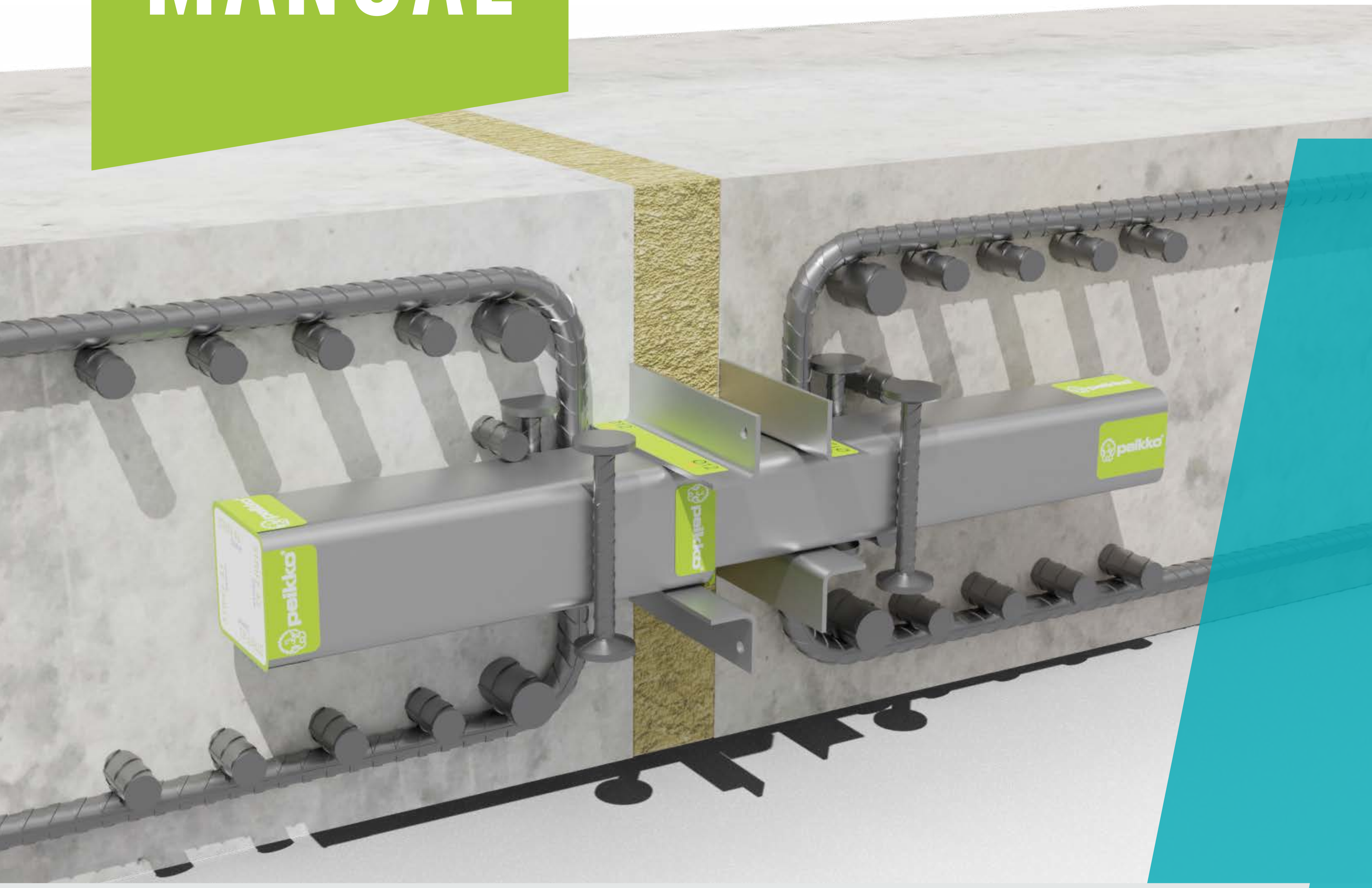
TECHNICAL MANUAL



STRIFF® Shear Dowel

Expansion Joint System

Version PEIKKO GROUP 11/2021

peikko®

STRIFF® Shear Dowel

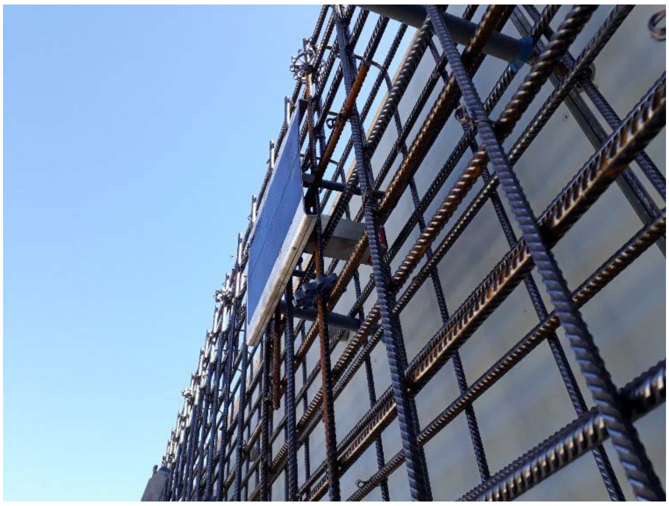
Expansion Joint System

- **High load capacity for expansion joints up to 80 mm width**
- **Optimised load-deformation behaviour, especially in-service condition**
- **High corrosion resistance**
- **Simple and time-saving installation**
- **Longitudinal or longitudinal and transverse displaceable versions**
- **Reduced crackling noises during movements thanks to rectangular cross section.**

Expansion or contraction joints are designed in concrete structures to reduce or prevent constrains (e.g. due to thermal expansion), which could lead to structural integrity damages like structural cracks. STRIFF® Shear Dowel system supports movement of the concrete structures in transverse and/or longitudinal directions of the expansion joints, to prevent mentioned constrains and further damages. In the same time STRIFF® restricts movement of concrete structures in vertical direction by securing the same horizontal level of connected structures.

STRIFF® Shear Dowel is available in two load models: STRIFF® 43 and STRIFF® 51. Both models consist of rectangular cross sections which significantly reduce stresses at the contact areas and has a positive effect to reduction of crackling noises during movements.

Thanks to using high-quality stainless-steel material, STRIFF® Shear Dowel is suitable not only for interior conditions.



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About STRIFF® Shear Dowel

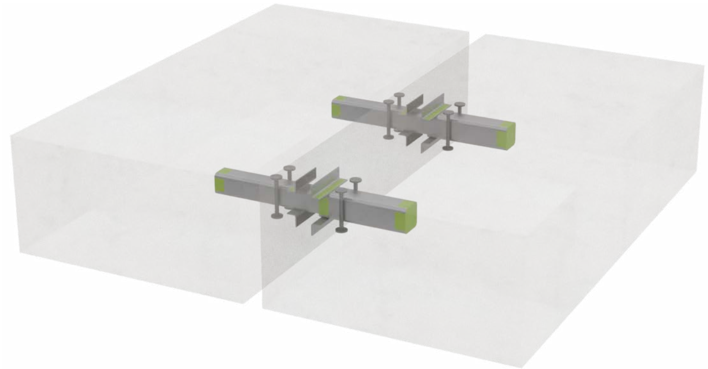
1. Product properties

The innovative STRIFF® Shear Dowel transfers vertical shear loads in expansion or contraction joints between two concrete structures. STRIFF® Shear Dowel supports movement in longitudinal and transverse directions in order to avoid undesirable defects in structures, for example due to thermal expansion, and at the same time prevents vertical movement of the expansion joints. The system is designed for connecting interfacing monolithic concrete elements that have been split during the casting process:

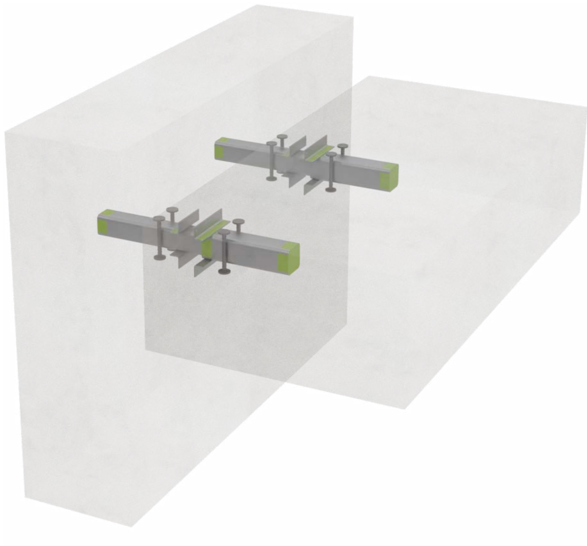
- Slab-to-slab expansion joint (*a*).
- Slab-to-wall expansion joint (*b*).

Figure 1. Possible expansion joint using STRIFF® Shear Dowel.

a) Expansion joint of slab-to-slab



b) Expansion joint of slab-to-wall



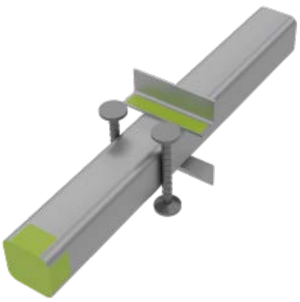
STRIFF® Shear Dowel is available in two models: STRIFF® 43 and STRIFF® 51. Each of these models provides two options of movement direction – longitudinal movement or longitudinal and transverse movement marked with "q". This system allows us to use/install insulation up to 80 mm thick within the expansion joint as a thermal break.

