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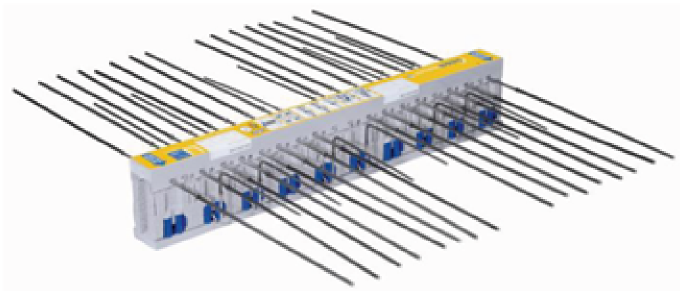

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Contact:
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Report 121212SCH

Thermal Performance of Concrete Balcony Connections using Different Connection Methods

Client

Schock Ltd.

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1. Objective

The aim of this investigation was to determine the heat loss, minimum surface temperature and hence temperature factor (f_{RSi}) resulting from use of Schock Isokorb Type K units connecting a concrete balcony to a floor slab and to compare these values with the use of no connectors (floor slab projecting straight through wall). Calculation was by means of three-dimensional finite difference analysis using SOLIDO software from Physibel.

2. Description

Two situations were modelled:

- Case 1. Wall construction with balcony slab formed by projecting concrete floor slab through wall with balcony door (Figure 1)
- Case 2. Same wall construction with Schock Isokorb Type K50 isolating balcony slab from floor slab with balcony door (Figure 2)

The Isokorb Type K units offer high thermal resistance by using a combination of a moulded thermal break of Neopor, incorporating plastic sleeves with high density pairs of high-strength concrete thrust-force bearings and an arrangement of stainless steel straight and bent bars to act as tension and shear reinforcement.

The three-dimensional models were constructed using an triangulated grid approximation, for example Figure 4.

3. Calculations

SOLIDO software from Physibel was used to construct three dimensional models of the applications described above in accordance with BS EN ISO 10211:1 (1996) [(1)]. Half a unit was modelled about its axis of symmetry. Steady state solution was by means of the iterative finite difference method.

Table 1. Thermal conductivities

Material	Thermal conductivity (W/mK)
Steel	
Concrete slab	2.100
Masonry	1.100
Wall insulation	0.040
Plaster	0.700
Floor screed	1.400
Bearing concrete	0.830
F90 Material	0.143
Stainless steel	15.000
Polystyrene foam (Neopor)	0.031
Door panel	0.18
Door frame	1.00

Boundary conditions

In the UK, surface resistances (R_s) are set in accordance with BS6946 [(2)] to determine U-values, thermal bridging heat loss, minimum surface temperature (and hence temperature factor). For walls:

Inside: t_{ai} = 20°C R_{si} = 0.13m^{2}K/W
Outside: t_{ae} = 0°C R_{so} = 0.04m^{2}K/W

In Germany, the surface resistances are set by DIN 4108-2 [(3)], which calls for different values to be used for determining minimum internal surface temperatures and hence temperature factor:

Inside: R_{si} = 0.25m^{2}K/W
Outside: R_{so} = 0.04m^{2}K/W

The UK result is presented in this report. See figures 4 and 5 for 3D views of the SOLIDO model.

4. Results and conclusions

Table 2 presents the temperature factor, surplus thermal transmittance and equivalent thermal transmittance for the case without an Isokorb unit installed, and for a Type K50.

In the UK, the temperature factor (f_{RSi}) is used to indicate condensation and mould risk as described in BRE IP1/06 [(4)], a document cited in Building Regulations Approved Documents Part L1[(5)] and L2 [(6)]. For dwellings, residential buildings and schools, f_{RSI} must be greater than or equal to 0.75, and for commercial buildings it should be greater than or equal to 0.5, calculated using an internal surface resistance of 0.13m^{2}K/W.

It can be seen from the results that the Schock Isokorb Type K50 unit, with f_{RSi} = 0.912 exceeds these values and will therefore meet the requirements of Building Regulations Approved Documents L1 and L2. The results for the case with no unit (f_{RSi} =0.725) is a failure for dwellings.

