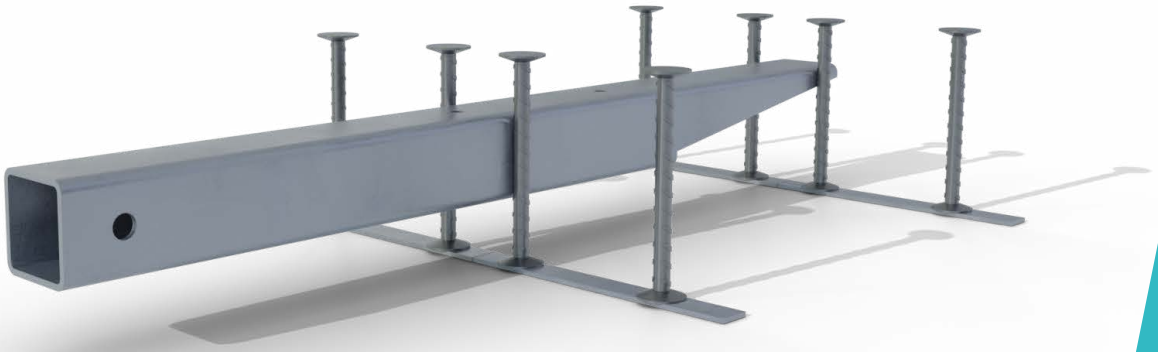
TECHNICAL MANUAL



SLADEX® Balcony Slab Connector

Precast Slab Support with Stud Reinforcement

Version PEIKKO GROUP 10/2020

peikko®

SLADEX® Balcony Slab Connector

Precast Slab Support with Stud Reinforcement

SLADEX® Balcony Slab Connector is used to create an efficient connection between the precast balcony slab and the floor slab without compromising the thermal insulation on the sandwich wall panels or the building envelope.

SLADEX® Balcony Slab Connector offers reliable load distribution with easy installation. It consists of a stainless steel RHS tube and rails with double headed studs, and it is cast in the balcony slab at the precast factory. Protrusion of 200mm to 500mm allows installation and support of the balcony slab on the load-bearing structure through the sandwich panels.

SLADEX® Balcony Slab Connector transfers vertical force from precast balcony slabs during the erection and final stages. Once cast in the load-bearing concrete element, it also transfers tensile forces.

SLADEX® Balcony Slab Connector is available in several standardized models with precalculated resistances.

peikko®

www.peikko.com

CONTENTS

About SLADEX®

1. Product properties

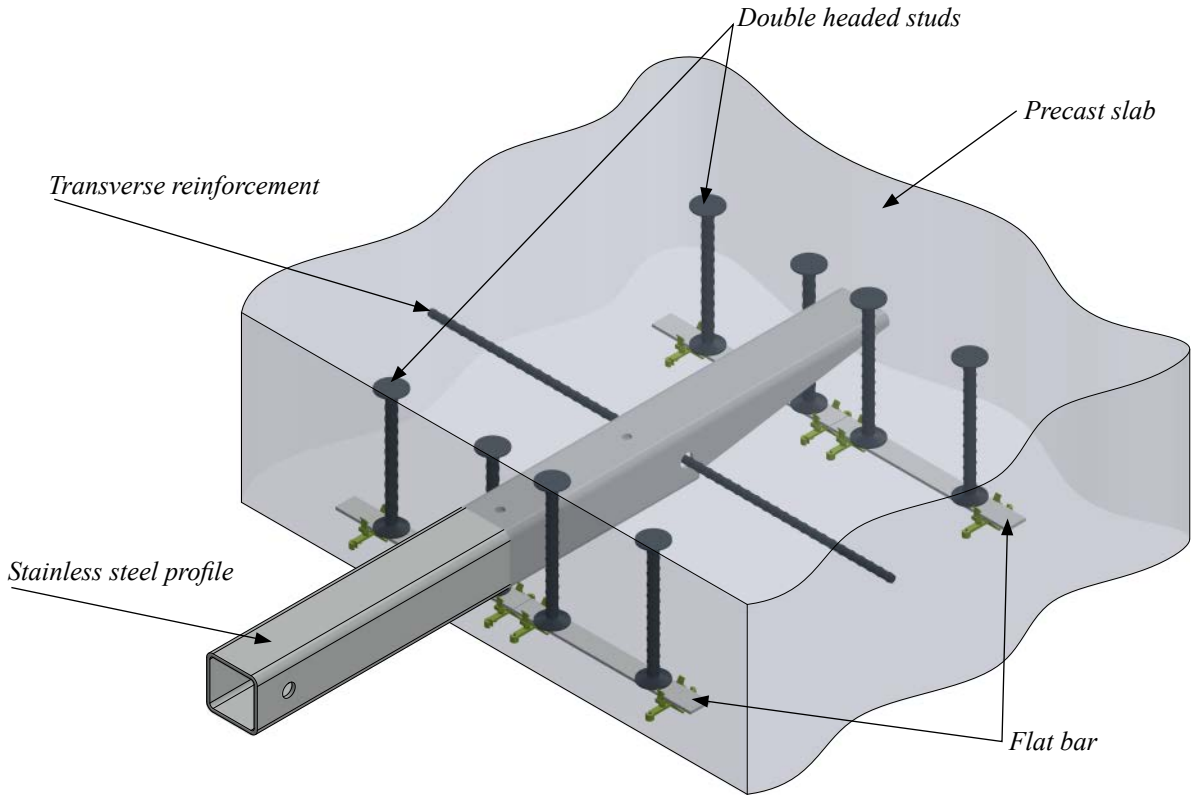
SLADEX® Balcony Slab Connector is used as a point support for precast concrete slabs. It is designed to transfer loads from a precast concrete slab trough the wall panel to load bearing structures such as columns, walls, and beams. One or several edges of the slab are supported to the load bearing structure with SLADEX® Balcony Slab Connectors and the other edges are supported on balcony wall elements or on balcony columns.

SLADEX® Balcony Slab Connector is available in several model variations with different dimensions. Variability of SLADEX® makes it possible to create protrusion with length between 200-500 mm based on the thickness of the wall panel.

SLADEX® Balcony Slab Connector is composed of the following components:

- Stainless steel tube
- Double headed studs welded on flat bars

Figure 1. SLADEX® Balcony Slab Connector.