STRIFF® Shear Dowel system consists of:

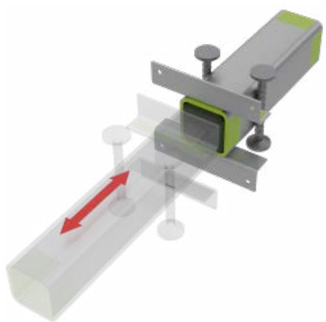
- Square dowel filled with high performance concrete to increase stiffness (*Figure 2.a*).
- Square sleeve for longitudinal movement (*Figure 2.b*).
- Rectangular sleeve marked with "q" for longitudinal and transverse movement (*Figure 2.c*).
- Fire protection collars BSM for longitudinal movement (*Figure 2.d*) or qBSM for longitudinal and transverse movement (*Figure 2.e*) can be provided.

Figure 2. Description of STRIFF® Shear Dowel parts.

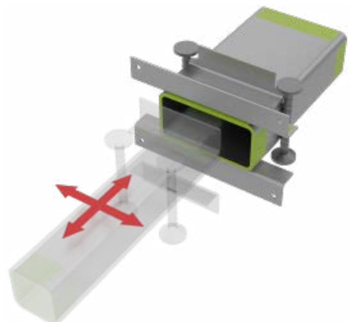
a) Dowel



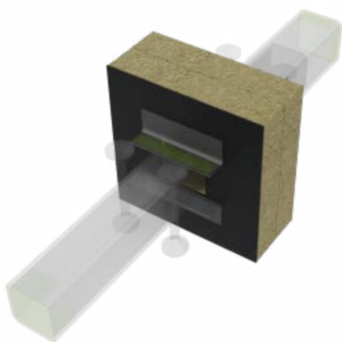
b) Square Sleeve (longitudinal movement)



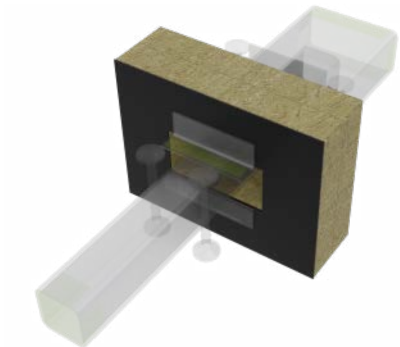
c) Rectangular qSleeve (longitudinal and transverse movement)



d) BSM – fire protection collar



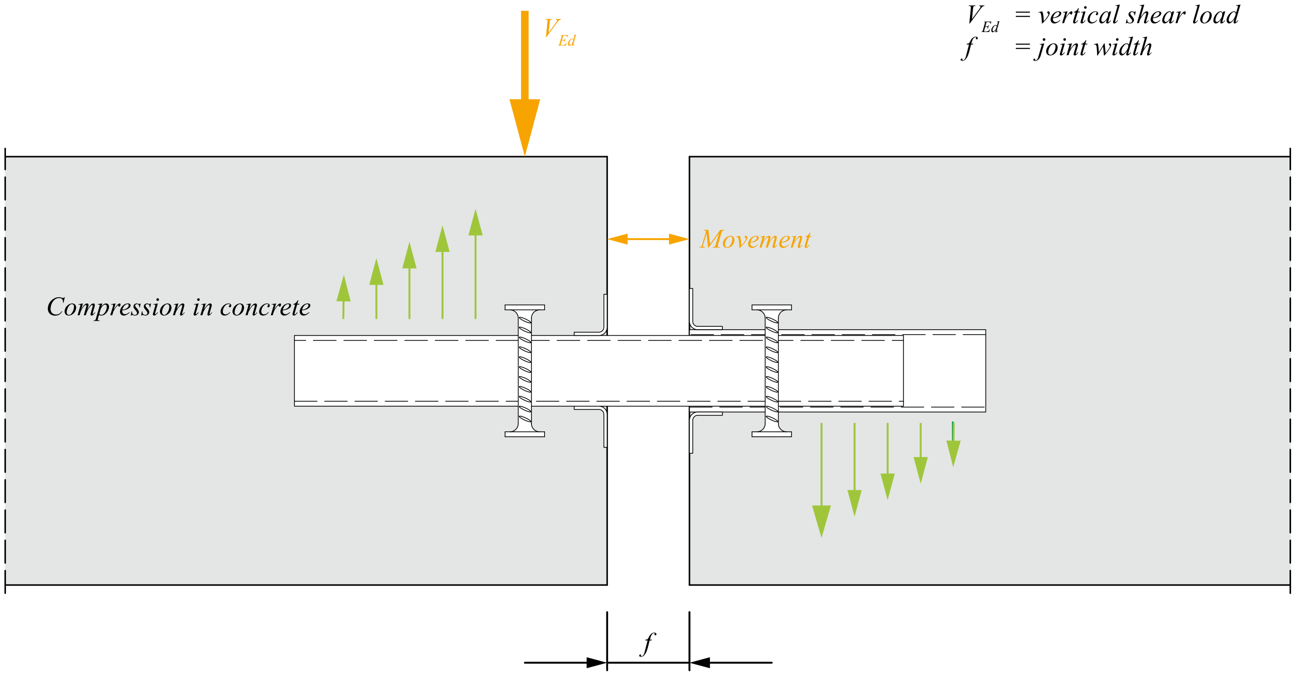
e) qBSM – fire protection collar



1.1 Structural behaviour

STRIFF® transfers vertical shear loads, whose values depend on the model, slab thickness, dowel spacing and joint width. It is used mostly in expansion joints because it facilitates movement in longitudinal direction or longitudinal and transverse direction of the concrete elements. Thanks to the unique stiff dowel system, STRIFF® provides high shear capacity and minimum movement of connected concrete element in vertical direction.

Figure 3. Structural behaviour of the expansion joint using STRIFF® Shear Dowel.



1.1.1 Final conditions

The connection can be assumed as a load bearing after the both components (dowel and sleeve) are embedded in adequately hardened concrete elements with required strength. The load transfer from the shear dowel into the reinforced concrete slab must be ensured by additional reinforcement. For detailed information see Section 4 Annex A - Additional reinforcement. The specified dowel and edge distances are adhered to.
STRIFF® Shear Dowel system can reduce crackling noises if both components (dowel and sleeve) are properly aligned in all directions.

1.2 Limitations for application

The shear resistances of STRIFF® Shear Dowel are guaranteed in reinforced concrete grade C25/30 and C30/37 or higher. STRIFF® Shear Dowel is designed to be used under the conditions stated in this chapter. If these conditions are not met, please contact Peikko Technical Support.

1.2.1 Loading and environmental conditions

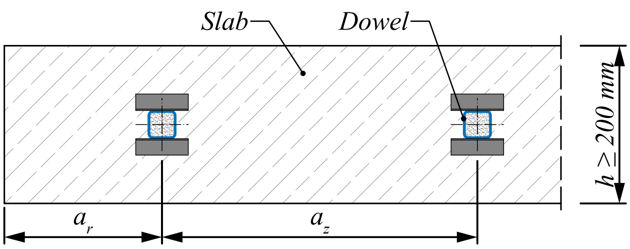
STRIFF® Shear Dowel is primarily designed to transfer static loads. Please contact Peikko technical support if transfer of dynamic loads is needed.
Shear resistances of STRIFF® Shear Dowel are determined in accordance with EN 1992-1-1: 2004.

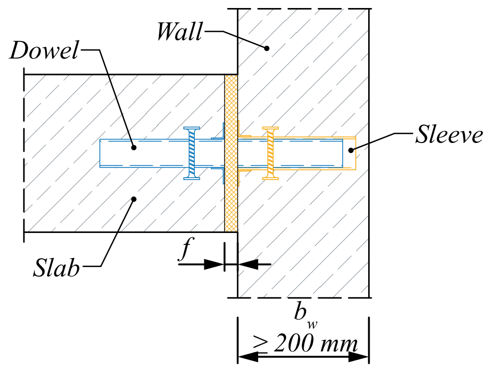
1.2.2 Positioning of STRIFF® Shear Dowel

When placing STRIFF® to concrete structure minimum spacings between the dowels and edge distance must be secured in accordance with *Table 1*. Minimum slab thickness for installation of STRIFF® is specified in *Table 5*., *Table 7*., depending on the model.

Table 1. Slab thickness and dowel spacing.

Front View	Section View





a_z = distance between the centers of dowels
a_r = distance the center of dowel from the edge
b_w = thickness of the wall element
h = thickness of the slab

Minimum spacing between dowels and edge distance	
$a_z \geq 3.0\ h$	$a_r \geq 1.5\ h$
$3.0\ h > a_z \geq 2.5\ h$	$1.5\ h > a_r \geq 1.25\ h$
$2.5\ h > a_z \geq 2.0\ h$	$1.25\ h > a_r \geq 1.0\ h$
$2.0\ h > a_z \geq 1.25h$	$1.0\ h > a_r \geq 0.625\ h$
$1.25h > a_z \geq 0.75h$	$0.625\ h > a_r \geq 0.375\ h$

If the dowel spacings exceed 5 times the slab thickness ($a_z > 5h$), the required bending reinforcement at the slab edge (parallel to the joint) must be dimensioned assuming a continuous beam and, if necessary, reinforced by additional reinforcement or by increasing the rebar cross-sections of the continuous additional reinforcement.

