Invisible connections™

Planning MEMO 52

Capacities and main dimensions RVK 41/RVK 101

The main components of the RVK-unit are two hollow rectangular steel tubes, where the smallest tube is sliding within the other, and is accessible from the surface of the concrete. The RVK-units are in particular designed to connect precast stairs and landings to the walls in the shafts. The units are embedded in the precast stair or landing, and all that is required in the wall is a recess.

During erection the inner tube is retracted into the unit, to be pushed out into the recess when the precast element is in the correct position. A rubber pad at the support in the wall is important in order to reduce the impact sound transfer from the stairs to the walls.

The capacity of the steel unit itself only depend upon the position of the global loading, and the anchoring reinforcement, as the anchoring stirrups serve as internal supports for the steel unit. The assumed conditions for the equilibrium and corresponding steel capacity are given in memo 54a and 54b.

The concrete elements capacity due to local punching shear may in some situations limit the applicable utilization of the steel unit. The punching shear capacity does not only depend on the capacity of the stirrups anchoring the unit, but also the reinforcement pattern in the vicinity of the unit. Important parameters are the units distance to the edge, as well as the thickness of the element. When the unit is located close to the corner, the reinforcement layout of the whole corner will influence on the local punching shear capacity. Detailing of the reinforcement will be of major importance when the concrete is governing the capacity. As the manufactures may have various solutions with respect to reinforcement layout, the final design of the elements and evaluation of punching shear capacity should be carried out under the supervision of structural engineer with knowledge about the behaviour of reinforced concrete.

The different recommended reinforcement patterns given in Memos 55a and 55b are in accordance with the reinforcement patterns in precast elements subjected to tests at Sintef, Norway in 2011. Only the local reinforcement in the vicinity of the unit is illustrated in the Memos. The recommended load reductions, due to concrete failure, as given in Figure 2 and Figure 3, are established based on results from the tests. Minimum requirements to location and slab thickness can be found in Table 5 and Table 10. The minimum concrete grade to make use of the test results are C35/45.

Based on the test results, the RVK 41 units may be fully utilized when the slab thickness is above 150mm, and the edge distance is above 240mm, see Figure 2. At slab thicknesses less than t=200mm, and corner distances between 160mm to 240mm, reduced ultimate limit load is recommended if not shear reinforcement is introduced.

The RVK 101 units require a slab thickness of 265mm to be fully utilized with the standard reinforcement pattern. Reduced ultimate limit load is recommended when the slab thickness is less than 265mm, see Figure 3. When the RVK 101 units is used in thinner slabs than 265mm, and located closer to the corner than 300mm, shear reinforcement may be used to increase the concrete capacity.