1.1 Structural behavior

SLADEX® Balcony Slab Connector transfers vertical force from a precast balcony slab during erection and final stage. In the final stage, after the SLADEX® Balcony Slab Connector is cast into the loadbearing concrete element, it can transfer also tensile forces. The vertical and the horizontal forces are transferred through the stainless-steel tube to the base structure. The double headed studs welded on flat bars are used to improve the vertical load bearing capacity of concrete in the anchorage zone of the tube.

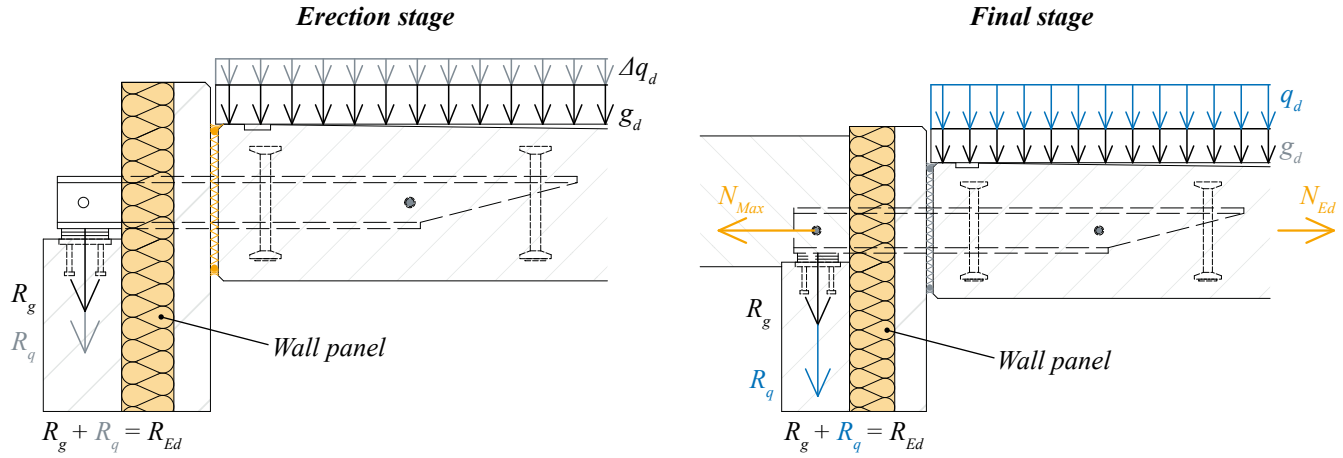
1.1.1 Temporary conditions

SLADEX® Balcony Slab Connector works as a point support during the erection stage. It transfers the vertical loads, mainly caused by the self-weight of the balcony slab g_d (+ additional loads caused by installation Δq_d) to the supporting load bearing structure (see *Figure 2*). The joint between the precast slab and the base structure is not cast at the erection stage, therefore the horizontal loads N_{Ed} between the precast slab and the base structure cannot be transferred by SLADEX® yet.

1.1.2 Final conditions

The connection is finalized after the joint in the base structure is cast and the concrete has reached the required strength. SLADEX® Balcony Slab Connector transfers the full load (self-weight of the balcony slab g_d, live load q_d and horizontal force N_{Ed}) from the precast balcony slab trough the wall panel into the base structure (see *Figure 2*).

Figure 2. Transfer of loads.



SLADEX® Balcony Slab Connector acts always as a point support for the balcony slab. This assumption must be always kept in mind during design of the precast balcony slab.

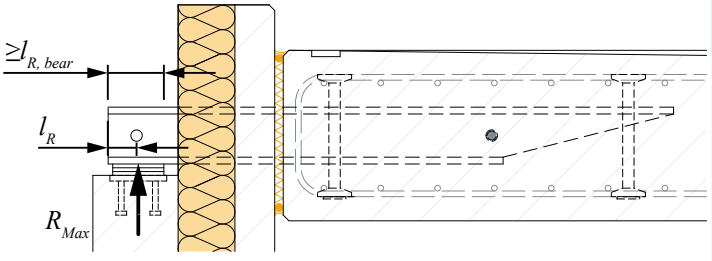
1.2 Limitations for application

The standard models of the SLADEX® Balcony Slab Connector are designed to be used in conditions specified in this chapter. If these conditions cannot be fulfilled, please contact Peikko technical support.

1.2.1 Loading and environmental conditions

SLADEX® Balcony Slab Connector is designed to carry static loads. The resistance of the SLADEX® Balcony Slab Connector is represented by the maximum design value (R_{Max}) of force applied at the end of the protruding tube. Distance l_R is valid for supporting structure with minimum concrete class C25/30.

Table 1. Position of load R_{Max}.



Models	Minimum distance of load force $l_{R,min}$ [mm]	Minimum bearing area $l_{R,bear}$ [mm]
A1	30	60
A2	30	60
B1	40	80
B2	40	80

SLADEX® Balcony Slab Connector is designed to be used in conditions determined for the outside balcony constructions in EN 1992-1-1. The concrete cover of the studs must be adequate according to the required environmental exposure class and designed operating life.

1.2.2 Positioning of the SLADEX® Balcony Slab Connector

SLADEX® Balcony Slab Connector is designed for use with a concrete slab of 260 mm (models A1 and A2) and 285 mm (models B1 and B2) in thickness.

Protrusion of the stainless steel tube (dimension *l*) can vary between 200 - 500 mm. Position of the RHS tube is in the middle of the concrete slab height (see *Figure 3*).

Table 2. Position requirements.

Model	Concrete cover of studs c_{nom} [mm]	Slab thickness h_c [mm]	Position of RHS tube x [mm]	Length of the studs L_s [mm]	Length of stud rail l_{ap} [mm]	Spacing between studs s_2 [mm]
A1	35	260	90	185	225	135
A2	35	260	90	185	225	135
B1	35	285	92.5	215	265	155
B2	35	285	92.5	215	265	155

Table 3. Spacing of the stud rails.

Length of cantilever part of steel profile l [mm]	Edge distance of first studrail s [mm]	Spacing between rows of studrails e [mm]
200	60	730
250		680
300		630
350		580
400		530
450		480
500		430

Figure 3. Position requirements for standardized models of SLADEX® Balcony Slab Connector.