Temperature distributions are shown in Figures 6 and 7.

References

1) BS EN ISO 10211-1:1996, Thermal Bridges in Building Construction – Heat flows and Surface Temperatures, General Calculation Methods BSI, 1996

2) BS6946:1997, Building Components and Building Elements – Thermal Resistance and Thermal Transmittance – Calculation method, BSI 1997

3) DIN4108-2:2003-07: Warmeschutz und Energie-Einsparung in Gebauden – Teil 2: Mindestanforderungen an den Warmeschutz. Beuth Verlag, Berlin

4) Ward T, Assessing the effects of thermal bridging at junctions and around openings, BRE IP1/06, Building Research Establishment 2006

5) Building Regulations Part L, Conservation of Fuel and Power, Approved Document L1, Conservation of Power in New Dwellings, April 2006

6) Building Regulations Part L, Conservation of Fuel and Power, Approved Document L2, Conservation of Power in New Buildings other than Dwellings, April 2006

Table 2. Results

	Without Isokorb	With Isokorb K50
Temperature factor (based on wall surface)	*0.725* [2]	*0.912* [1]
Linear thermal transmission Ψ (W/mK)	*1.230*	*0.714*

[1] This detail conforms to the UK Building Regulations Part L requirements for minimum temperature factor in dwellings (f_{RSi}=0.75)

[2] This detail does NOT conform to the UK Building Regulations Part L requirements for minimum temperature factor in dwellings (f_{RSi}=0.75)