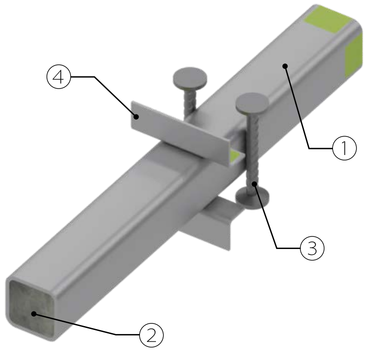
1.3 Other properties

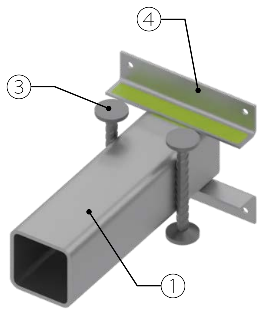
STRIFF® Shear Dowel is produced from components with following properties:

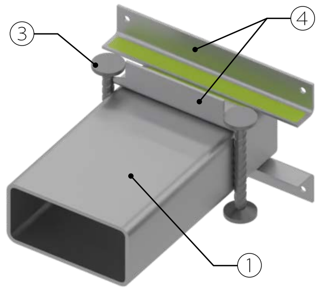
1.3.1 Materials

Table 2. Materials of STRIFF® parts.

a) Dowel	b) Sleeve	c) qSleeve

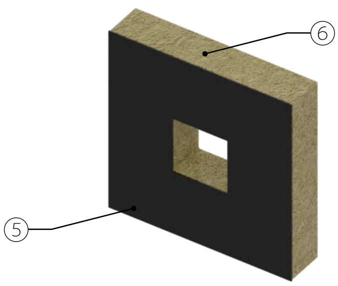






	Component	Material	Standard
1	Tube profile	Stainless steel 1.4462	EN 10088-4
2	UHPC core	Ultra-high-performance fiber concrete	EN 196-1
3	Double headed stud	Reinforcement steel B500B	EN 10080
4	L-profile	Stainless steel 1.4301	EN 10088-4

Table 3. Materials of BSM fire protection collar.



	Component	Material	Standard
5	Supporting plate	Rock-wool	EN 13162: 2012
6	Protection laminate	PROMASEAL-PL	-

1.3.2 Dimensions

The dimensions of standard STRIFF® models are summarized in *Figure 4 - Figure 5*.

STRIFF® 43

Longitudinal movement

Longitudinal and transverse movement

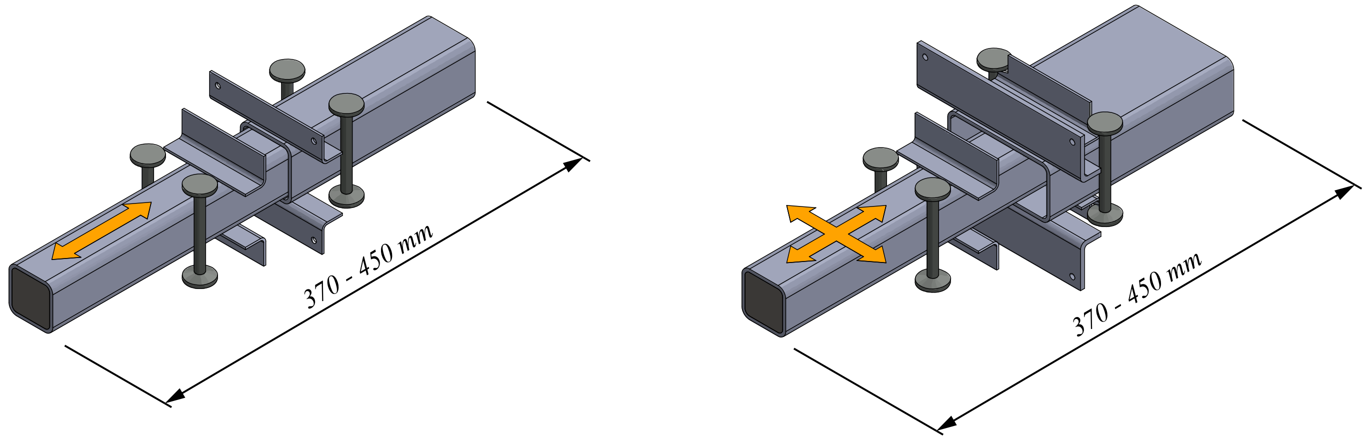
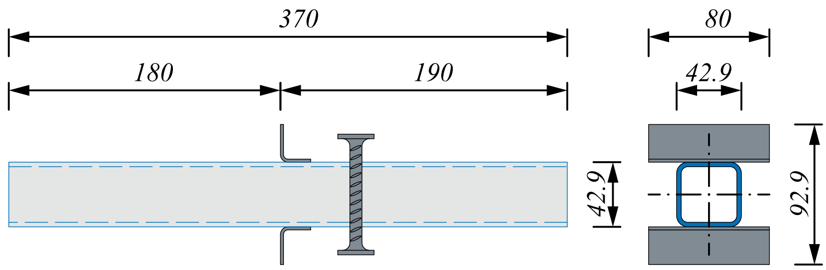
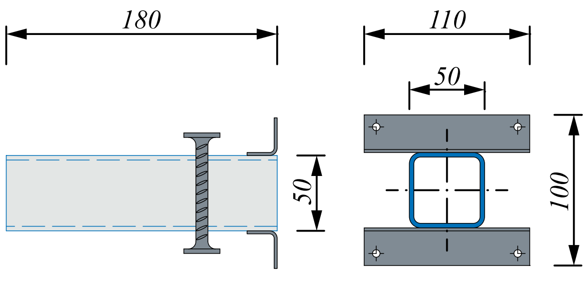


Figure 4. Dimensions of STRIFF® 43.

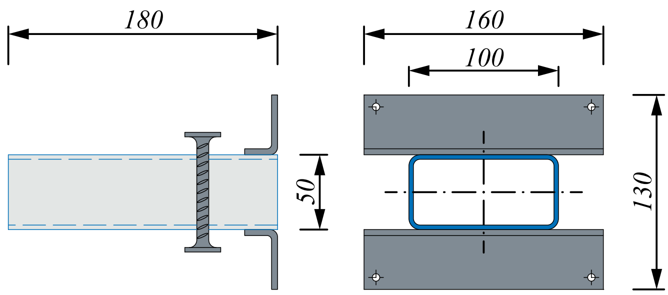
STRIFF® 43 Dowel



STRIFF® 43 Sleeve



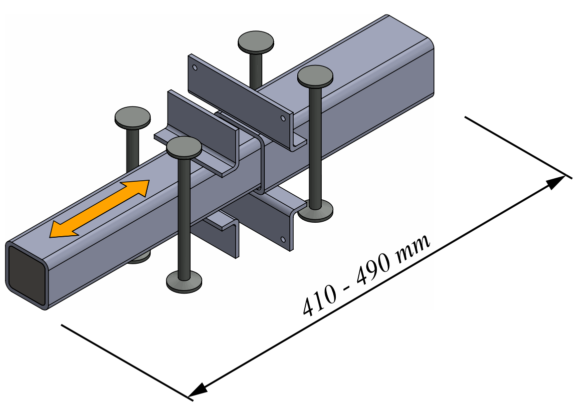
STRIFF® 43 qSleeve



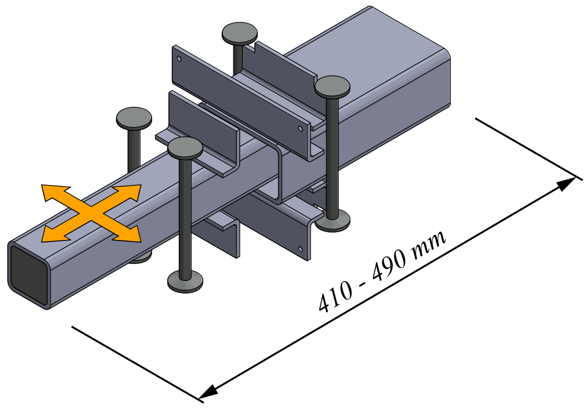
STRIFF® 51

Figure 5. Dimensions of STRIFF® 51.