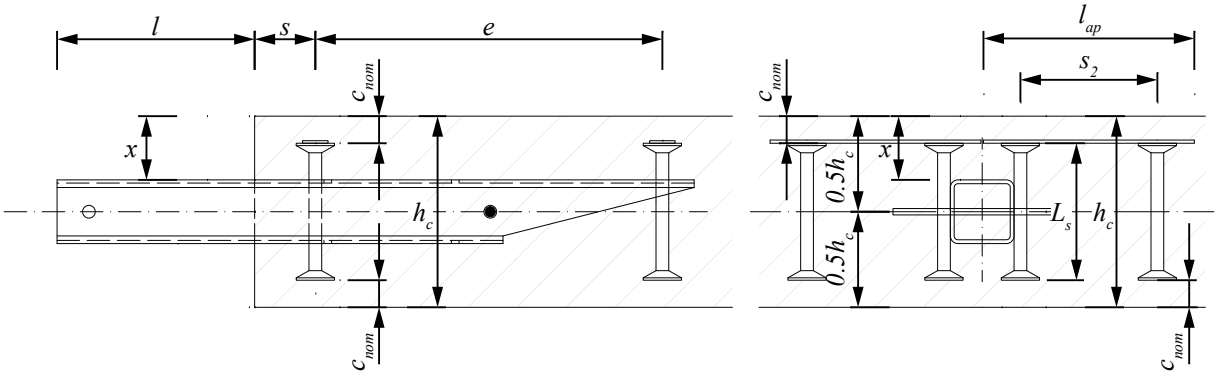
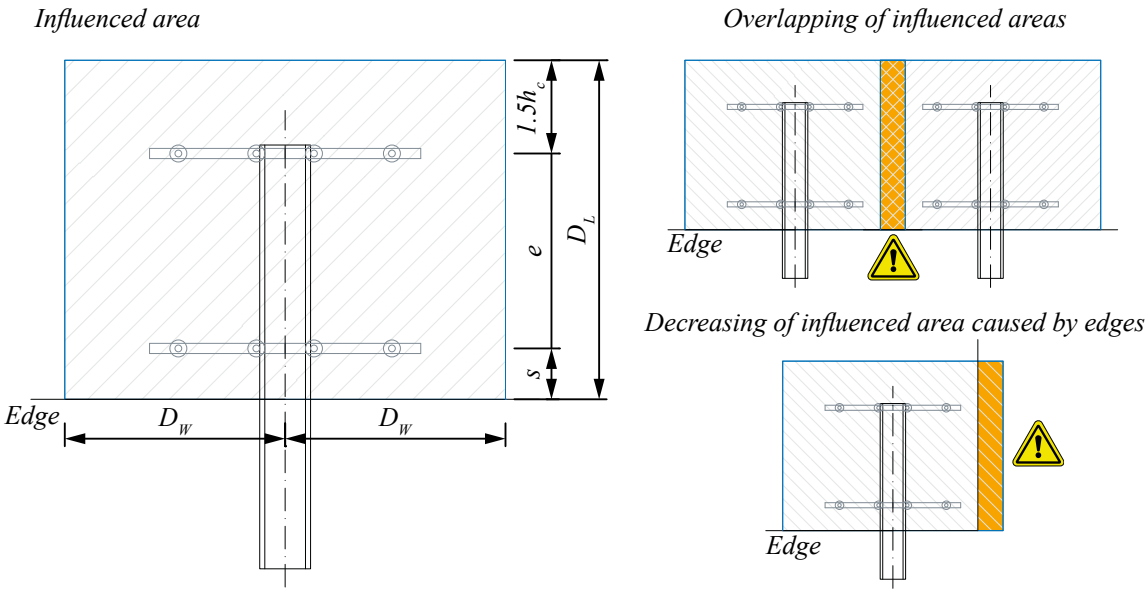


Table 4. Space requirements.

Length of cantilever part of steel profile l [mm]	Model A1 and A2		Model B1 and B2	
	Distance D_W [mm]	Distance D_L [mm]	Distance D_W [mm]	Distance D_L [mm]
200	615	1180	680	1220
250		1130		1170
300		1080		1120
350		1030		1070
400		980		1020
450		930		970
500		880		920

Figure 4. Space requirements for SLADEX® Balcony Slab Connector.



Overlapping or reducing the influenced area by the edges is not allowed for the SLADEX® Balcony Slab Connector models A1, A2, B1, B2 (see *Figure 4*).

For cases where the slab thicknes is different than the values specified in *Table 2*, or where the influenced area is limited by the edge of the concrete or overlapped with other influenced areas, please contact Peikko Technical support for individual solution with SLADEX® Balcony Slab Connector.

1.3 Other properties

SLADEX® is produced from components with following properties.

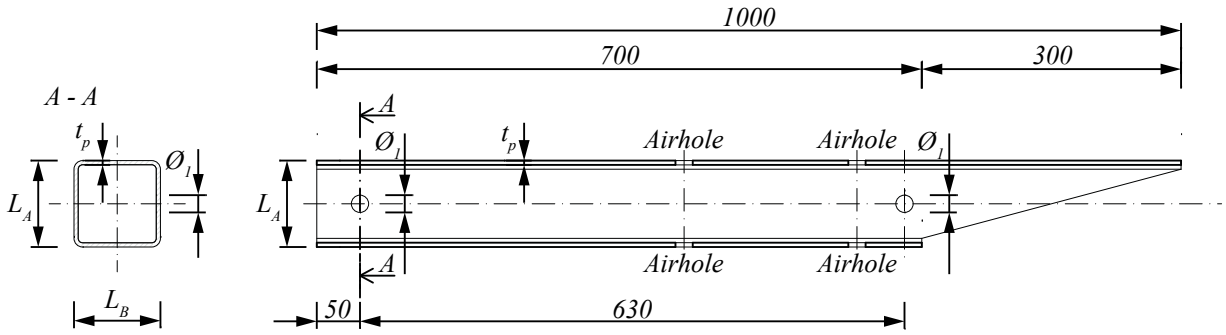
SLADEX® Balcony Slab Connector material properties:

Stainless steel profile	1.4301/1.4307	EN 10088-2
	f_{yk} = min 350 MPa	EN 10088-4
	Surface treatment:	EN 10219-2
	Brushed or acid pickling	
Double headed studs	B500B	EN 10080
Assembly profile	S235JR	EN 10025-2

SLADEX® Balcony Slab Connector delivery is composed of a rectangular hollow section tube (RHS tube) and studrails with double headed studs. The transverse reinforcement is not a part of the delivery.

STAINLESS STEEL PROFILE

Table 5. Dimensions of the RHS tube.



Model	Height of RHS tube L_A [mm]	Width of RHS tube L_B [mm]	Diameter $Ø_1$ [mm]	Wall thickness of the tube t_p [mm]	Weight [kg]
A1	80	80	20	5	13.4
A2	80	80		6	15.1
B1	100	100		5	16.6
B2	100	100		6	18.8

DOUBLE HEADED STUDS

Figure 5. Dimensions of the double headed studs.

