according to **Błąd! Nie można odnaleźć źródła odwołania.** and **Błąd! Nie można odnaleźć źródła odwołania.**.

Table 3 Structure gauge widenings resulting from the impact of a curve and a cant above the height of 380 mm

	Scope	**In the external direction [mm]**	**In the internal direction [mm]**
Widening due to curve radius – Δb_s	250≤R<∞	-	
	150≤R<250	$\frac{60000}{R} - 225$	$\frac{50000}{R} - 185$
Widening due to cant impact – Δb_D	Regardless of track curvature	-	$\frac{D \times H_i}{1500}$

Table 4 Structure gauge widenings resulting from the impact of a curve and a cant up to the height of 380 mm

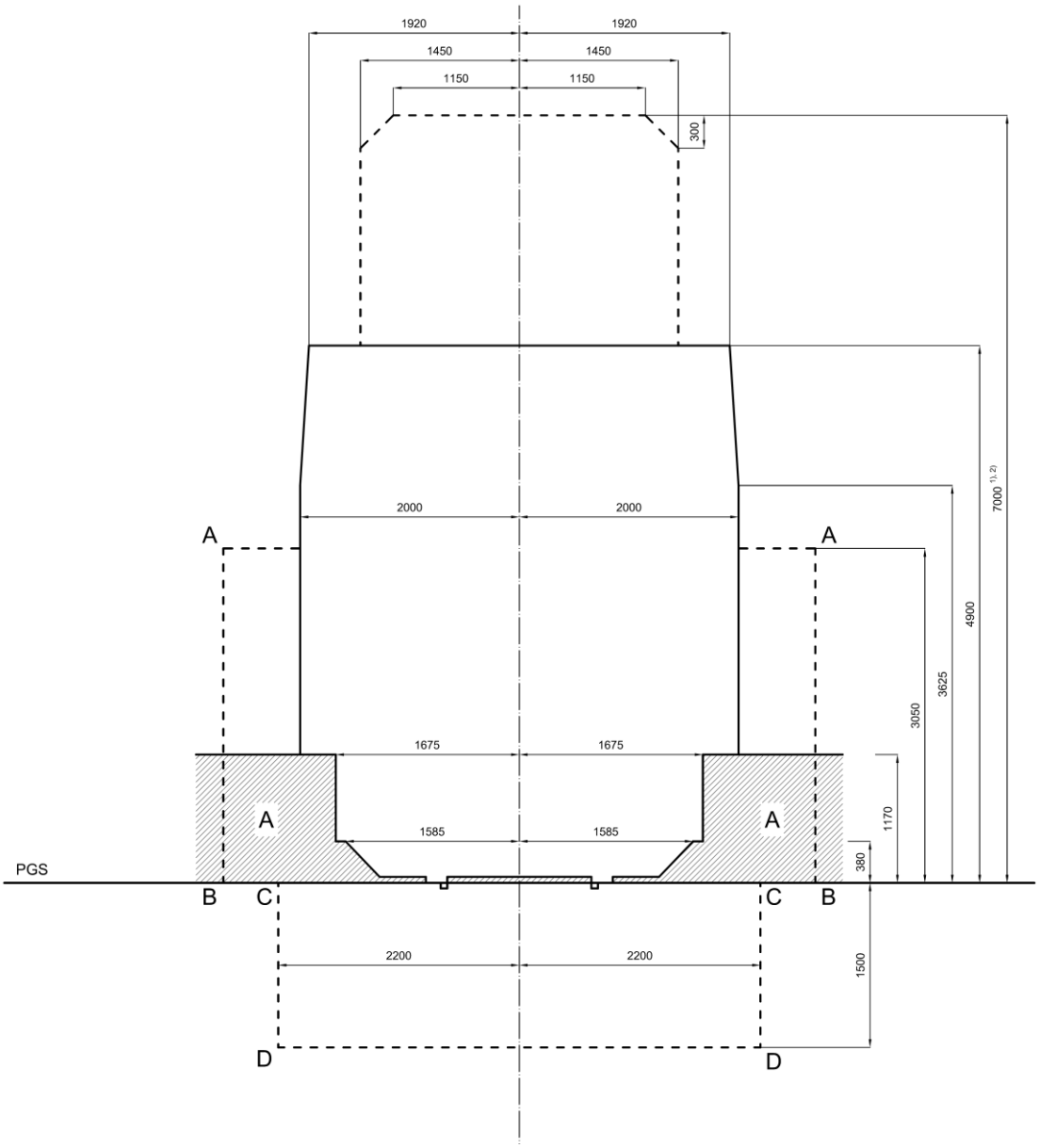
	Scope	**In the external direction [mm]**	**In the internal direction [mm]**
Widening due to curve radius – Δb_s	250≤R<∞	$\frac{3750}{R}$	
	150≤R<250	$\frac{60000}{R} - 225$	$\frac{50000}{R} - 185$
Widening due to cant impact – Δb_D	Regardless of track curvature	-	$\frac{D \times H_i}{1500}$