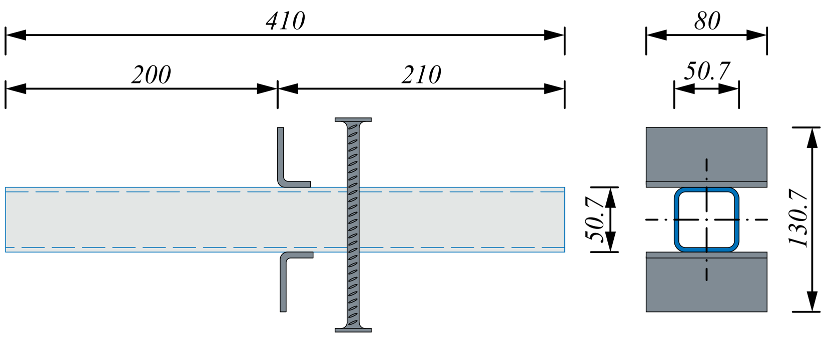
Longitudinal movement



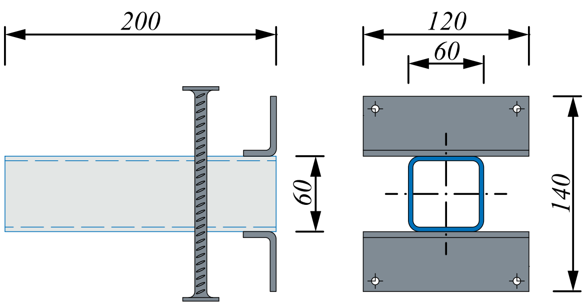
Longitudinal and transverse movement



STRIFF® 51 Dowel



STRIFF® 51 Sleeve



STRIFF® 51 qSleeve

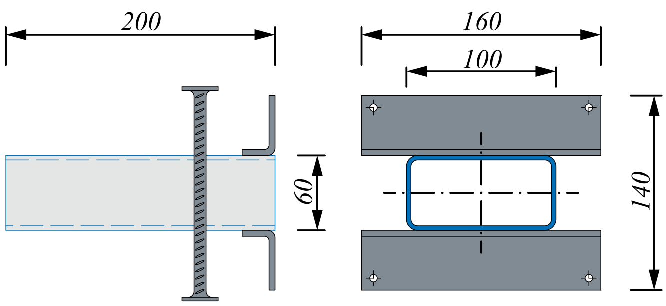
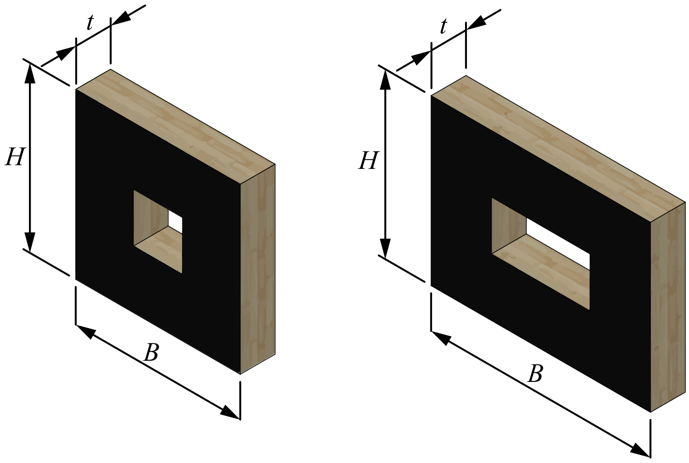


Table 4. Dimensions of BSM and qBSM.

<table>
<tr><th>Type</th><th>B
[mm]</th><th>H
[mm]</th><th>(q)BSM 20
t [mm]</th><th>(q)BSM 30
t [mm]</th><th>(q)BSM 40
t [mm]</th></tr>
<tr><td>43 BSM</td><td>150</td><td>150</td><td rowspan="4">21.8</td><td rowspan="4">31.8</td><td rowspan="4">41.8</td></tr>
<tr><td>51 BSM</td><td>160</td><td>160</td></tr>
<tr><td>43 qBSM</td><td>200</td><td>150</td></tr>
<tr><td>51 qBSM</td><td>210</td><td>160</td></tr>
</table>



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

The products bear the inspection mark, the emblem of Peikko Group, the type of products, and the year and week of manufacturing.

2. Resistances

The design values of shear load resistance for expansion joints using STRIFF® Shear Dowel are determined according to following standards:
EN 1992-1-1:2004/A1:2014
EN 1993-1-1: 2005
EN 1993-1-4: 2006
EN 1993-1-8: 2005

The ultimate limit state resistances of expansion joint against shear loading for STRIFF® 43 are summarized in *Table 5* and for model STRIFF® 51 in *Table 7*.

Figure 6. Acting shear force on the slab connected to slab by shear dowel.

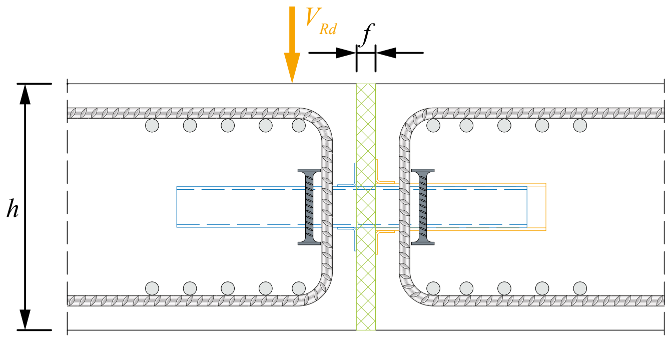


Figure 7. Spacing between the dowels.

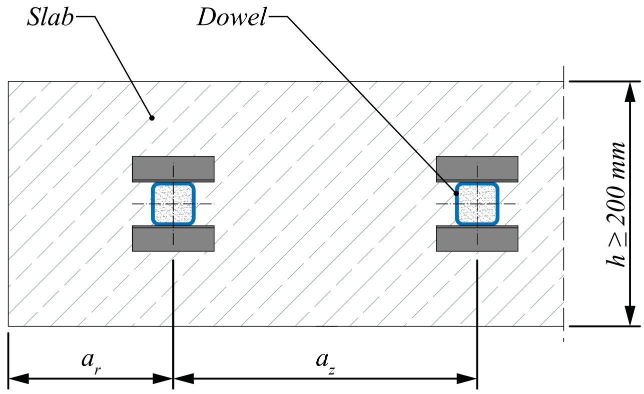


Table 5. Ultimate limit state resistances of STRIFF® 43.

<table>
<tr><th colspan="12">Ultimate limit state resistances (ULS)</th></tr>
<tr><th rowspan="4">f [mm]</th><th rowspan="4">h [mm]</th><th colspan="10">V_{Rd} [kN/ dowel]</th></tr>
<tr><th colspan="2">$1.25\ h > a_z \geq 0.75\ h$</th><th colspan="2">$2.0\ h > a_z \geq 1.25\ h$</th><th colspan="2">$2.5\ h > a_z \geq 2.0\ h$</th><th colspan="2">$3.0\ h > a_z \geq 2.5\ h$</th><th colspan="2">$a_z \geq 3.0\ h$</th></tr>
<tr><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = 0.5\ k_{ser}$</th></tr>
<tr><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th></tr>
<tr><td rowspan="4">$f \leq 20$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td>92</td><td>98</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td>76</td><td>80</td><td>82</td><td>87</td><td>104</td><td>108</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td><td>84</td><td>89</td><td>90</td><td>96</td><td>115</td><td>123</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>81</td><td>87</td><td>92</td><td>98</td><td>99</td><td>106</td><td>119</td><td>128</td></tr>
<tr><td rowspan="4">$20 < f \leq 40$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td>92</td><td>98</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td>76</td><td>80</td><td>82</td><td>87</td><td rowspan="3">102</td><td rowspan="3">108</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td><td>84</td><td>89</td><td>90</td><td>96</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>81</td><td>87</td><td>92</td><td>98</td><td>99</td><td>106</td></tr>
<tr><td rowspan="4">$40 < f \leq 60$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td rowspan="4">88</td><td rowspan="4">93</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td>76</td><td>80</td><td>82</td><td>87</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td><td>84</td><td>89</td><td rowspan="2">88</td><td rowspan="2">93</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>81</td><td>87</td><td>88</td><td>93</td></tr>
<tr><td rowspan="4">$60 < f \leq 80$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td rowspan="4">77</td><td rowspan="4">80</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td rowspan="3">76</td><td rowspan="3">80</td><td rowspan="3">77</td><td rowspan="3">80</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>77</td><td>80</td></tr>
</table>

Table 6. *Stiffness of the connection in service state.*

f [mm]	$f \leq 20$	$20 < f \leq 40$	$40 < f \leq 60$	$60 < f \leq 80$
k_{ser} [kN/mm/dowel]	40	30	25	25