SB PRODUKSJON AS

Planning
MEMO 52

Capacities and main dimensions RVK 41/RVK 101

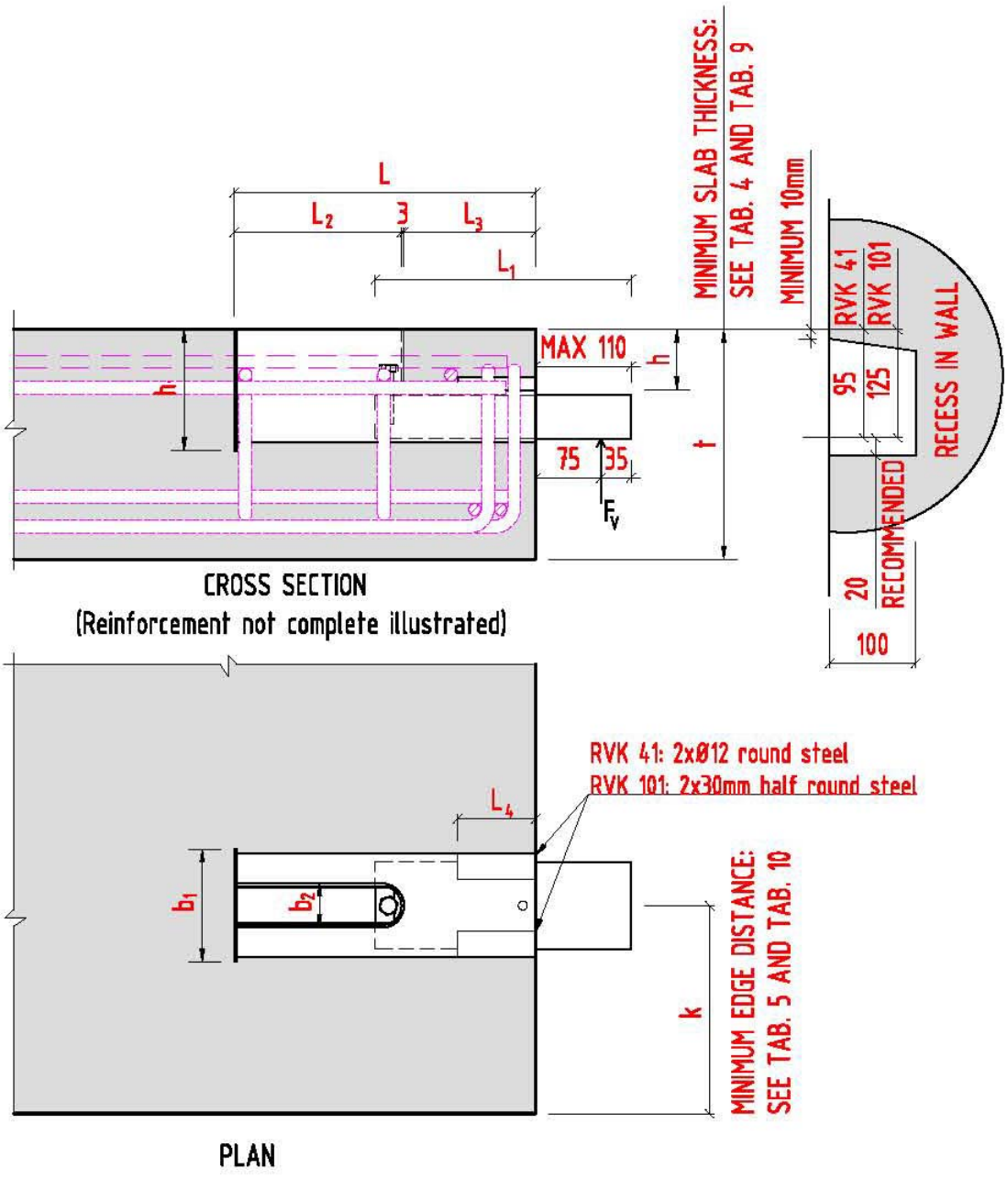

Figure 1: RVK dimensions.

Invisible connections™

Planning MEMO 52

Capacities and main dimensions RVK 41/RVK 101

RVK 41

Unit	Outer tube b/h/t	Inner tube b/h/t	Clearances between tubes	
			Vertically	Horizontally
mm	80/50/4	70/40/4	2	2

Table 1: Tube dimensions.

Unit	L	L_1	L_2	L_3	L_4	h	h_1	b_1	b_2
mm	298	275	163	132	80	50	110	90	36
in	11.7	10.8	6.5	5.2	3.2	2.0	4.3	3.5	1.4

Table 2: Dimensions.

Unit	Vertical load F_V
kN	40
kips	9

Table 3 Maximum capacity of the steel unit.

Unit	Minimum slab thickness - due to available space (t)
mm	150
in	5.9

Table 4: Minimum slab thickness – due to available space.

Unit	Slab thickness (t)	Minimum edge distance[1)] (k)
mm	150	160
in	5.9	6.3
[1)] Special requirements to the reinforcement pattern in the corner, see Memo 55a		

Table 5: Recommended minimum slab thickness to take advantage of the steel unit capacity, see Figure 1 and Figure 2.