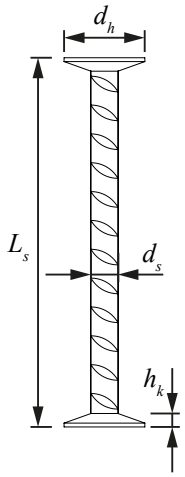


Table 6. Dimensions of the double headed studs.

Model	Shaft diameter d_s [mm]	Head diameter d_h [mm]	Height of the head h_k [mm]	Length of the studs L_s [mm]
A1 and A2	14	42	7	185
B1 and B2				215

Peikko Group's production units are externally controlled and periodically audited on the basis of the production certifications and product approvals by various independent organizations.

2. Resistances

The maximum allowed vertical loads on SLADEX® Balcony Slab Connectors are provided in *Table 7*. The maximum applied vertical load has been determined by using a design concept which is based on the following standards:

- EN 1992-4: 2018
- EN 1992-1-1: 2014
- EN 1993-1-1: 2005
- EN 1993-1-4: 2006

The design value of the maximum allowed vertical design load R_{Max} is depending on the protrusion length of the RHS tube, specified in *Table 7* (see *Figure 6*).

Figure 6. Loads and parameters characterizing the model of the SLADEX® Balcony Slab Connector.

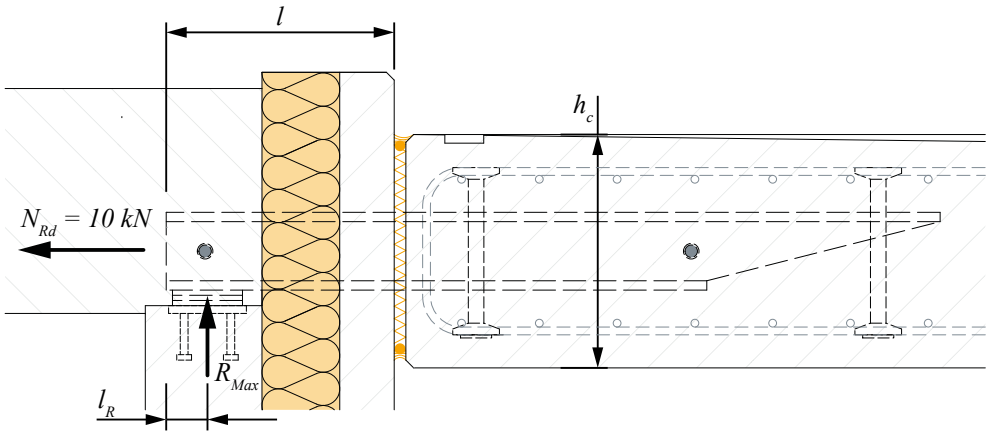


Table 7. Maximum allowed vertical design load R_{Max} of the SLADEX® Balcony Slab Connector for concrete grade C25/30.

Model		A1 R_{Max} [kN]	A2 R_{Max} [kN]	B1 R_{Max} [kN]	B2 R_{Max} [kN]
		h_c = 260 mm		h_c = 285 mm	
l [mm]	200	45.5	51.1	76.1	84.9
	250	37.3	42.1	63.7	72.8
	300	31.7	35.7	53.9	61.6
	350	27.5	31.1	46.6	53.3
	400	24.3	27.5	41.1	47.0
	450	21.8	24.6	36.7	42.0
	500	19.7	22.3	33.2	38.0

The design value of the maximum horizontal load N_{Rd} (see *Figure 6*) is defined in *Table 8* for all models.

Table 8. Maximum horizontal design load N_{Rd} of SLADEX® Balcony Slab Connector.

All models	N_{Rd} [kN]
Tensile design resistance of SLADEX®	10.0

Selecting SLADEX® Balcony Slab Connector

The following aspects must be considered when selecting the appropriate model of SLADEX®:

- Load
- Slab thickness
- Concrete cover in balcony slab (upper and bottom)
- Required protrusion of tube
- Concrete grade

Selecting SLADEX® Balcony Slab Connector

The selected type of the SLADEX® Balcony Slab Connector must meet the following conditions:

$$R_{Ed} \le R_{Max} \quad ; \quad N_{Ed} \le N_{Rd}$$

R_{Ed}, N_{Ed} – Design values of loads from precast slab
R_{Max} – Maximum allowed vertical design load of selected type of SLADEX® (see *Table 7*)
N_{Rd} – Maximum design horizontal load (see *Table 8*)

After selecting the correct SLADEX® Balcony Slab Connector, a product code describing the product may be defined according to the following description. Please use the product code in the drawings and while ordering a product from Peikko Sales.

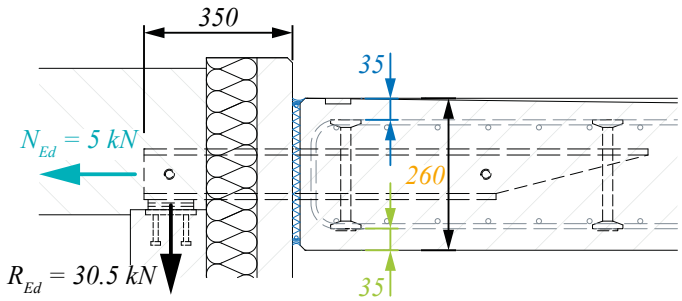
SLADEX® XY – c_u/c_b/h_c

XY is a model of SLADEX® selected from *Table 7* according to vertical reaction
c_u is the upper concrete cover in the balcony slab
c_b is the bottom concrete cover in the balcony slab
h_c is slab thickness

EXAMPLE

Input data

Design vertical load:	R_{Ed} = 30.5 kN
Design horizontal load:	N_{Ed} = 5 kN
Slab thickness (orange):	h_c = 260 mm
Concrete cover up (blue):	$c_{nom,up}$ = 35 mm
Concrete cover bottom (green):	$c_{nom,bot}$ = 35 mm
Protrusion length:	l = 350 mm
Concrete grade:	C30/37



Selection process:

The proper type of SLADEX® will be selected from *Table 7* according to vertical design load $\boldsymbol{R_{Ed}}$, thickness of the concrete slab $\boldsymbol{h_c}$, required protrusion of tube $\boldsymbol{l}$, and value $\boldsymbol{N_{Rd}}$ = **10 kN** based on *Table 8*.