Figure 8. *Acting shear force on the slab connected to slab by shear dowel.*

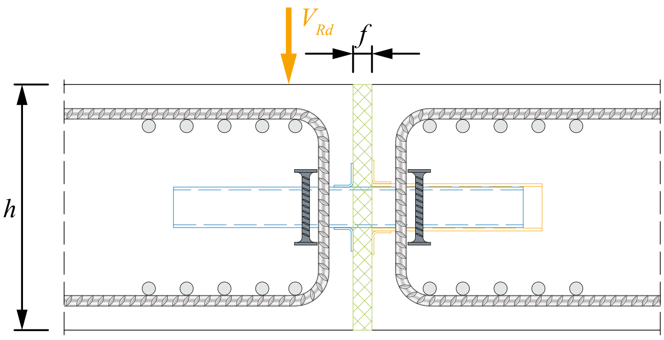


Figure 9. *Spacing between the dowels.*

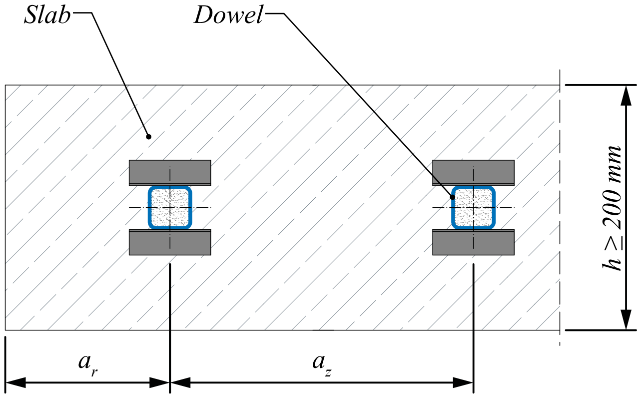


Table 7. *Ultimate limit state resistances of STRIFF® 51.*

Ultimate limit state resistances (ULS)											
		V_{Rd} [kN/ dowel]									
f [mm]	h [mm]	$1.25\,h > a_z \geq 0.75\,h$		$2.0\,h > a_z \geq 1.25\,h$		$2.5\,h > a_z \geq 2.0\,h$		$3.0\,h > a_z \geq 2.5\,h$		$a_z \geq 3.0\,h$	
		$k = k_{ser}$		$k = k_{ser}$		$k = k_{ser}$		$k = k_{ser}$		$k = 0.5\,k_{ser}$	
		C25/30	C30/37	C25/30	C30/37	C25/30	C30/37	C25/30	C30/37	C25/30	C30/37
$f \leq 20$	260	75	79	82	87	92	98	100	106	128	136
	280	81	87	89	95	101	107	109	115	139	148
	300	88	94	97	103	109	116	118	125	151	161
	320	95	101	104	111	118	125	127	135	164	174
	≥ 340	103	109	112	119	127	135	137	145	176	187
$20 < f \leq 40$	260	75	79	82	87	92	98	100	106	128	136
	280	81	87	89	95	101	107	109	115	139	148
	300	88	94	97	103	109	116	118	125	151	161
	320	95	101	104	111	118	125	127	135	157	168
	≥ 340	103	109	112	119	127	135	137	145		
$40 < f \leq 60$	260	75	79	82	87	92	98	100	106	128	136
	280	81	87	89	95	101	107	109	115	139	148
	300	88	94	97	103	109	116	118	125		
	320	95	101	104	111	118	125	127	135		
	≥ 340	103	109	112	119	127	135	137	145		
$60 < f \leq 80$	260	75	79	82	87	92	98	100	106	124	131
	280	81	87	89	95	101	107	109	115		
	300	88	94	97	103	109	116	118	125		
	320	95	101	104	111	118	125	124	131		
	≥ 340	103	109	112	119	124	131				

Table 8. Stiffness of the connection in service state.

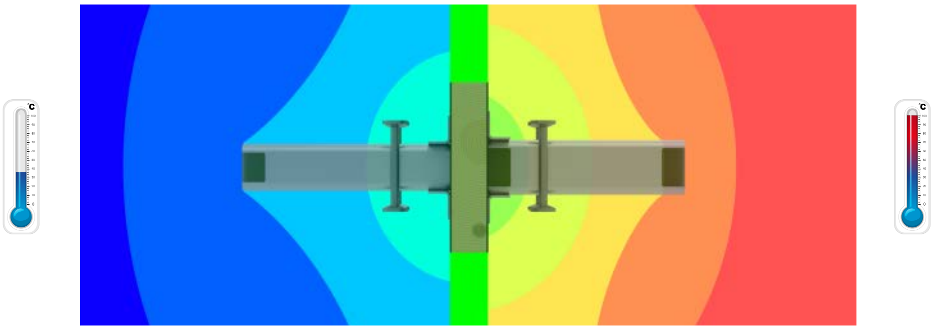
f [mm]	$f \leq 20$	$20 < f \leq 40$	$40 < f \leq 60$	$60 < f \leq 80$
k_{ser} [kN/mm/dowel]	60	50	30	30

2.1 Thermal resistance

The construction of STRIFF® Shear Dowel allows it to be used also in joints between the interior and the exterior of the structure. Stainless steel material and a small cross section of the tube secure small thermal conductivity of the product.

Thermal resistance of the joint (R_{eq}) is then influenced by the number of shear dowels in connection and by material properties of the thermal insulation. Equivalent thermal resistances R_{eq} presented in *Table 9*. and *Table 10*. are precalculated for thermal insulation with thermal conductivity at λ = 0.035 W/mK. Thermal resistances of the joint are calculated for one-meter length of the joint with minimum supported spacing (2.0 h) of the dowels.

Figure 10. Heat flow between two concrete elements connected by STRIFF® Shear Dowel.



STRIFF® 43

Table 9. Thermal resistance of the joint equivalent of 1 meter.

Thermal resistance of the joint R_{eq} [m²K/W]				
f [mm]	h [mm]			
	200	220	240	260
$f \leq 20$	0.0985	0.1065	0.1142	0.1650
$20 < f \leq 40$	0.1969	0.2130	0.2285	0.3300
$40 < f \leq 60$	0.2954	0.3195	0.3427	0.4950
$60 < f \leq 80$	0.3939	0.4259	0.4569	0.6600

STRIFF® 51

Table 10. Thermal resistance of the joint equivalent of 1 meter.

Thermal resistance of the joint R_{eq} [m²K/W]					
f [mm]	h [mm]				
	260	280	300	320	340
$f \leq 20$	0.1217	0.1290	0.1360	0.1428	0.1494
$20 < f \leq 40$	0.2435	0.2580	0.2720	0.2856	0.2988
$40 < f \leq 60$	0.3652	0.3870	0.4081	0.4285	0.4482
$60 < f \leq 80$	0.4870	0.5160	0.5441	0.5713	0.5976

2.2 Fire resistance

STRIFF® Shear Dowel with a fire protection collar BSM/qBSM provides fire protection for the dowel system. The fire protection collars BSM/qBSM can be ordered optionally.

2.2.1 Fire protection collar BSM

Figure 11. Fire protection collar BSM.

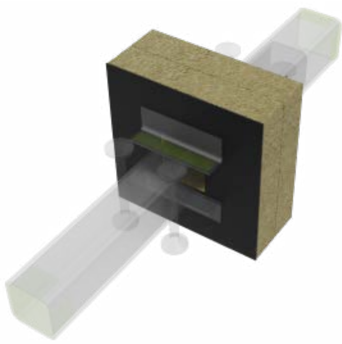
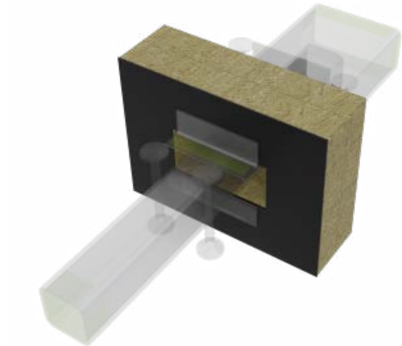


Figure 12. Fire protection collar qBSM.



2.2.2 Effects of the fire protection collar BSM/qBSM and fire resistance of a joint

The fire protection laminate expands to its original thickness when exposed to heat and forms a thermally stable foam layer with low thermal conductivity. The foam layer fills the joint in the area of the dowel and protects the dowel from the effects of the heat.

The expansion foam of BSM collar works up to 10 mm of gap caused by thermal deformation.

The use of fire protection collars ensures the load-bearing capacity of the dowels under the influence of fire. STRIFF® Shear Dowel with fire protection collar BSM has fire resistance of R120.

For proper fire resistance of STRIFF® with BSM fire protection collar, the adequate fire protection of the entire joint must be ensured. The achievable fire resistance classes and the required thickness of the sealant must be selected to avoid spreading fire through joint in accordance with the technical application recommendations (see *Table 11*).

2.2.3 Types and dimensions

The BSM fire protection collars are made for longitudinal movement of the dowels and the qBSM ones are made for longitudinal and transverse movement of the dowels. The dimensions of the fire protection panels for each collar type are shown in *Table 4*. The thicknesses (t), width (B) and height (H) of the fire protection collar must be observed when preparing the recesses of the joint material.

Figure 13. Fire protection collar BSM/qBSM.