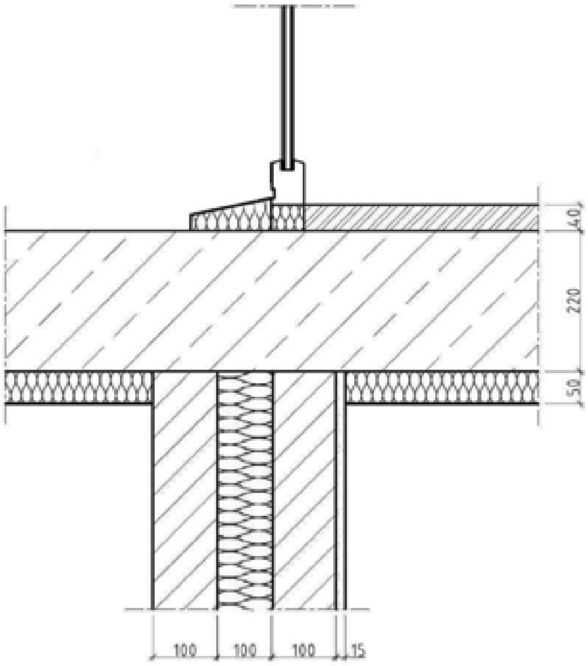

Figure 1. Wall construction with balcony slab through

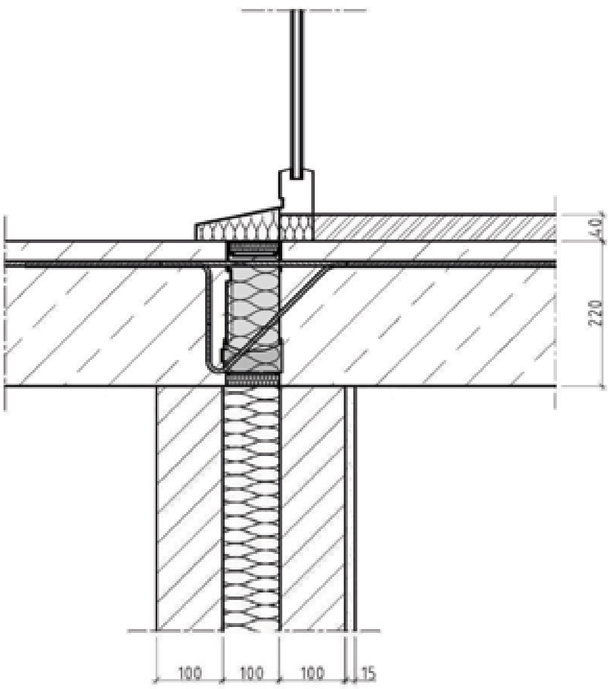

Figure 2. Schock K50 installed in construction

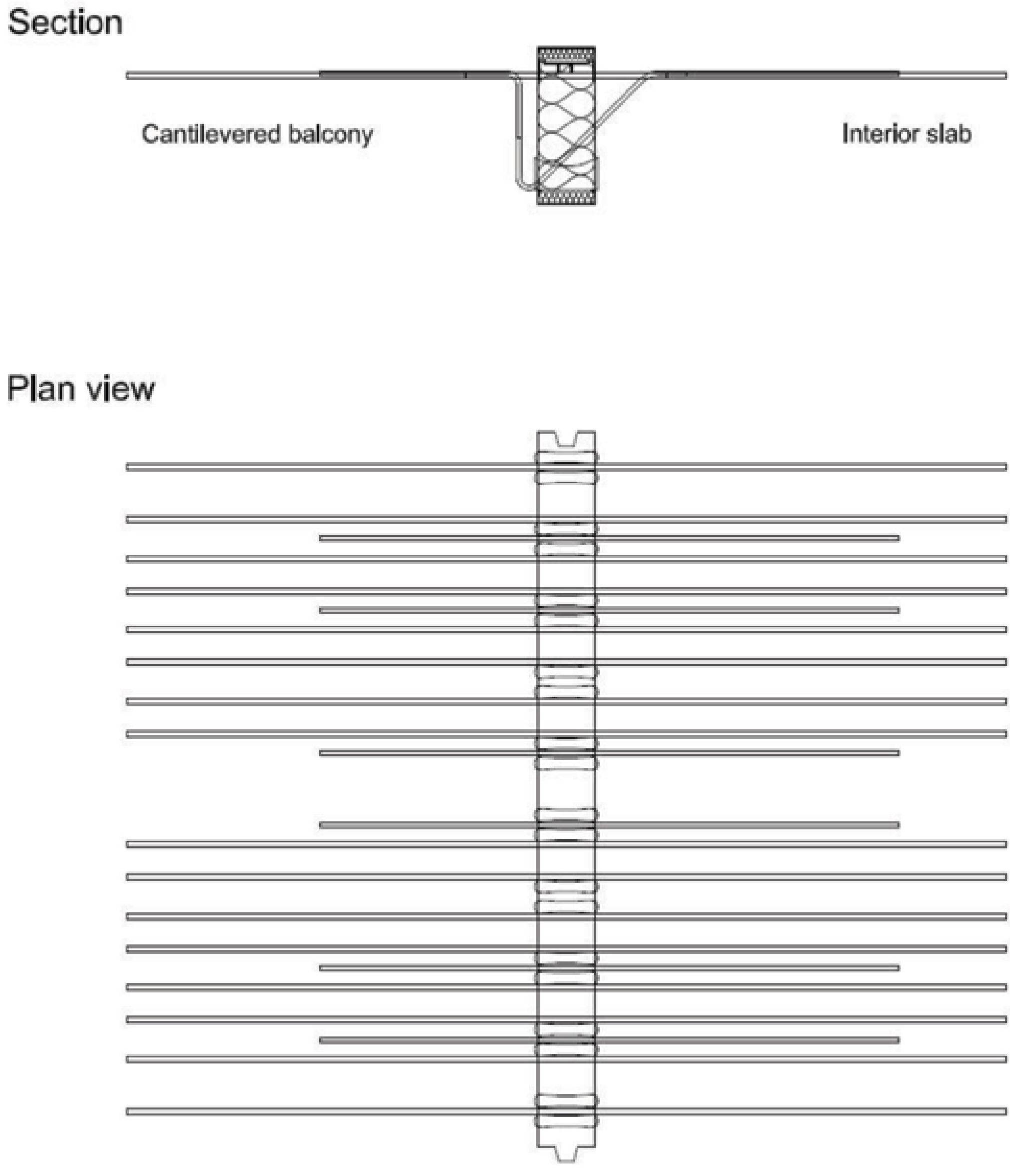

Figure 3. Section and plan view of Schock Type K unit

