CALCULATION OF LOADS FOR SINUS PROFILE

The use of dowels is a development of the evolution of Dewmark profiles used as expansion joints. Due to the quick-detachable casings, adjacent to the dowel body, and the increase in the contact area of the dowel and concrete, it was possible to increase the load-bearing capacity of the floor.

The dowels carry and transfer the load between two adjacent sections of the concrete floor, that is, the equipment with the "P" load moves along the finished floor without causing stress in the concrete slab.

A concrete slab usually has only about 50% of its bearing capacity at the edges, so the dowels support the slab at the edges and help to support and transfer weight from one slab to another, allowing the slabs to flex slightly, gently transferring the load along its surface.

The calculation of the bearing capacity of the dowels is given in the British methodological guidelines **TR34, version 4, clause 6.5 and Appendix D**.

Standard dowels are made of steel S355 with yield strength $\sigma_{0.2}$=355 MPa and have the following dimensions:

Таб. cl.1

Type	Width, W (mm)	Length, L (мм)	Thick, T (мм)	Spacing, c/c (мм)	Casing color
60/SinOP-5	150	120	5	600	Green
60/SinOP-6	150	130	6	600	Blue
60/SinOP-8	150	130	8	600	Orange
60/SinOP-10	150	140	10	600	Red

Destructive forces acting on the dowel:

Bending (Pmax plate) and shear (Psh plate) single dowel for concrete C32/40
According to TR34 ver.4 point 6.5

Таб. cl.2

Dowel type	Joint opening, mm	Shear force, $P_{sh\ plate}$, кН	Bending force $P_{max\ plate}$, кН
60/SinOP-5	10	150,03	48,07
	15		37,58
	20		30,44
60/SinOP-6	10	180,03	63,12
	15		50,77
	20		41,89
60/SinOP-8	10	240,04	94,73
	15		79,51
	20		67,69
	25		58,46
	30		51,18
60/SinOP-10	10	300,05	127,44
	15		110,22
	20		96,13
	25		84,61
	30		75,17

The number of dowels involved in the work and the total perceived load directly depend on:
- The base on which the floor slab is poured,
- thickness of the floor slab,
- class of concrete.

Table cl.3 shows the most common measures of perceived stress.

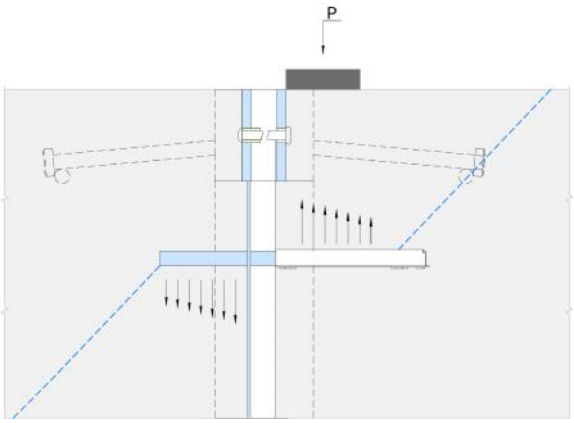

fig.1 Force diagram

By changing the geometry of concrete support on the dowel from straight to wavy, it was possible to increase the design values for loads by 20% when using a standard dowel.

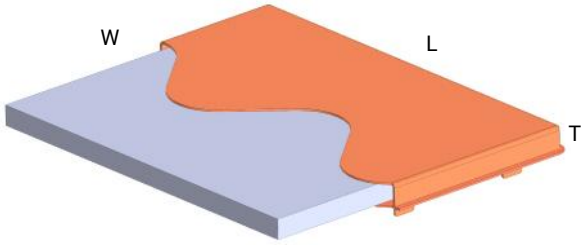

fig.2 Dimensions of dowel

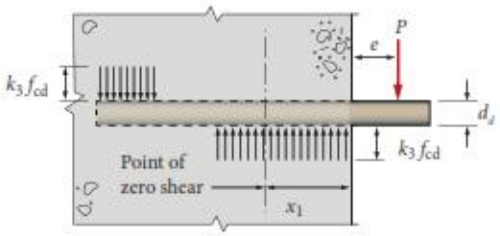

fig.3 External and internal forces affecting the dowel

The shear force on the dowel is determined by the formula:

$P_{sh\ plate} = A \times 0.9 \times 0.6 \times P_y$

Bearing / bending load on the dowel:

$P_{max\ plate} = 0.5[(b_1^2+c_1^2)^{0.5}-b_1]$

Where:
A — cross-sectional area of the dowel
P_y — yield strength of steel
$b_1 = 2ek_3\ f_{cd}\ P_b$
$c_1 = 2k_3 f_{cd}\ P_b^2 t_p^2 f_{yd}$
e — distance of application of load from concrete surface; with a symmetrical arrangement, this is equivalent to half the opening of the joint (see. Fig.5)
k_3=3 (const)
f_{cd} — concrete strength (cylinder)= f_{ck} /y_c
P_b — dowel width
$t_з$ — dowel thickness