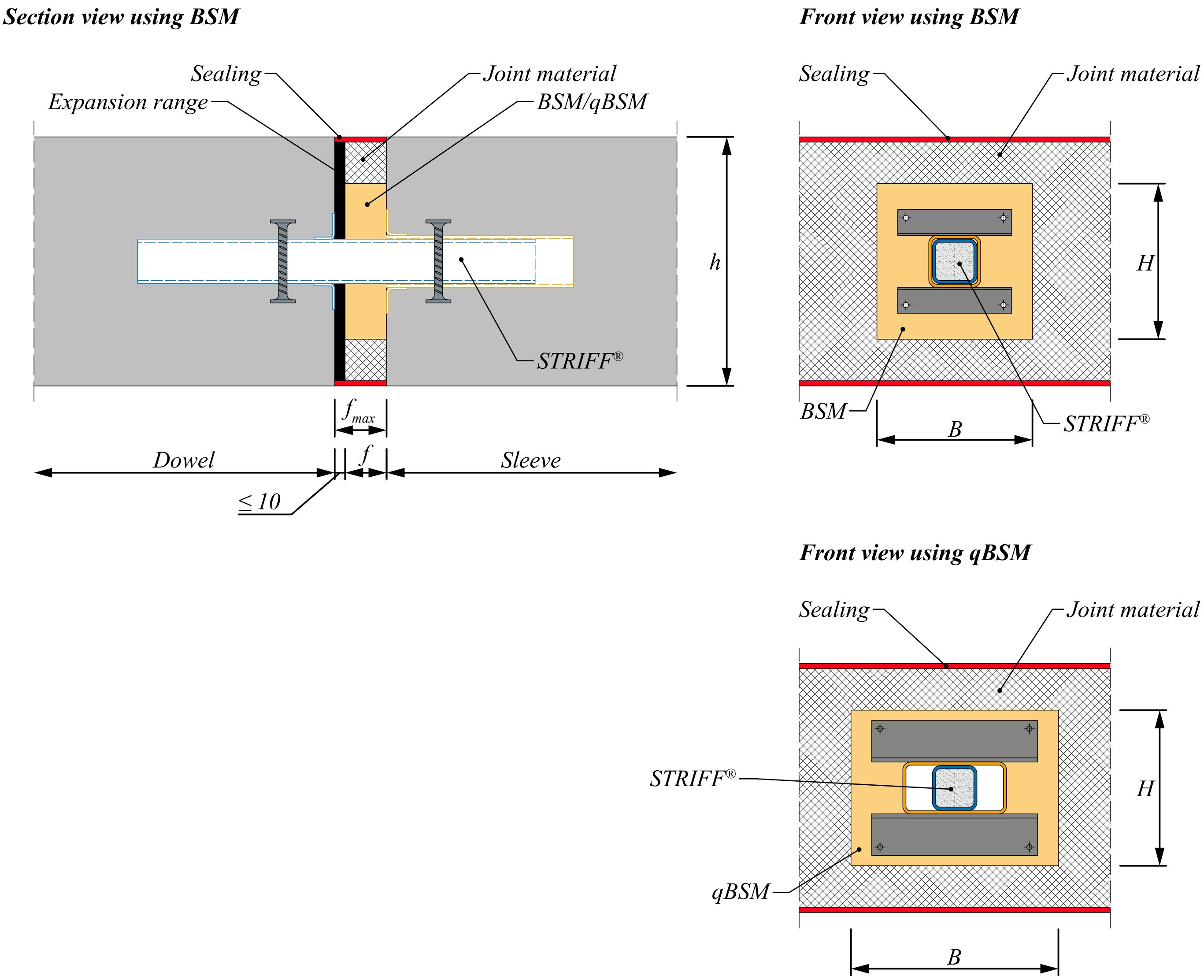


Table 11. Maximum joint width using fire protection collar.

Fire protection collar (BSM)		
f [mm]	BSM/qBSM	f_{max} [mm]
20	20	30
30	30	40
40	40	50
50	20 + 30	60
60	30 + 30	70
70	30 + 40	80
80	40 + 40	90

f = nominal value of the joint width
f_{max} = maximum joint width after expansion

Selecting of STRIFF® Shear Dowel

The following aspects must be considered when selecting an appropriate model of STRIFF® Shear Dowel to be used in a project:

- Load bearing capacity
- Properties of the wall/slab and the slab
- Width of the joint (thickness of the insulation)
- Concrete class
- Supported directions of movement (longitudinal/ longitudinal + transverse).

STRIFF® Shear Dowel is loaded with vertical loads only. In this case, the load bearing capacity of STRIFF® Shear Dowel is verified by:

$$V_{Ed} \leq V_{Rd}$$

where:

V_{Ed} is the design value of reaction during standard use [kN/dowel]

V_{Rd} is the design value of resistance read from *Table 5.* or *Table 7.* [kN/dowel]

Example

Input data

Design shear load for one dowel	V_{Ed} = 74.6 kN/dowel
Concrete class	C30/37
Thickness of the slab	h = 220 mm
Spacing between the dowels	a_z = 600 mm (range of 3.0 $h > a_z \geq$ 2.5 h)
Width of the joint	f = 50 mm (range of 40 < $f \leq$ 60)
Direction movement	longitudinal + transverse

Considering the thickness of the slab and all aspects based on the properties of the joint, STRIFF® 43 is suitable for this construction.

<table>
<tr><th colspan="12">Ultimate limit state resistances (ULS)</th></tr>
<tr><th rowspan="4">f [mm]</th><th rowspan="4">h [mm]</th><th colspan="10">V_{Rd} [kN/ dowel]</th></tr>
<tr><th colspan="2">$1.25\,h > a_z \geq 0.75\,h$</th><th colspan="2">$2.0\,h > a_z \geq 1.25\,h$</th><th colspan="2">$2.5\,h > a_z \geq 2.0\,h$</th><th colspan="2">$3.0\,h > a_z \geq 2.5\,h$</th><th colspan="2">$a_z \geq 3.0\,h$</th></tr>
<tr><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = k_{ser}$</th><th colspan="2">$k = 0.5\,k_{ser}$</th></tr>
<tr><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th><th>C25/30</th><th>C30/37</th></tr>
<tr><td rowspan="4">$f \leq 20$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td>92</td><td>98</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td>76</td><td>80</td><td>82</td><td>87</td><td>104</td><td>108</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td><td>84</td><td>89</td><td>90</td><td>96</td><td>115</td><td>123</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>81</td><td>87</td><td>92</td><td>98</td><td>99</td><td>106</td><td>119</td><td>128</td></tr>
<tr><td rowspan="4">$20 < f \leq 40$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td>92</td><td>98</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td>76</td><td>80</td><td>82</td><td>87</td><td rowspan="3">102</td><td rowspan="3">108</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td><td>84</td><td>89</td><td>90</td><td>96</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>81</td><td>87</td><td>92</td><td>98</td><td>99</td><td>106</td></tr>
<tr><td rowspan="4">$40 < f \leq 60$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td rowspan="4">88</td><td rowspan="4">93</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td>76</td><td>80</td><td>82</td><td>87</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td><td>84</td><td>89</td><td rowspan="2">88</td><td rowspan="2">93</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>81</td><td>87</td><td>88</td><td>93</td></tr>
<tr><td rowspan="4">$60 < f \leq 80$</td><td>200</td><td>54</td><td>58</td><td>60</td><td>63</td><td>68</td><td>72</td><td>73</td><td>77</td><td rowspan="4">77</td><td rowspan="4">80</td></tr>
<tr><td>220</td><td>61</td><td>65</td><td>67</td><td>71</td><td rowspan="3">76</td><td rowspan="3">80</td><td rowspan="3">77</td><td rowspan="3">80</td></tr>
<tr><td>240</td><td>67</td><td>72</td><td>74</td><td>79</td></tr>
<tr><td>≥ 260</td><td>74</td><td>79</td><td>77</td><td>80</td></tr>
</table>

SELECTING

Maximum design load for one dowel V_{Rd} = 87 kN/dowel

$$V_{Ed} \leq V_{Rd}$$

74.6 kN/dowel < 87 kN/dowel

Selected product parts

STRIFF® 43 Dowel **STRIFF® 43 qSleeve** **STRIFF® 43 qBSM 20 + qBSM 30**

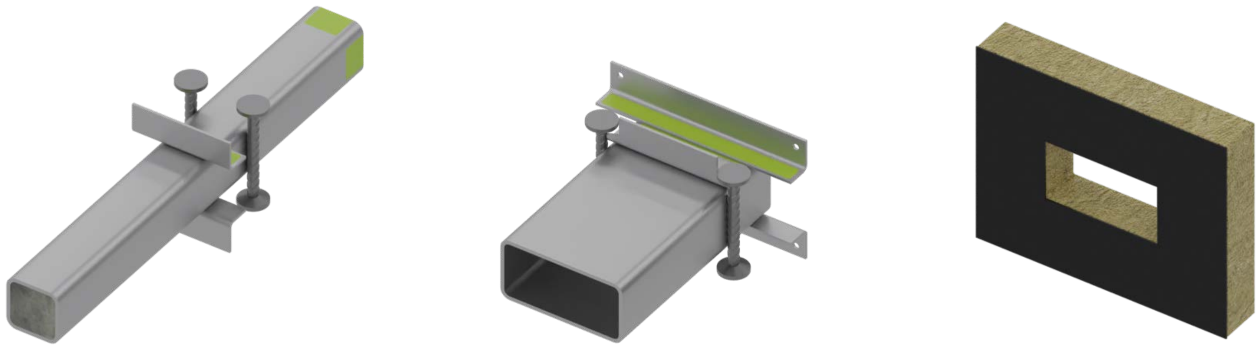
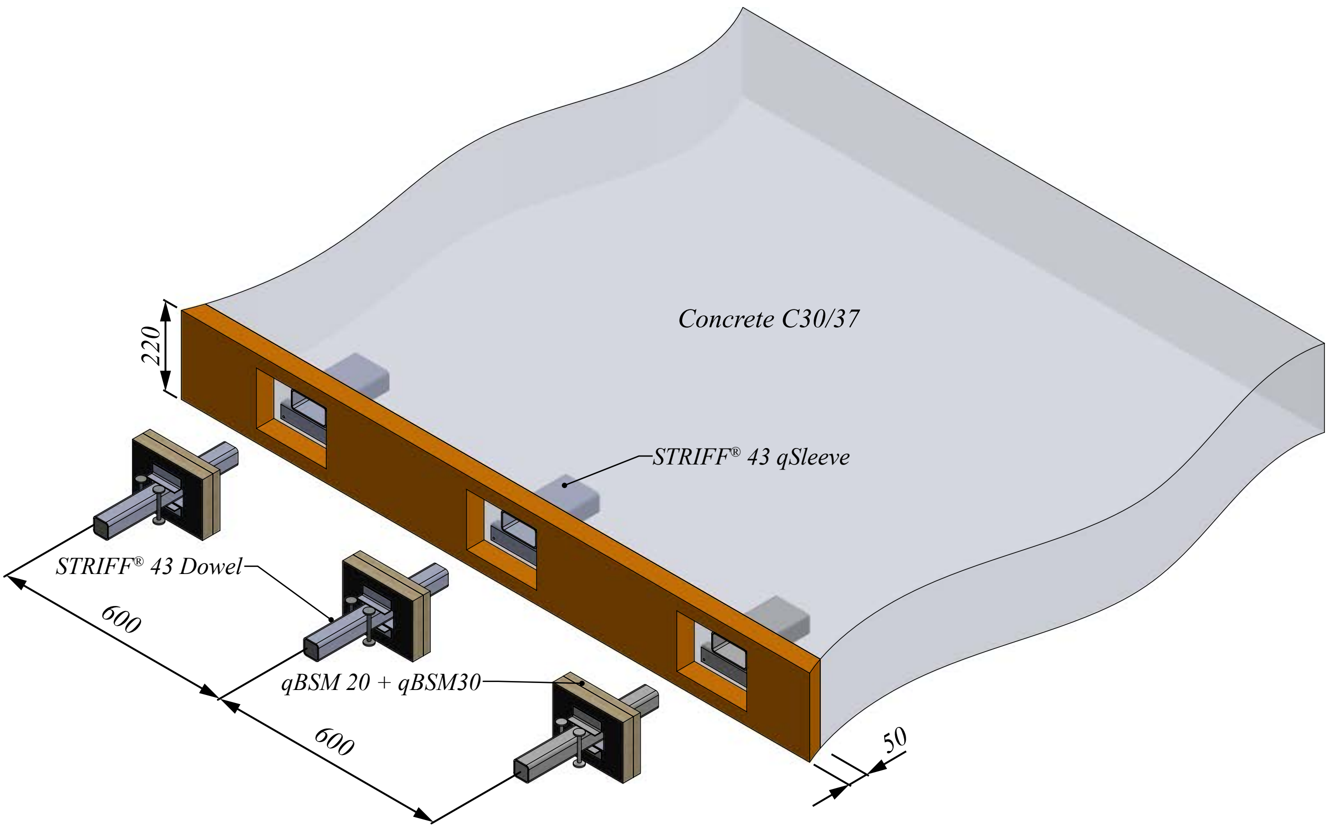