Table 9. Selected row from Table 7 for required protrusion of tube.

l [mm]	A1 R_{Max} [kN]	A2 R_{Max} [kN]	B1 R_{Max} [kN]	B2 R_{Max} [kN]
350	27.5	31.1	46.6	53.3

Selection of model: $R_{Ed} \le R_{Max}$ → 30.5 kN ≤ 31.1 kN → SLADEX® A2
Verification of horizontal force: $N_{Ed} \le N_{Rd}$ → 5 kN ≤ 10 kN → OK
Created product code: SLADEX® A2 – 35/35/260

Annex A – Reinforcement

Where the SLADEX® Balcony Slab Connector is used, the minimum square area of the bending reinforcement must be secured (see *Figure 7*). The bending reinforcement of the balcony slab can be used for this purpose if requirements specified in *Table 10* are met. Otherwise, a sufficient amount of additional reinforcement bars should be added in order to meet the needed minimum square area in X direction $A_{m,x,min}$ and in Y direction $A_{m,y,min}$ (see *Figure 7* and *Table 10*).

Figure 7. Position of additional reinforcement.

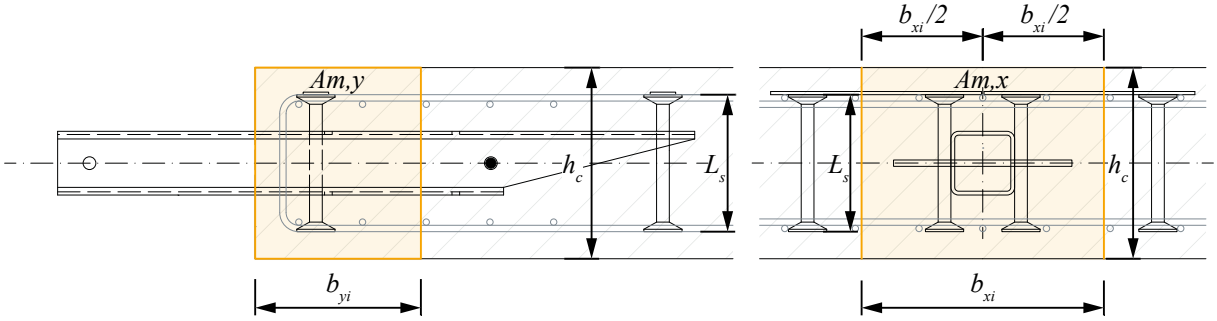


Table 10. Minimum cross-section area of transverse bending reinforcement in defined areas.

Model	Minimum cross section area of rebars		Width of defined minimum cross section area of rebars		Maximum diameter of rebars [mm]
	$A_{m,x,min}$ [mm^2]	$A_{m,y,min}$ [mm^2]	b_{xi} [mm]	b_{yi} [mm]	
A1	307.9	307.9	710	350	14
A2	307.9	307.9	710	350	
B1	461.8	307.9	800	380	
B2	461.8	461.8	800	380	

Steel double headed studs will fit between the top and the bottom bending reinforcement of the slab (value L_s in *Figure 7*). For cases where there is no possibility to meet the standard height of the studs according to *Table 2*, please contact Peikko Technical support for custom design of the stud length L_s.

Transverse reinforcement

The tensile load from the precast balcony slab to the load bearing base structure is transfered by transverse reinforcement added through the holes in the SLADEX® Balcony Slab Connector.

The transverse reinforcement is placed through the opening in the RHS tube on the slab end in precast factory and to the protruding end at the base-structure site according to *Figure 8*. The length L_{tb} and the diameter $Ø_{tb}$ of additional transverse reinforcement are specified in *Table 11*.

Material B500B EN 10080

Figure 8. Position of the transverse additional reinforcement.

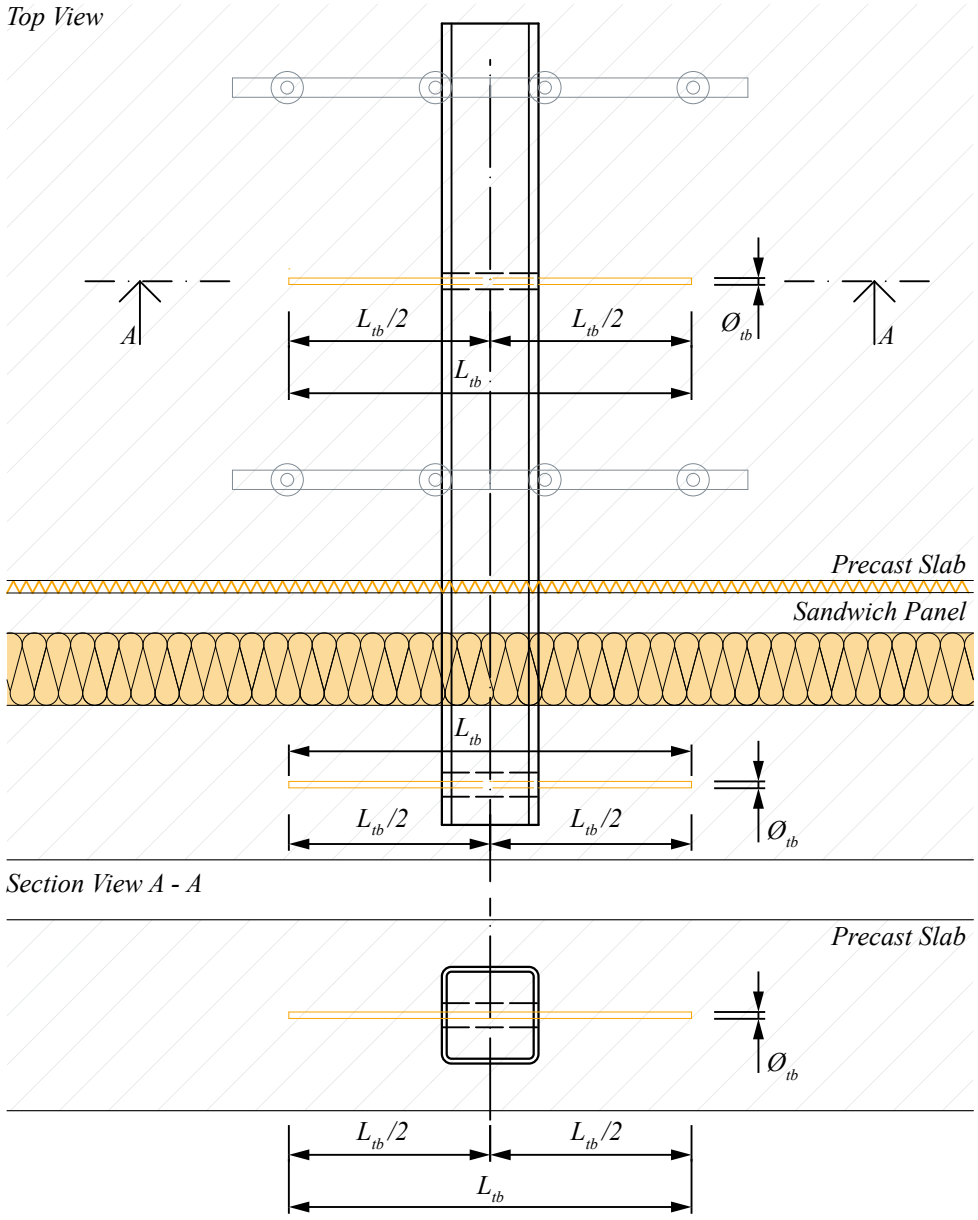


Table 11. Dimensions of the transverse reinforcement.