The values of the widenings Δb_D specified according to **Błąd! Nie można odnaleźć źródła odwołania.** are shown in **Błąd! Nie można odnaleźć źródła odwołania.**.

Table 5 Structure gauge widening values Δb_D [mm] depending on the cant and the height above the rail head

Cant [mm]	**Δb_D [mm] measured at the height H [mm] above the rail head:**			
	H=4900	**H=3625**	**H=760**	**H=380**
150	490	363	76	38
145	474	350	73	37
140	457	338	71	35
135	441	326	68	34
130	425	314	66	33
125	408	302	63	32
120	392	290	61	30
115	376	278	58	29
110	359	266	56	28
105	343	254	53	27
100	327	242	51	25
95	310	230	48	24
90	294	218	46	23

Cant [mm]	Δb_D [mm] measured at the height H [mm] above the rail head:			
	H=4900	H=3625	H=760	H=380
85	278	205	43	22
80	261	193	41	20
75	245	181	38	19
70	229	169	35	18
65	212	157	33	16
60	196	145	30	15
55	180	133	28	14
50	163	121	25	13
45	147	109	23	11
40	131	97	20	10
35	114	85	18	9
30	98	73	15	8
25	82	60	13	6
20	65	48	10	5



PL	EN
PGS	RHL

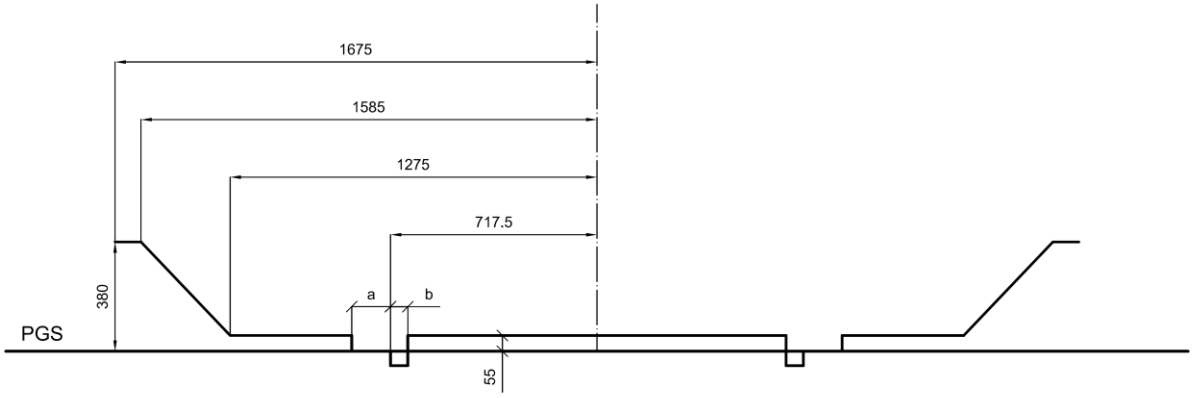
A *– The space made available for construction of platforms, ramps as well as equipment and structures directly serving railway traffic. (In the case of structures located in this space, widening values according to* ***Błąd! Nie można odnaleźć źródła odwołania.*** *should* be used*)*

AB – Minimum distance between the track centre line and the track-side structures as per point ***Błąd! Nie można odnaleźć źródła odwołania.****.*

1) – In justified cases, with the consent of the Company, the distance may be reduced provided that it is demonstrated that the overhead catenary system wires can be suspended in accordance with the requirements of Volumes II.1 and II.2.