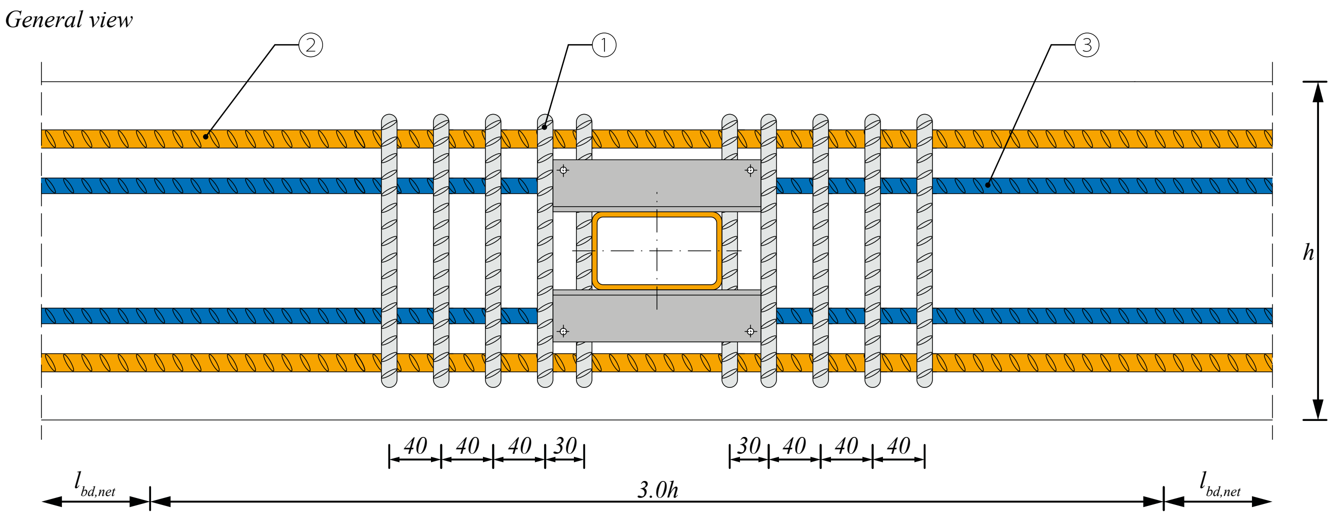
Figure 14. STRIFF® 43 selected parts.



Annex A – Additional reinforcement

The load transferring from the shear dowel into the reinforced concrete element must be ensured by additional reinforcement. The structural arrangement of supplementary reinforcement of STRIFF® Shear Dowel is shown below and should be considered. The additional reinforcement shown below (see *Figure 15*.) is a required minimum reinforcement for plate connections and must be inserted on each dowel and sleeve side.

Figure 15. Minimum required additional reinforcement for STRIFF® Shear Dowel.



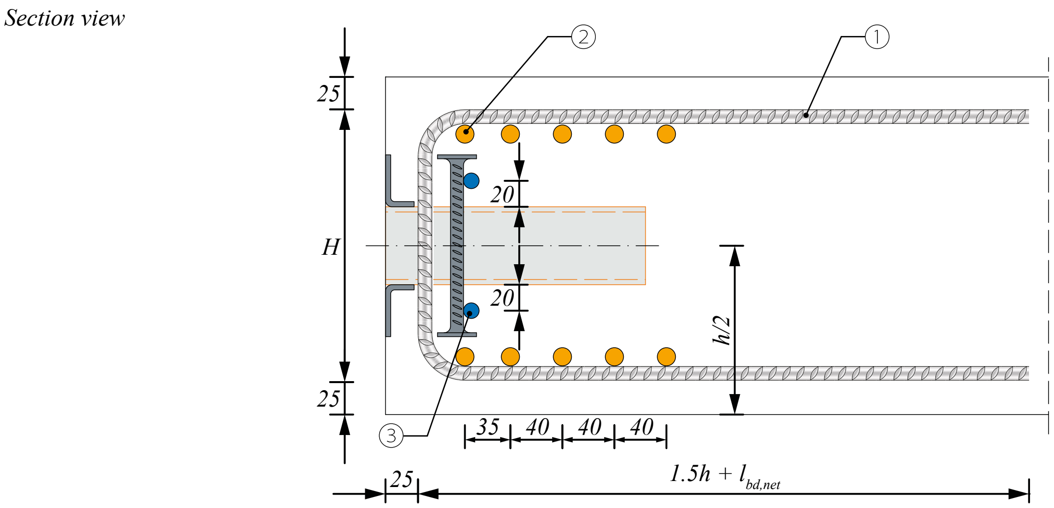


Table 12. Dimensions of additional reinforcement installed with the dowel.

Additional reinforcement on site made of steel B500B						
Position	Product	Pieces	Rebar Diameter	Name	$l_{bd,net}$ [mm]	Minimum length
1	STRIFF® 43 + 51	10	Ø12	U-stirrup	405	$1.5\ h + l_{bd,net}$
2	STRIFF® 43 + 51	10	Ø14	Rebar	500	$3.0\ h + 2\ l_{bd,net}$
3	STRIFF® 51 only	2	Ø12	Rebar	405	$3.0\ h + 2\ l_{bd,net}$

Please note that reinforcement No.3 (see *Figure 15*) is installed only with STRIFF® 51.

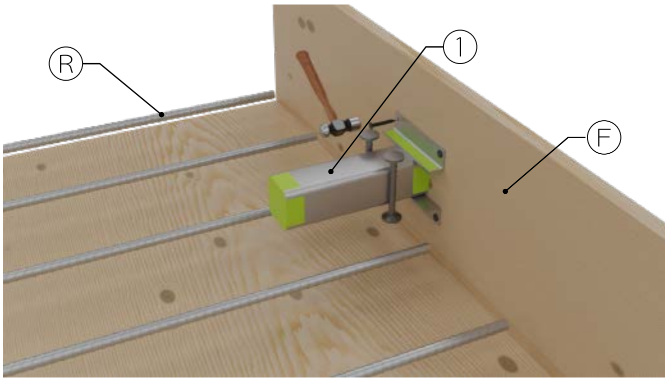
Notes for the additional reinforcements to be installed on site

- The first U-stirrup must be installed on each side between the double-headed studs and the front L profiles so that they are in contact with the sleeve or the dowel profile.
- When installing the stirrups, make sure that the first stirrup spacing is 30 mm. Further stirrup spacings are shown in *Figure 15*.
- The additional reinforcement described in this section should be applied in every case.
- In different installation cases not covered in this technical manual, the reinforcement must be specified by the designer.