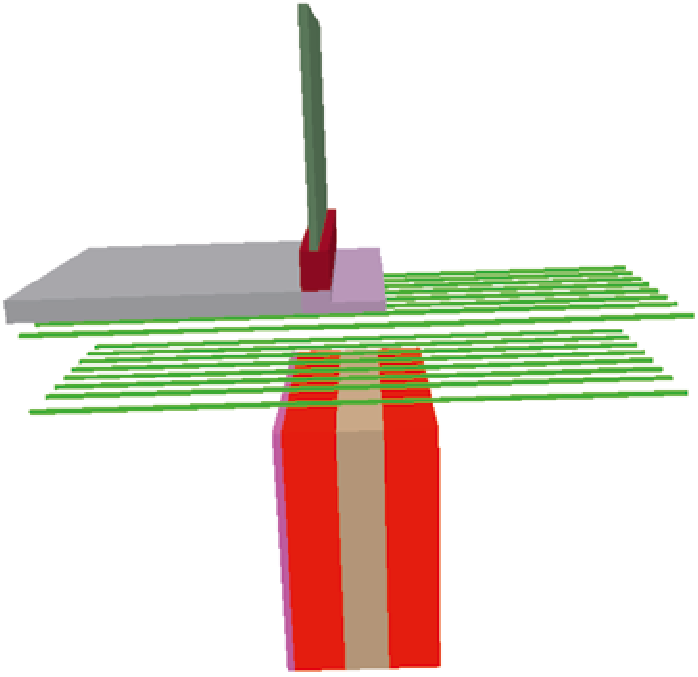

Figure 4. TRISCO model of balcony (no Isokorb)

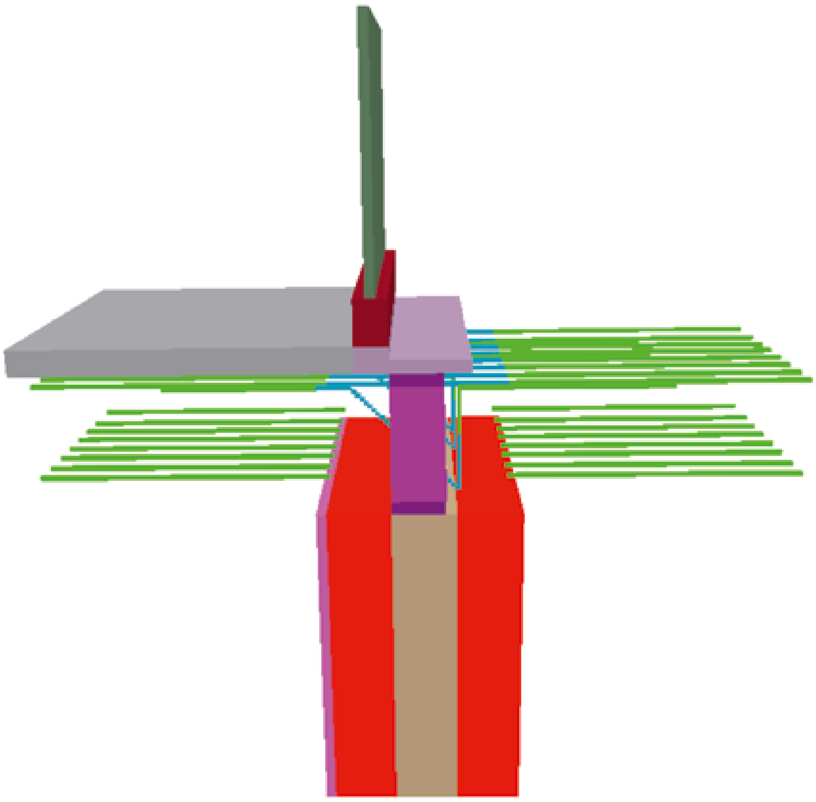

Figure 5. TRISCO model of Schock Isokorb Type K50: internal components (concrete and insulation omitted for clarity)

