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# Planning MEMO 53

# Capacities and main dimensions TSS 41/TSS 101

The TSS-unit is the same as the RVK-units, but without the access slot from the surface of the concrete. The smallest tube is sliding within the other, and is pulled out with a white string attached to the inner tube. If the need to retract the inner tube should arise, this can be done by means of a blue string. The TSS units are designed especially to be used to connect precast stairs and landings to the walls in the shafts, where the final surface finishes of the elements are provided in the factory.

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 pulled out into the recess when the precast element is in the correct position. A safety stop will prevent the inner tube from excess protrusion.

The capacity of the steel unit itself depends only on 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 54c and 54d.

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 55c and 55d 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 TSS 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 TSS 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 TSS 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.

## Capacities and main dimensions TSS 41/TSS 101

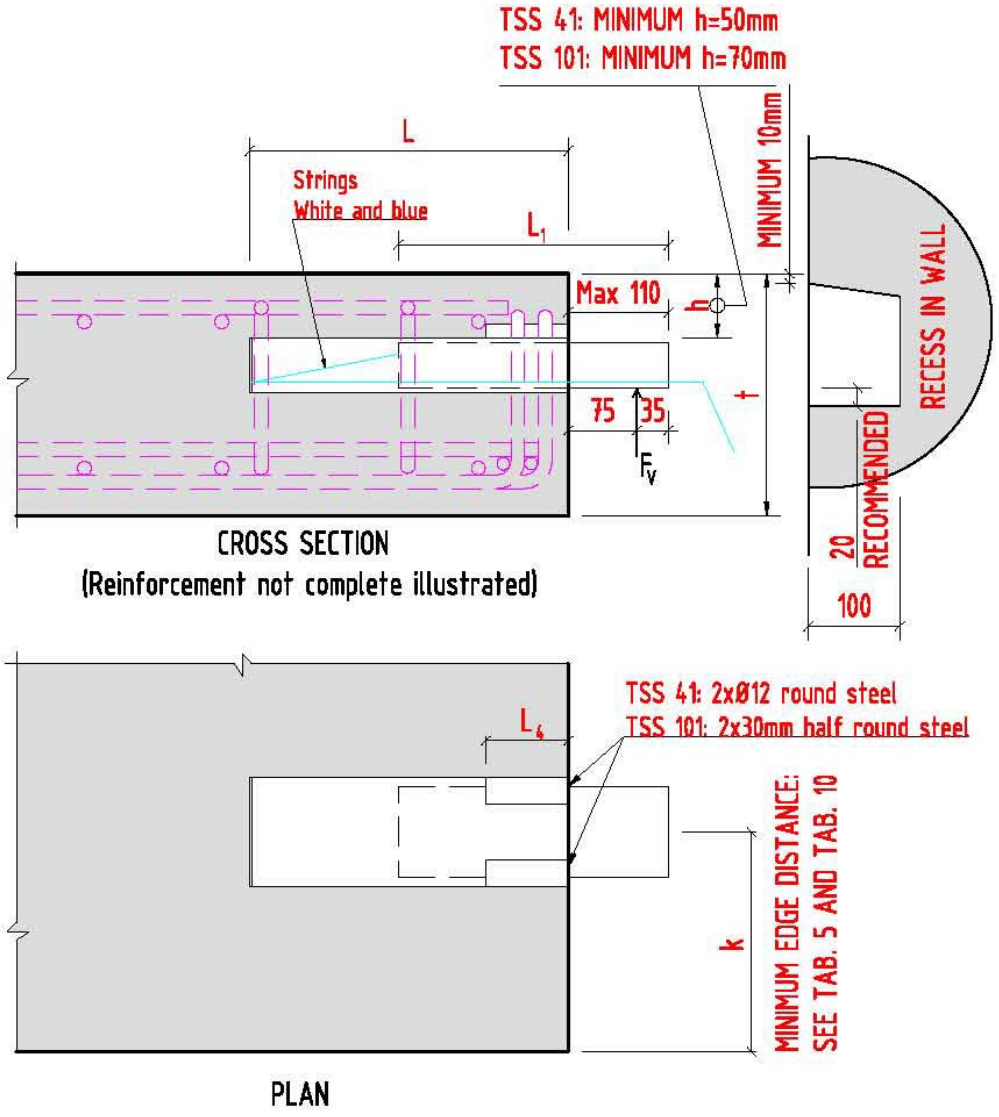


**Figure 1: TSS dimensions.**

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# Capacities and main dimensions TSS 41/TSS 101

## TSS 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 | $L_1$ | $L_4$ |
|---|---|---|---|
| mm | 320 | 275 | 80 |
| in | 12.6 | 10.8 | 3.2 |

**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 55c | | |

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



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# Capacities and main dimensions TSS 41/TSS 101

## TSS 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 | $L_1$ | $L_4$ |
|---|---|---|---|
| mm | 345 | 295 | 90 |
| in | 13.6 | 11.6 | 3.5 |