2) – In the case of tunnels, the distance should be determined individually in agreement with the Company, in accordance with the requirements of Volumes II.1 and II.2.

Figure 1. Structure gauge unified on STH railway lines from the height of 380 mm above the rail head level



PL	EN
PGS	RHL

a – 135 mm for fixed objects permanently connected to the contact rail and 150 mm for other fixed objects.
b – As specified in separate regulations.

Figure 2. Structure gauge on STH railway lines up to the height of 380 mm above the rail head level

4 Track centre line spacing for undeveloped intertrack spaces

The designed nominal distances between the open line and main straight track centre lines are specified in Volume I.1 – Layout geometry.

However, the value ($2\Delta b_s+\Delta b_{\delta D}$) should be added to the values specified in the aforementioned Volume for railway line sections in curves with a radius smaller than 250 m, and in the case of railway line sections in curves with a radius greater than or equal to 250 m – $\Delta b_{\delta D}$. The widening Δb_s should be calculated according to **Błąd! Nie można odnaleźć źródła odwołania.**. The widening $\Delta b_{\delta D}$ should be used if the outer track cant is greater than the inner track cant, according to the formula:

$$\Delta b_{\delta D} = \frac{H_k}{1500}[D_a - D_i]$$

For the $2\Delta b_s$ widening, Δb_s separately for each track should be considered.

The minimum distance between the centre line of the main straight track and the centre line of the main secondary or side track, with the exception of intertrack spaces in the area of track connections, should ensure the possibility of creating a safe zone between these tracks in accordance with the requirements specified in point **Błąd! Nie można odnaleźć źródła odwołania.**, even if the spacing of the main tracks is large enough to create a safe zone between them.

The minimum distance between the centre lines of other tracks – except for intertrack spaces in the area of track connections and tunnels equipped with escape routes – should be 4.00 m.

The clearance point indicator (W17) should be set between the inner rails of a track branch at a location where the distance between the track centre lines is at least 3.75 m.

The above value should be increased:

- if one of the tracks is located in a curve with a radius smaller than 250 m by the value Δb_s,
- if two tracks are located in a curve with a radius smaller than 250 m by the sum of Δb_s of each track,
- if the outer track cant is greater than the inner track cant by the value $\Delta b_{\delta D}$,

In justified cases, due to local conditions and upon agreement with the Company, the clearance point indicator (W17) may be set at a greater distance from the turnout than it results from the rules specified above.

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5 Minimum distance from the track centre line to the track-side structures

The minimum distances from the track centre line to the track-side structures located in the intertrack space depending on the speed (outline AB **Błąd! Nie można odnaleźć źródła odwołania.**) are presented in **Błąd! Nie można odnaleźć źródła odwołania.**.

Table 6 Distance from the track centre line to the structures located in the intertrack space

Speed	**Indicators and supporting structures of the signalling device signal head and perpendicular to the centre line of the platform end guarding track**	**Overhead catenary system and lighting system support structures**
V ≤ 80 km/h	2.30 m + Δb_D	2.50 m
80 km/h < V ≤ 160 km/h	2.30 m + Δb_D	2.60 m
160 km/h < V ≤ 250 km/h	2.30 m + Δb_D	2.80 m
250 km/h < V ≤ 350 km/h	2.30 m + Δb_D	3.00 m

The minimum distances from the track centre line to the track-side structures located on the track bench (outline AB **Błąd! Nie można odnaleźć źródła odwołania.**) are presented in **Błąd! Nie można odnaleźć źródła odwołania.**.

Table 7 Minimum distances from the track centre line to track-side structures located on the track bench

Facility located on the track bench	**Distance from the track centre line**
Perpendicular to the centre line of the platform end guarding track	2.30 m
Survey control points – KODP	2.70 m
Indicators and supporting structures of the signalling device signal head	2.70 m
Supporting structures of the overhead catenary system, lighting and power system	3.00 m
Span structures of half-through engineering structures	3.00 m
Acoustic baffles (excluding baffles on engineering structures)	4.75 m
Supports for engineering and civil structures and retaining walls (excluding retaining walls at tunnel entrances)	5.65 m

At least on one side of each track, except for intertrack spaces in the area of track connections and tunnels equipped with escape routes, a safe zone with free access to it from the side of the track should be provided. Upon the consent of the Company, the safe zone may be located on the platform with solutions facilitating access from the track to the platform.
The value of the designed distance between the centre line of the nearest track and the safe zone boundary (outline AB **Błąd! Nie można odnaleźć źródła odwołania.**) should be at least as specified in the table below.