Model	Length of transverse bar L_{tb} [mm]	Diameter of transverse bar $Ø_{tb}$ [mm]
A1 and A2	300	10
B1 and B2		

NOTE: Transverse reinforcement bars are not a part of SLADEX® Balcony Slab Connector delivery.

Installation of SLADEX® Balcony Slab Connector

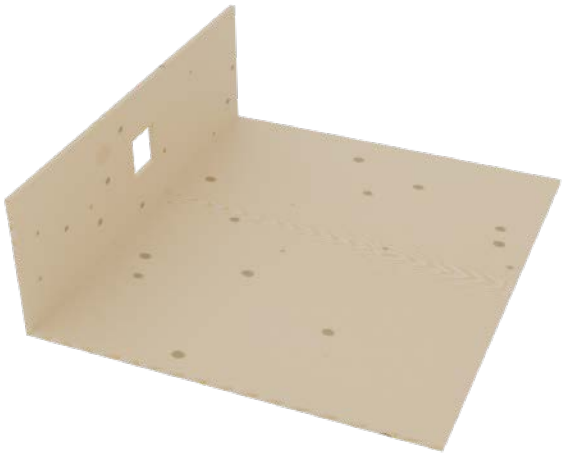
SLADEX® Balcony Slab Connector is installed into the planned position before casting concrete. Position of each component of SLADEX® is indicated in the installation drawing.

PRECAST FACTORY

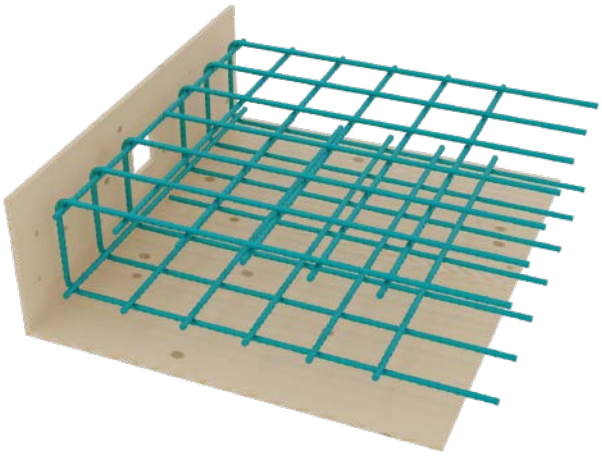
Balcony slabs can be cast either in using direction (top surface up) or reversed with bottom surface of balcony up. SLADEX® can be installed to the formwork in two ways based on installation of the double headed studs:.

Top installation:

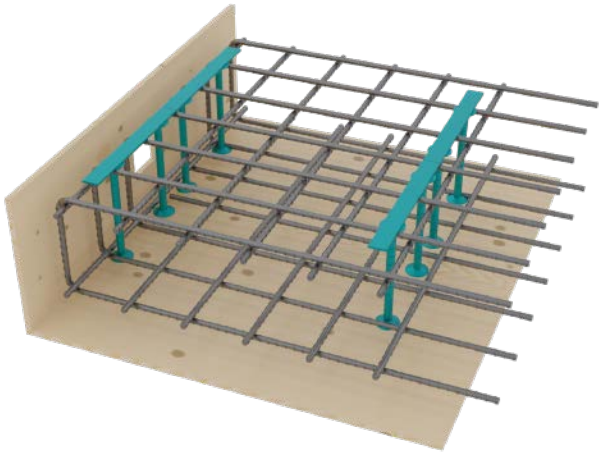
Double headed studs are installed from top to main reinforcement of the slab. Balcony slab presented in figures is cast in reversed direction with bottom surface of balcony slab in top



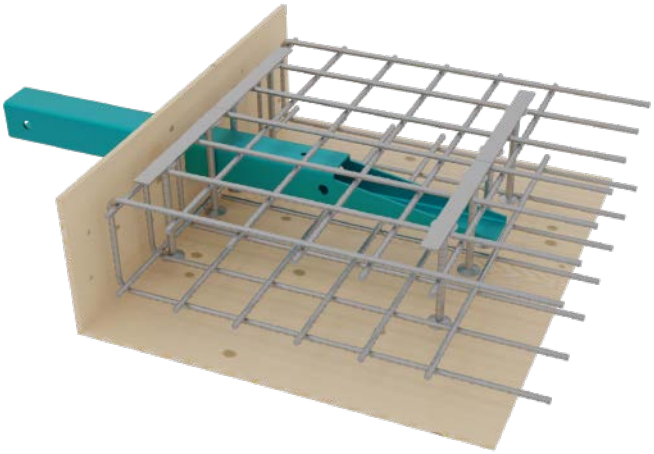
1. Prepare formwork and cut the opening for the RHS tube profile.