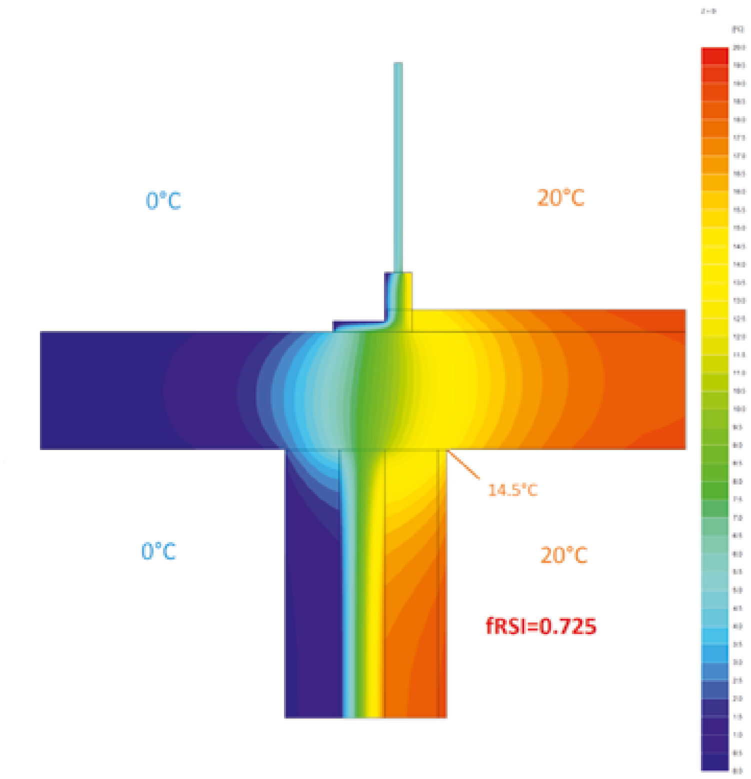

Figure 6. Wall construction without units: Temperature distribution (section)
This detail does NOT conform to UK Building Regulations Part L requirements for minimum temperature factor in dwellings (f_{Rsi} = 0.75)

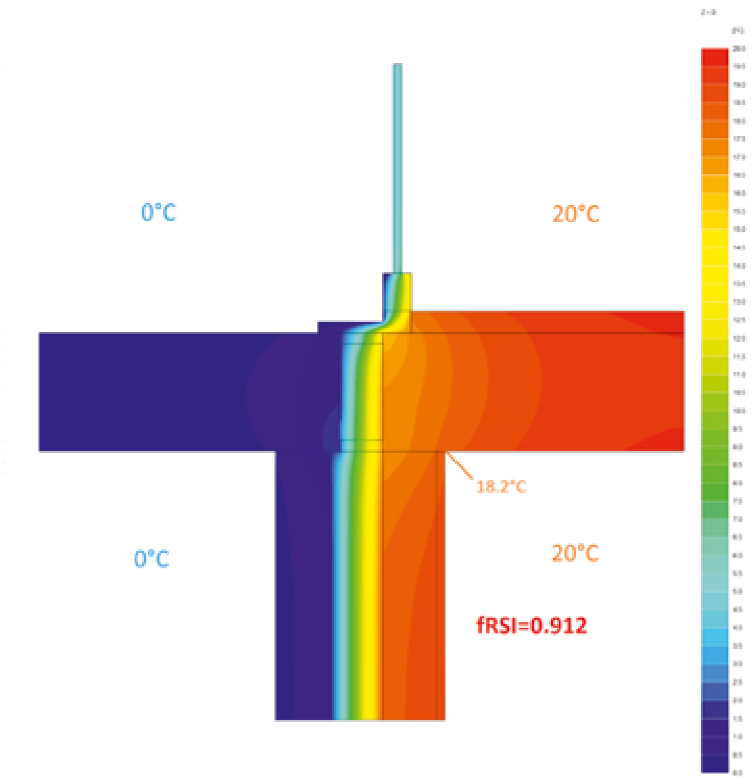

Figure 7. Schock Isokorb Type K50 Temperature distribution (section)
This detail **conforms** to UK Building Regulations Part L requirements for minimum temperature factor in dwellings (f_{Rsi} = 0.75)