Table 8 Designed distance from the track centre line to the boundary of the safe zone

Speed	Distance
V ≤ 80 km/h	2.50 m
80 km/h < V ≤ 160 km/h	2.70 m
160 km/h < V ≤ 250 km/h	3.00 m
V > 250 km/h	3.80 m

The width of the safe zone should be at least 0.80 m. Possible obstacles in the area of the safe zone may not cause its narrowing to a width of less than 0.75 m, and the length of such obstacles may not exceed 2 m. A stable substrate should be provided in the safe zone.

On engineering structures (bridges, overpasses, retaining walls, culverts, railway subways), safe zones should be provided on pavements or track benches.

The minimum distance between the railings and acoustic baffles and the track centre line on engineering structures should take into account the location and size of the safe zone.

In the case of half-through engineering structures, when pavements are located outside the span structure, it should be possible to access the safe zone from the track along the entire length of the structure between the structural elements of this structure.

The requirements concerning pavements on engineering structures are specified in Volume III.1 – Engineering structures.

The designed distance of the escape route in a tunnel (located on the escape pavements) from the centre line of the nearest track should be at least 2.40 m in a single-track tunnel and 2.30 m in a multi-track tunnel. The requirements concerning escape routes in tunnels are specified in the TSI “Safety in railway tunnels” **Błąd! Nie można odnaleźć źródła odwołania.** and in Volume III.2 – Tunnels. In the case of single-track tunnels, if the niches referred to in the regulation **Błąd! Nie można odnaleźć źródła odwołania.** are not ensured on the side opposite to an escape route, an additional free space of at least 0.6 m in width should be provided.

If low acoustic baffles are used, the location of the baffle in relation to the safe zone should be subject to individual consideration depending on the design of the particular type of baffle, and all necessary technical measures should be taken to ensure the safety of personnel and the safety of travellers in case of evacuation.

6 Free space below the rail head

In order to ensure the possibility of operation of railway infrastructure maintenance equipment, it should be necessary to provide a free space outline below the rail head according to the outline CD in **Błąd! Nie można odnaleźć źródła odwołania.**.
The required width of 2.20 m of the outline CD should not apply to tracks at platforms, ramps and load yards.
The requirement of 1.50 m below the RHL of the outline CD does not apply to engineering structures or the structure of transition zones in their vicinity.
The above requirements do not apply to a ballast-free surface.

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7 Location of the platform and ramp edge relative to the track centre line

The nominal distance of the platform and ramp edge from the track centre line on a straight line without a cant should be 1675 mm. With the consent of the Company, this value may be reduced in the case of a platform-side track with a ballast-free surface, taking into account the location conditions based on the standard **Błąd! Nie można odnaleźć źródła odwołania.**.
The nominal height of the platform edge from the grade line of a track without a cant should be 760 mm.
The nominal height of the ramp edge from the grade line of a track without a cant should be 1100 mm.
In justified cases, after consultation with the Company, other platform and ramp heights are allowed.
The above values are subject to change due to the curve radius or cant.
The values of widening or reduction of the nominal distance between the platform edge and the track centre line and the nominal height of the platform edge from the level of the track grade line are presented in **Błąd! Nie można odnaleźć źródła odwołania.**.
Where platforms for tracks with variable curvatures and a cant are to be designed, the nominal distance of the platform edge from the track centre line on a straight line should be increased by the value Δb_s according to **Błąd! Nie można odnaleźć źródła odwołania.** and **Błąd! Nie można odnaleźć źródła odwołania.**. The value Δb_s should be calculated according to the formulas in **Błąd! Nie można odnaleźć źródła odwołania.**.
The widening value Δb_s changes linearly from the minimum value Δb_s for a given curve radius at the beginning of the widening zone to the maximum value Δb_s for a given curve radius at the end of the widening zone.