2. Insert the main reinforcement of the slab.

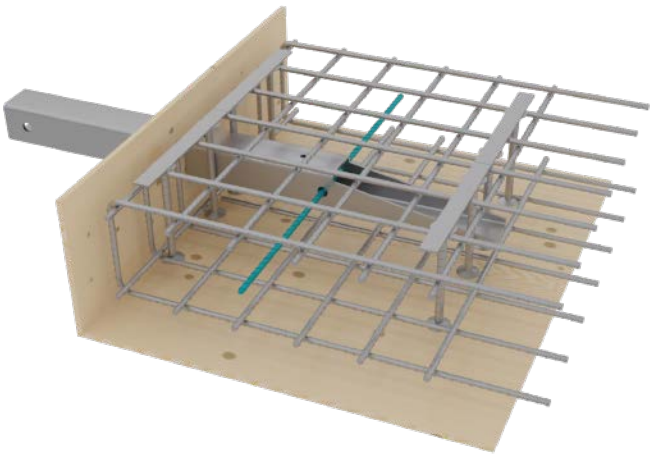


3. Insert stud rails one by one in the right position around the tube opening.

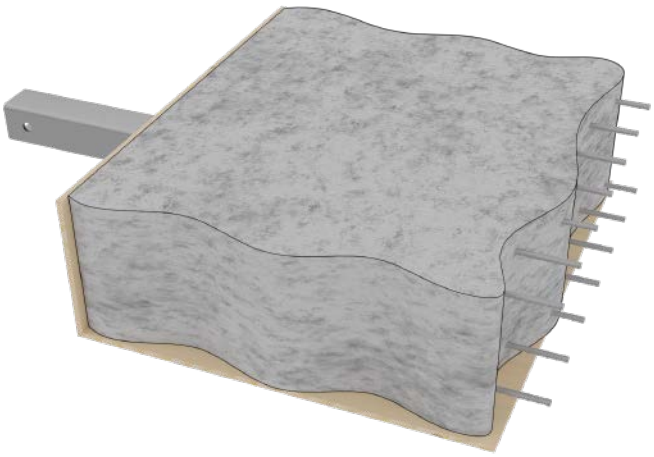


4. Fill the tube (e.g. with stone wool) in the formwork wall level. Insert the RHS tube through the hole in the formwork.

   Secure the openings against leaking of the concrete outside of the formwork.



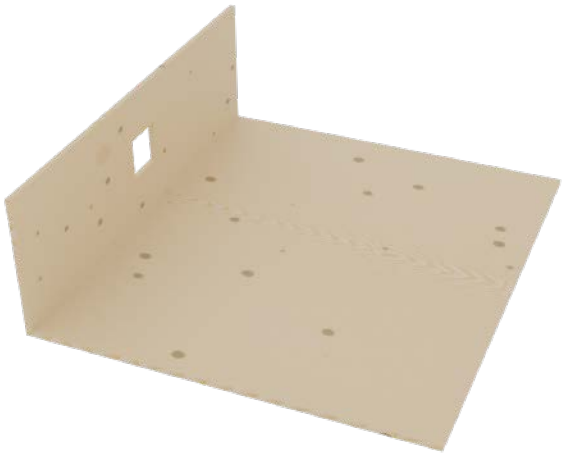
5. Insert the transverse reinforcement through the hole at the end of the tube. Tighten the RHS tube to the vertical reinforcement and secure the position of the tube during casting.



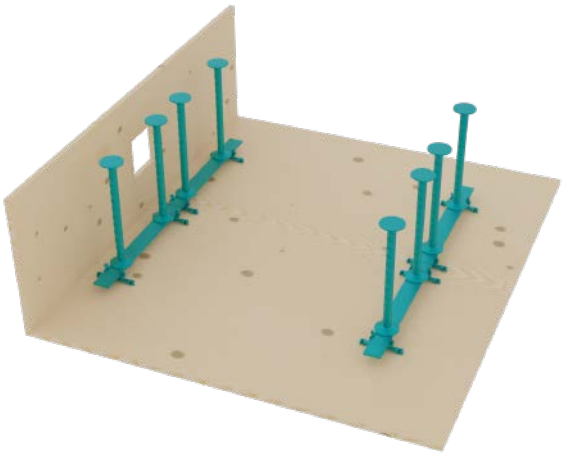
6. Fill the RHS tube in the formwork with concrete. Pour the concrete into the formwork. After the concrete reaches the required strength, remove the precast element from the formwork.

Bottom installation:

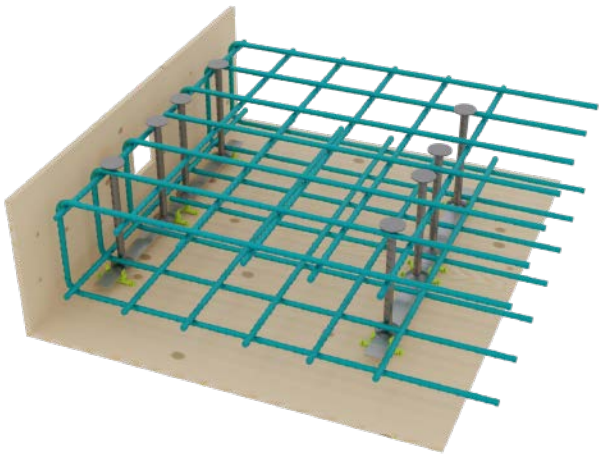
Double headed studs are installed before the installation of the main reinforcement of the slab.



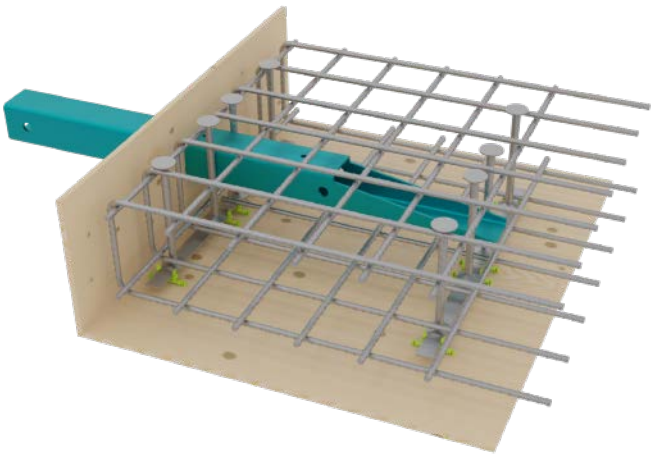
1. Prepare the formwork and cut out the opening for the RHS tube.