**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 55d | | |

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

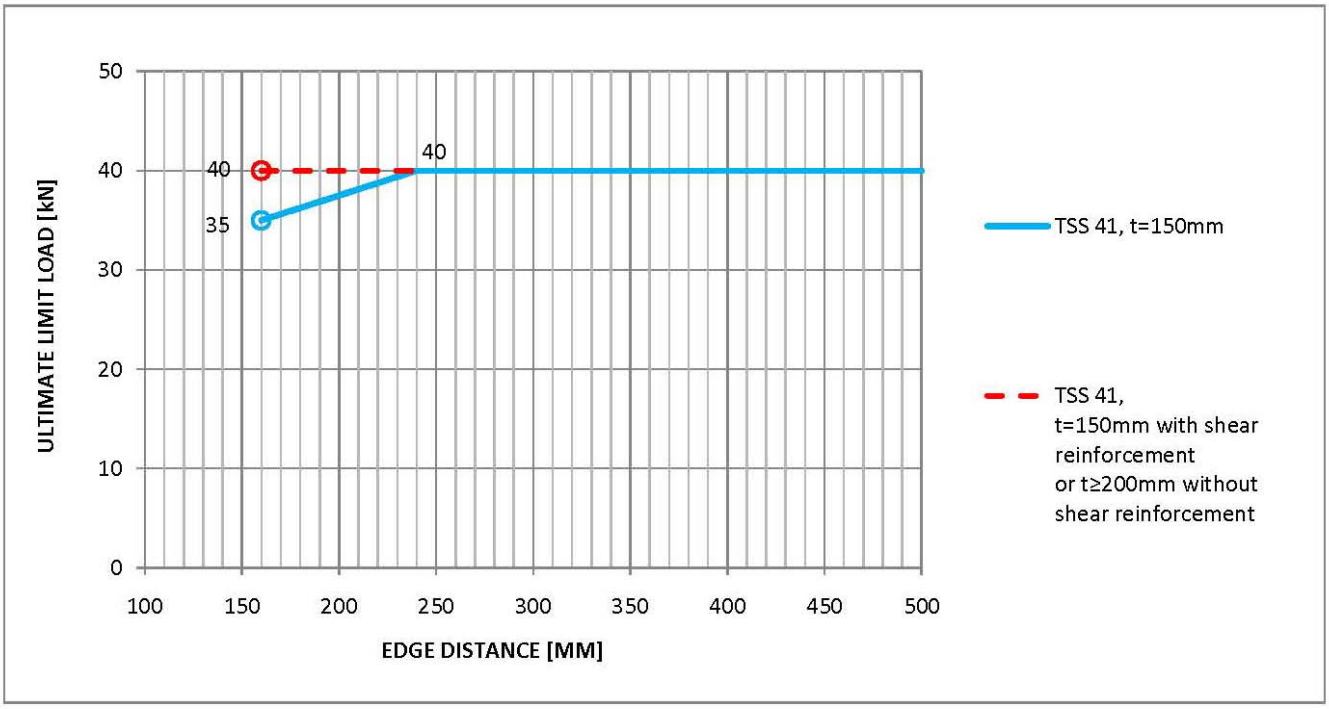


**Figure 2: Recommended ultimate limit load when using TSS 41 with slab thicknesses t≥150mm.**

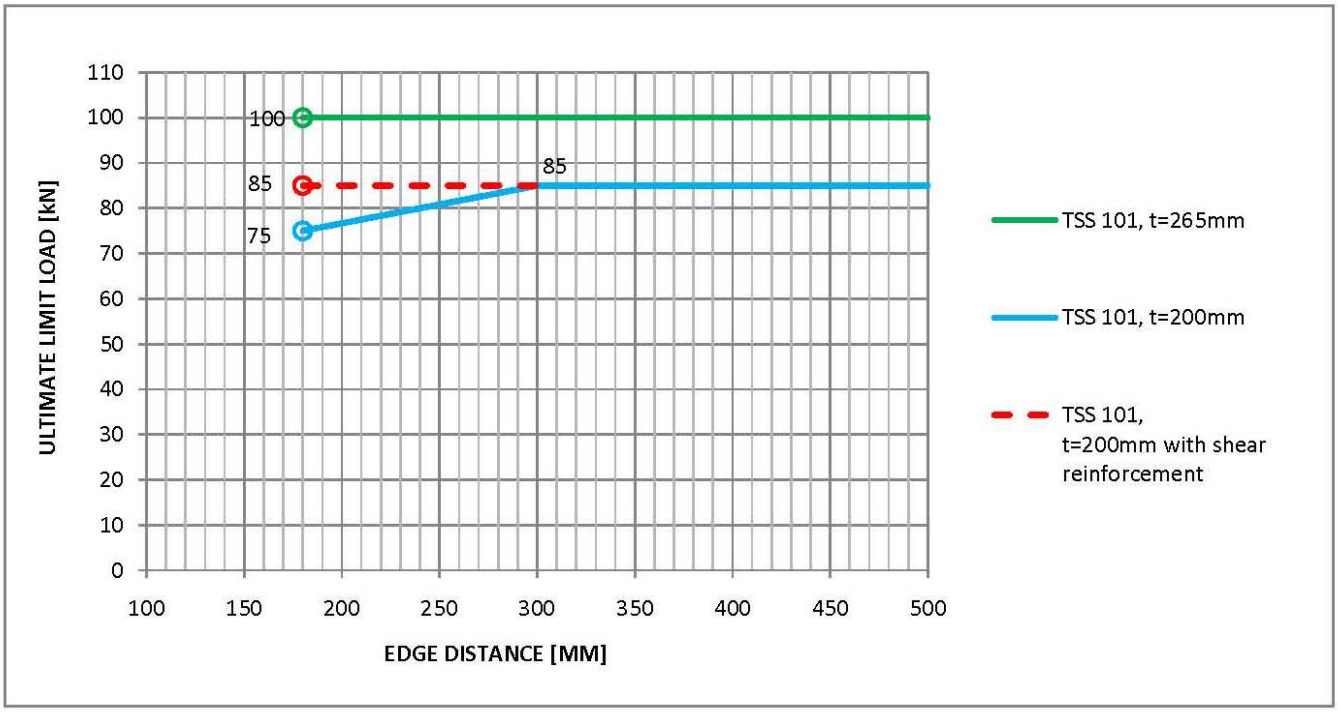


**Figure 3: Recommended ultimate limit load when using TSS 101 with slab thicknesses t=200mm-265mm.**