Table 9 Distance between the platform edge and the track centre line and platform height if the platform is located by the track on a curve and a cant

	Outside the curve [mm]	**To the inside of the curve [mm]**
Designed distance of the platform edge from the track centre line	$X_{Ba} = X_B + \Delta b_s - \Delta b_D$	$X_{Bi} = X_B + \Delta b_s + \Delta b_D$
Designed height of the platform edge from the track grade line	$H_{Ba} = H_B + \frac{D}{2} + \frac{D \times (X_b + \Delta b_s)}{1500}$	$H_{Bi} = H_B + \frac{D}{2} - \frac{D \times (X_b + \Delta b_s)}{1500}$

Table 10 Change points of the platform edge widening distance from the track centre line at tracks with variable curvatures and a cant

Configuration	**Outer side of curve**		**Inner side of curve**	
	Beginning of the widening change zone	**End of the widening change zone**	**Beginning of the widening change zone**	**End of the widening change zone**
Transition curve – horizontal curve	TCS – 26 m	TCS – 6 m	TCS – 20 m	TCE
Straight line – horizontal curve	TCS – 26 m	TCS – 6 m	TCS – 20 m	HCE
Change of track cant	TCS – 26 m	TCS – 6 m	TCS – 20 m	ERE

Note: HCS = HCE

The remaining requirements concerning platform parameters are presented in Volume VIII.3 – Structures.

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8 Reference documents

The following reference documents were used to prepare Volume I.4:

8.1 EU legal documents

- directives:

[1] Dyrektywa Parlamentu Europejskiego i Rady (UE) 2016/797 z dnia 11 maja 2016 r. w sprawie interoperacyjności systemu kolei w Unii Europejskiej (Dz.U.UE L 138/44 z dnia 26.05.2016)

[2] Dyrektywa Parlamentu Europejskiego i Rady (UE) 2016/798 z dnia 11 maja 2016 r. w sprawie bezpieczeństwa kolei (Dz.U.UE L 138/102 z dnia 26.5.2016)

- regulations:

[3] Rozporządzenie Komisji (UE) nr 1299/2014 z dnia 18 listopada 2014 r. dotycząca technicznych specyfikacji interoperacyjności podsystemu „Infrastruktura" systemu kolei w Unii Europejskiej (Dz.U.UE L 356/1 z dnia 12.12.2014)

[4] Rozporządzenie Komisji (UE) nr 1301/2014 z dnia 18 listopada 2014 r. dotycząca technicznych specyfikacji interoperacyjności podsystemu „Energia" systemu kolei w Unii Europejskiej (Dz.U.UE L 356/179 z dnia 12.12.2014)

[5] ROZPORZĄDZENIE KOMISJI (UE) NR 1303/2014 z dnia 18 listopada 2014 r.w sprawie technicznej specyfikacji interoperacyjności w zakresie aspektu „Bezpieczeństwo w tunelach kolejowych" systemu kolei w Unii Europejskiej (Dz.U.UE L 356/394 z dnia 12.12.2014)

8.2 Legal documents of the Republic of Poland

[6] Ustawa z dnia 28 marca 2003 r. o transporcie kolejowym (Dz.U.2020, poz.1043)

[7] Rozporządzenie Ministra Transportu i Gospodarki Morskiej z dnia 10 września 1998 r. w sprawie warunków technicznych, jakim powinny odpowiadać budowle kolejowe i ich usytuowanie (Dz. U. 1998, Nr 151, poz. 987, z późniejszymi zmianami)

[8] Rozporządzenie Ministra Infrastruktury z dnia 26 kwietnia 2019 r. zmieniające rozporządzenie w sprawie ogólnych warunków prowadzenia ruchu kolejowego i sygnalizacji (Dz. U. 2019, poz. 964)

8.3 Normative documents

[9] PN-EN 15273-1:2013 Kolejnictwo - Skrajnie - Część 1: Postanowienia ogólne - Wymagania wspólne dla infrastruktury i pojazdów szynowych

[10] PN-EN 15273-2:2010 Kolejnictwo - Skrajnie - Część 2: Skrajnia pojazdów szynowych

[11] PN-EN 15273-3:2013 Kolejnictwo - Skrajnie - Część 3: Skrajnie budowli