2. Insert stud rails one by one in the right position. Use plastic spacers to secure the proper concrete cover. **Spacers are not part of the standard delivery and need to be ordered separately.**

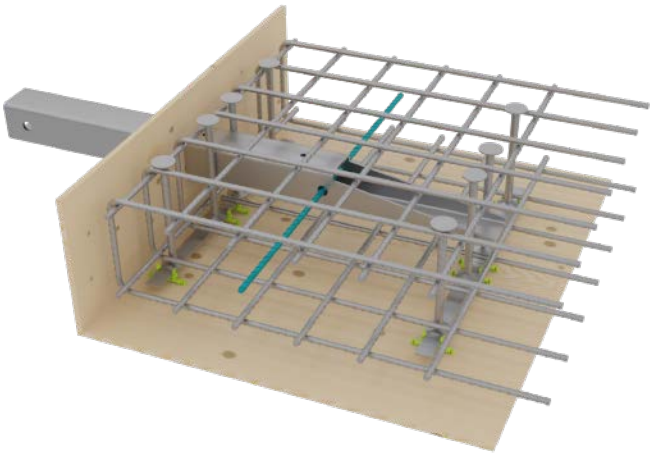


3. Insert the main reinforcement of the slab.

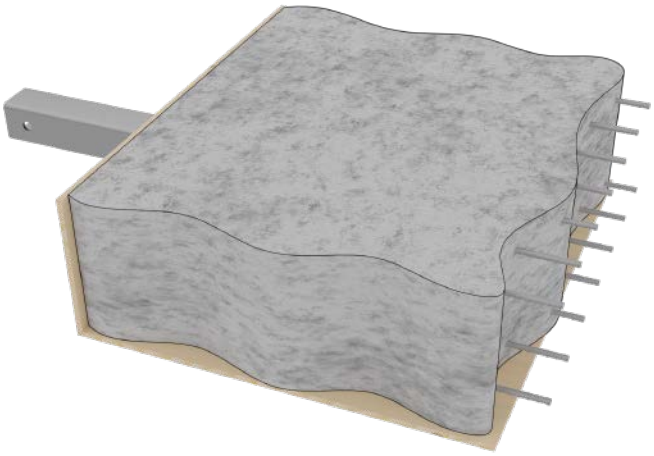


4. Fill the tube (e.g. with stone wool) in the formwork wall area. Insert the RHS tube through the hole in the formwork.

   Secure the openings against leaking of the concrete outside of the formwork.

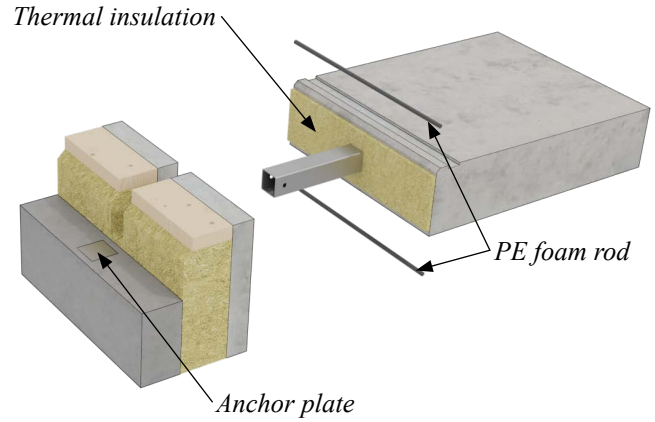


5. Insert the transverse reinforcement through the hole at the end of the tube. the RHS tube to vertical reinforcement and secure the position during casting.



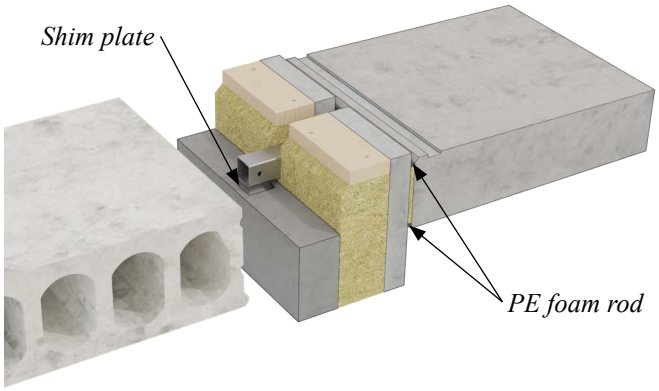
6. Pour the concrete into the formwork. After the concrete reaches the required strength, remove the precast element from the formwork.

BUILDING SITE



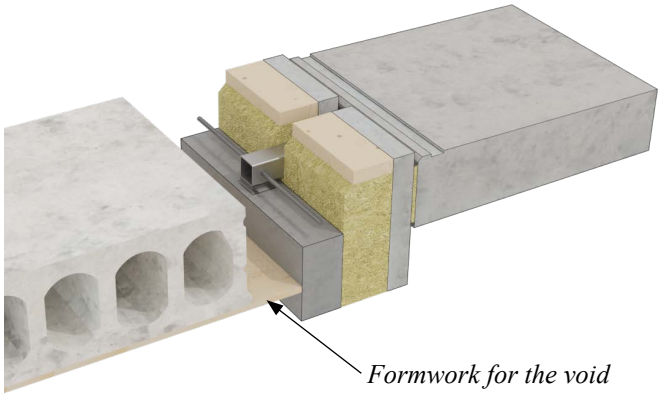
1. Wall panel is produced with a slot for installation of the SLADEX® balcony tube and anchor plate at loadbearing part of the wall.

   Place a layer of thermal insulation to precast balcony element to fill the gap between balcony and wall panel.



2. Place the protruding part of the SLADEX® Balcony Slab Connector on the existing base structure through slot in the wall panel. Level of the RHS tube is adjusted by shim plates. Shim plates are placed between RHS tube and anchor plate. (Shim plates are not a part of Peikko delivery)

   Gap between balcony slab and wall element will be secured after installation by PE foam rod and sealant.



3. Secure the needed fixing to the frame structure and ensure that possible joint reinforcement is in place. Check also that the formwork is done according to the assembly details and plans and insert the additional reinforcement bar through the hole at the end of the stainless steel profile.

4. Pour the concrete into the formwork and fill the void between floor slab and wall panel. After the concrete reaches the required resistance, remove the formwork. SLADEX® carries full load from the precast slab into the base structure.

NOTES

Revisions

Version: PEIKKO GROUP 10/2020. Revision: 001

- First publication.

Resources

DESIGN TOOLS

Use our powerful software every day to make your work faster, easier, and more reliable. Peikko design tools include design software, 3D components for modeling programs, installation instructions, technical manuals, and product approvals of Peikko's products.

peikko.com/design-tools

TECHNICAL SUPPORT

Our technical support teams around the world are available to assist you with all of your questions regarding design, installation etc.

peikko.com/technical-support

APPROVALS

Approvals, certificates, and documents related to CE-marking (DoP, DoC) can be found on our websites under each products' product page.

peikko.com/products

EPDS AND MANAGEMENT SYSTEM CERTIFICATES

Environmental Product Declarations and management system certificates can be found at the quality section of our websites.

peikko.com/qehs

COMPANY WITH
MANAGEMENT SYSTEM
CERTIFIED BY DNV
ISO 9001 • ISO 14001
ISO 45001