Installing STRIFF® Shear Dowel

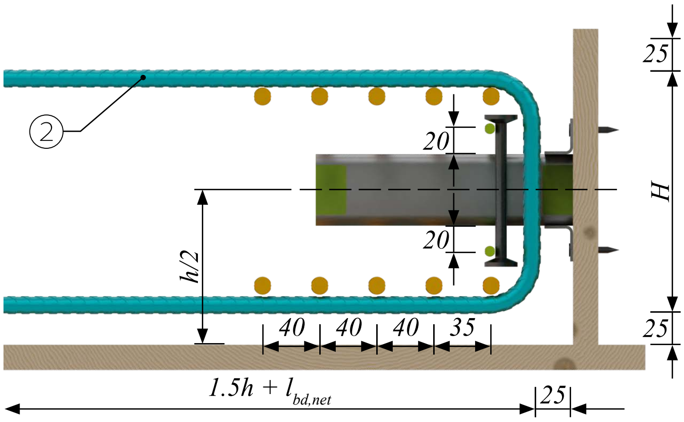
Step 1

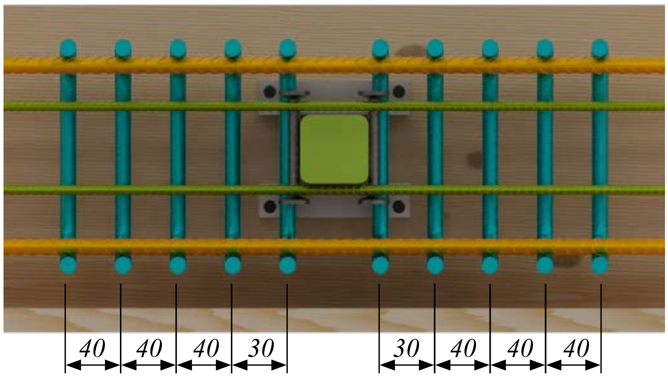
Fixing STRIFF® sleeve ① to the formwork Ⓕ with nails or screws after the main bottom reinforcement Ⓡ of the slab is installed. Make sure that the product labels are not damaged. The double-headed studs must be positioned parallel with the side edge of the cast element. **Please make sure the sleeve is installed perpendicularly and is not twisted.**



Step 2

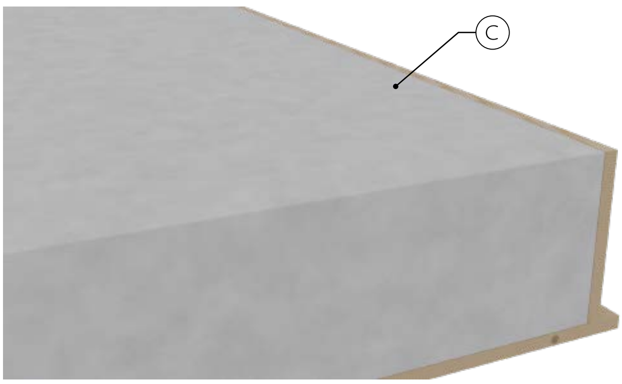
Installing aditional reinforcement ② with concrete cover stated according to EN 1992-1-1 and specified spacing between the rebars.





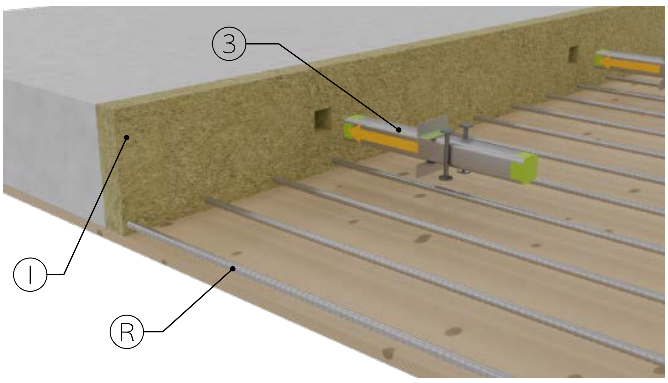
Step 3

Concreting Ⓒ first construction stage.

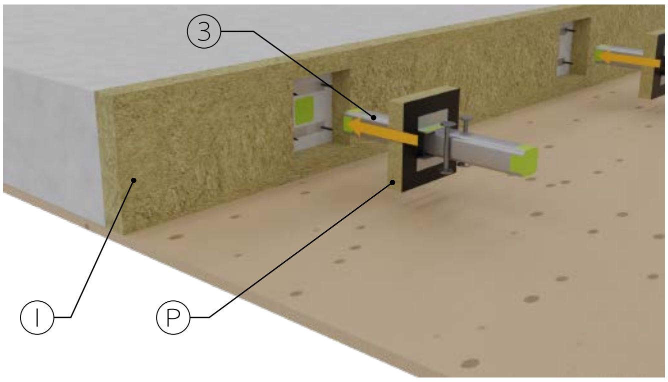


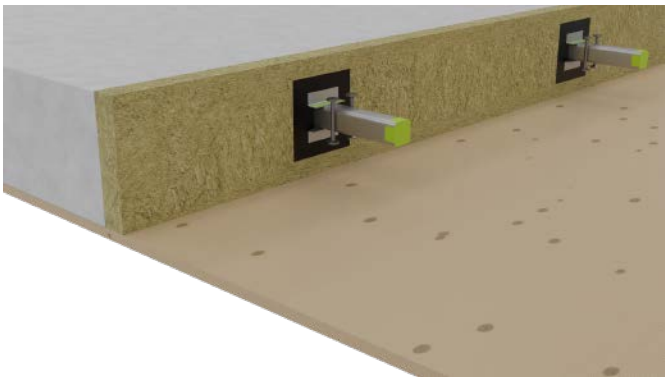
Step 4

Installation of the joint material and the dowel – the joint material Ⓘ must be prepared with recesses for the dowels and, if necessary, for the fire protection collars. The dowels ③ are inserted through the joint material into the sleeve up to the stop after the main bottom reinforcement of the element is installed. The front sleeve labels must first be punctured in the middle. **Please make sure the dowel is installed perpendicularly and is not twisted.**



While using fire protection collar Ⓟ placing the joint material Ⓘ with cut-out recesses for the pre-attached fire protection collars. The arrangement and type of the BSM must be selected based on the joint width according to *Table 4*.



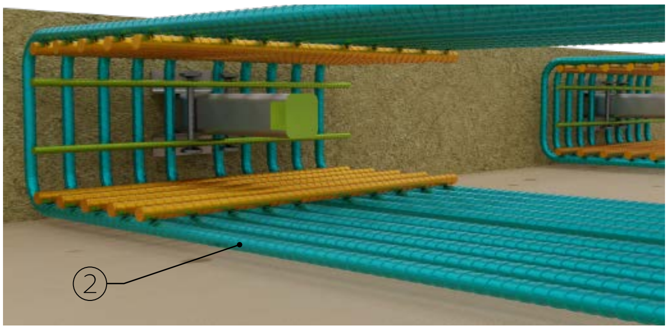


Attention! Fire protection collar BSM must be attached to the dowel and the dowel must be pushed into the sleeve up to the stop.

Optionally – Sealing of the joint with fire protection sealant on the upper and lower sides of the joint. When selecting the height of the joint material, the required thickness of the sealant should be considered.

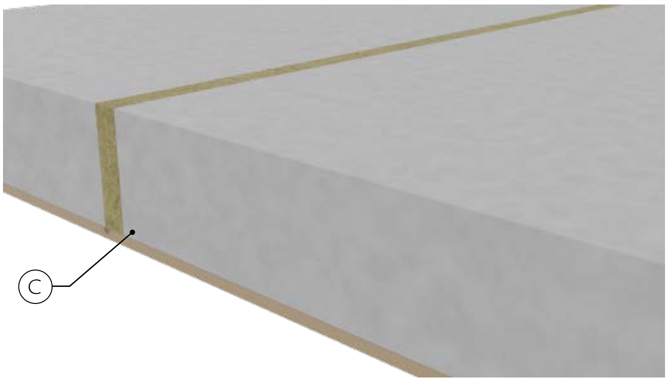
Step 5

Installation of additional reinforcement ② on dowel side according to requirements in Section 4 Annex A - Additional reinforcement.



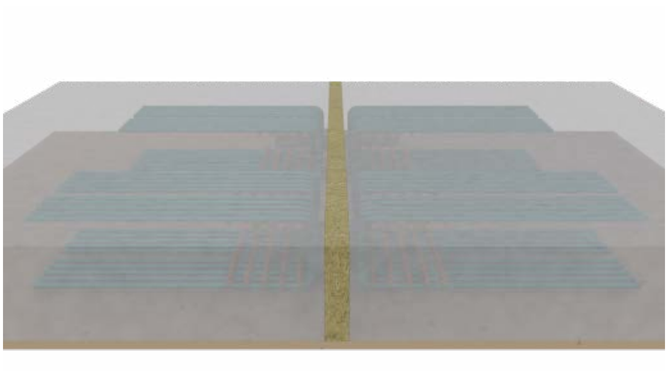
Step 6

Concreting Ⓒ second stage



Step 7

Built-in shear dowel. Depending on the specified fire resistance class of the component, a fire protective technical sealing of the joint could be required.



Notes for the construction site

The elements must be handled with care during unloading and storage on site. Damaged elements must not be installed. The installation direction must be observed when installing the elements (according to the product labels). The elements must not be cut or shortened, and no product components must be removed. The correct installation of the element must be checked by the responsible engineer as part of the reinforcement inspection. Further information and notes in Section 4 Annex A - Additional reinforcement and Section 2.1 Thermal resistance.

Revisions

Version: PEIKKO GROUP 11/2021. Revision: 002

- Added two dowel spacing groups $1.25\ h > a_z \geq 0.75\ h$ and $2.0\ h > a_z \geq 1.5\ h$ with resistances.
- Updates to Tables 1, 5 and 7.

Version: PEIKKO GROUP 06/2020. 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.

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EPDS AND MANAGEMENT SYSTEM CERTIFICATES

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

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