SB PRODUKSJON AS

Invisible connections™

Planning MEMO 52

Capacities and main dimensions RVK 41/RVK 101

RVK 101

Unit	Outer tube b/h/t	Inner tube b/h/t	Clearances between tubes	
			Vertically	Horizontally
mm	120/60/4	100/50/6	2	12

Table 6: Tube dimensions.

Unit	L	L_1	L_2	L_3	L_4	h	h_1	b_1	b_2
mm	348	295	193	152	90	70	140	130	51
in	13.7	11.6	7.5	6.0	3.5	2.8	5.5	5.1	2.0

Table 7: Dimensions.

Unit	Vertical load F_V
kN	100
kips	22

Table 8 Maximum capacity of the steel unit.

Unit	Minimum slab thickness - due to available space (t)
mm	200
in	7.9

Table 9: Minimum slab thickness – due to available space.

Unit	Slab thickness (t)	Minimum edge distance[1)] (k)
mm	265	180
in	10.4	7.1
[1)] Special requirements to the reinforcement pattern in the corner, see Memo 55b		

Table 10: Recommended minimum slab thickness to take advantage of the steel unit capacity, see Figure 1 and Figure 3.

SB PRODUKSJON AS

Capacities and main dimensions RVK 41/RVK 101

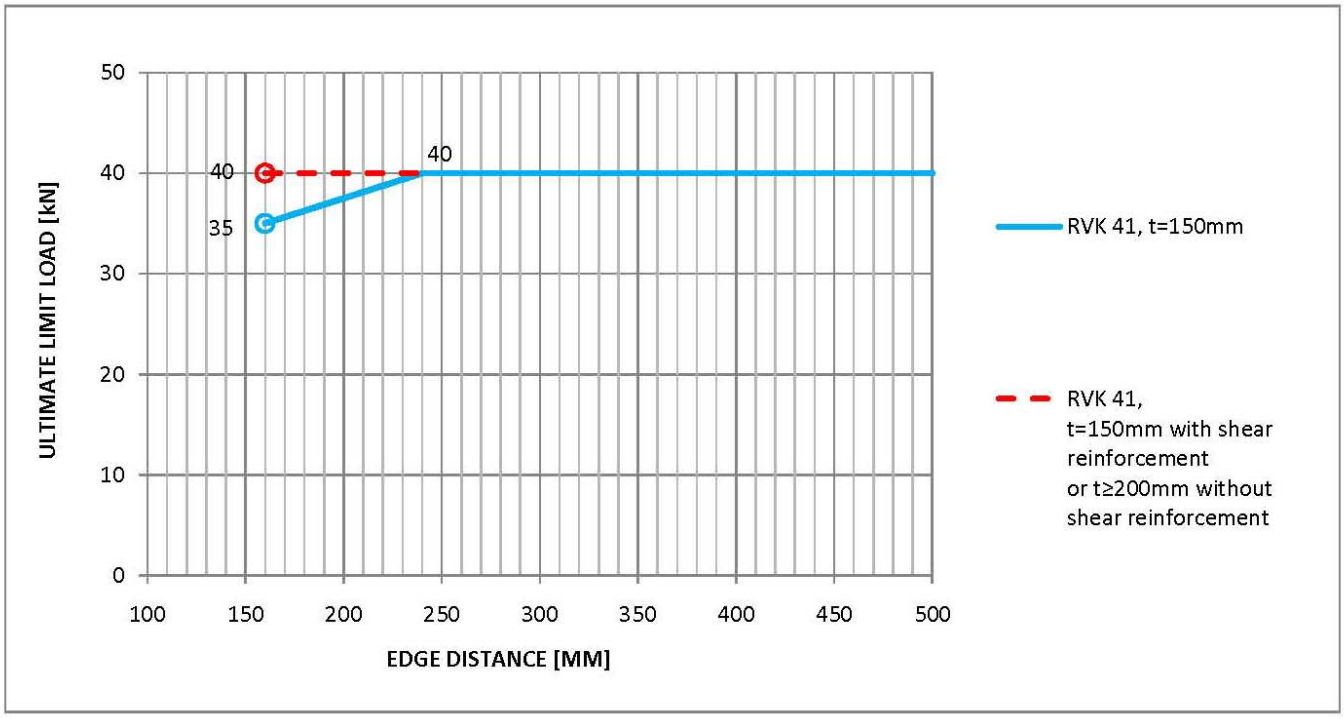

Figure 2: Recommended ultimate limit load when using RVK 41 with slab thicknesses t≥150mm.

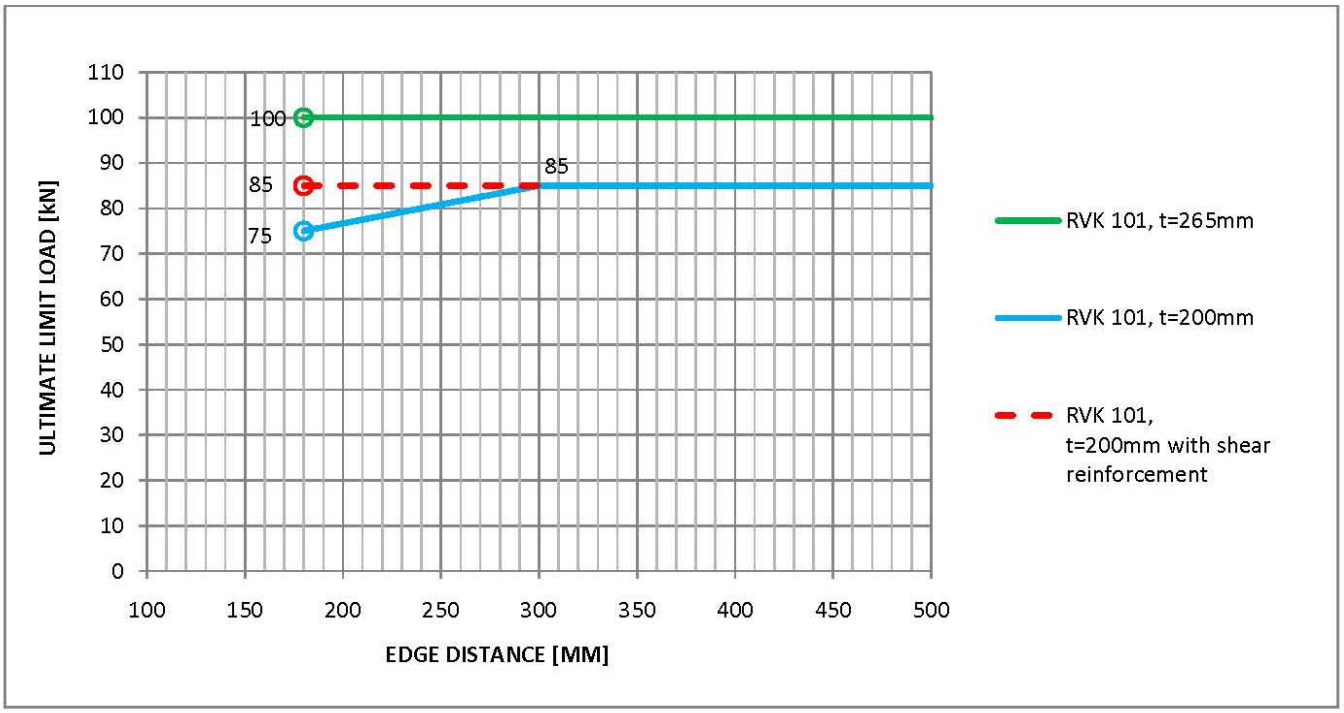

Figure 3: Recommended ultimate limit load when using RVK 101 with slab thicknesses t=200mm-265mm.