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/OP-5	150	120	5	600	Green
60/OP-6	150	130	6	600	Blue
60/OP-8	150	130	8	600	Orange
60/OP-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/OP-5	10	125,02	40,05
	15		31,32
	20		25,37
60/OP-6	10	150,03	52,60
	15		42,31
	20		34,91
60/OP-8	10	200,03	78,94
	15		66,26
	20		56,41
	25		48,72
	30		42,65
60/OP-10	10	250,04	106,20
	15		91,85
	20		80,11
	25		70,51
	30		62,64

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,
- Reinforcement type.

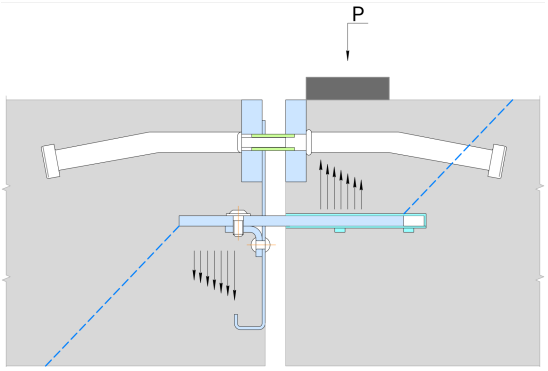


fig.1 Force diagram

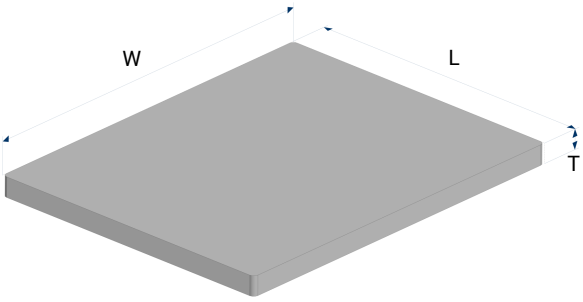


fig.2 Dimensions of dowel

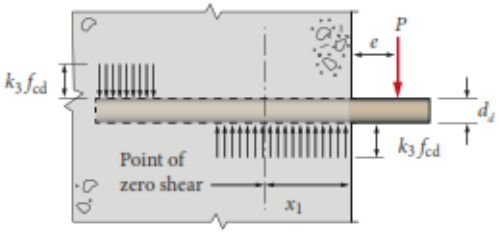


fig.3 External and internal forces affecting the dowel

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

EN

DEWMARK CONCRETE

CALCULATION OF LOADS

Upon request we can make design calculations for our profiles in accordance with TR 34. To enable us to make an accurate calculation you should send us all known parameters of the project as mentioned below. Apart from all possible load cases we need to know the planned thickness of the floor, the class of concrete, planned reinforcement of the floor and the design parameters of the subbase. If you have any questions about that, please let us know.

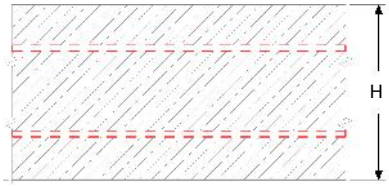
CUSTOMER:

PROJECT:

DATE:

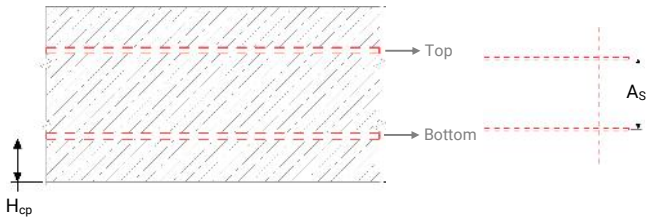
Slab data

1. Characteristics of the concrete slab:
   - Concrete class (from C25/30 to C50/60) ___
   - Thickness of the slab H, mm _____



2. Reinforcement type (if there are several options, then fill in all known):

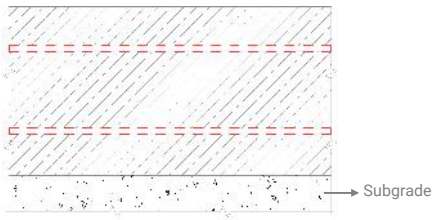
Bar:
- Diameter, mm _____
- Spacing A_s, mm _____
- Pos. in the slab (Top, bottom or both) ___
- Nominal cover H_{cp}, mm _____



Macro-synthetic fiber:
- Residual flexural strength at CMOD 0.5 ___
- Residual flexural strength at CMOD 3.5 ___

Steel fiber:
- Residual flexural strength at CMOD 0,5 ___
- Residual flexural strength at CMOD 1.5 ___
- Residual flexural strength at CMOD 2.5 ___
- Residual flexural strength at CMOD 3.5 ___

3. Type of subgrade:
   Either a detailed description of the subgrade (sand, crushed stone, soil, compacted sand, etc.), or the modulus of subgrade reaction (from 0.015 to 0.3 N/mm3) _____



Load Data

(if there are several options, then fill out this form as many times as necessary):

4. Type of load by intensity:
   - Permanent
   - Dynamic

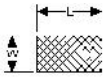
5. Type of load by impact:
   - Point load
   - Line load

6a. For point load:

Load at one point, kN: _____

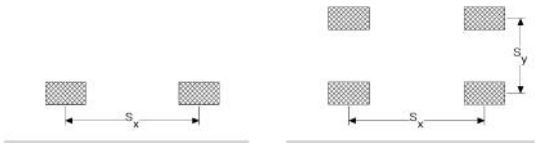
Number of points:
- Single load
- Dual load
- Quadruple load

Contact patch size LxW, mm _____



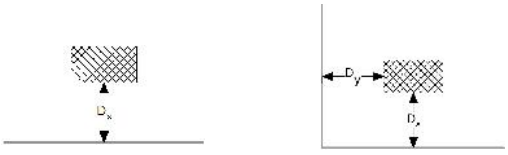
Spacing S_x, mm _____
(in case dual loads)

Spacing S_y, mm _____
(in case quadrupol load)

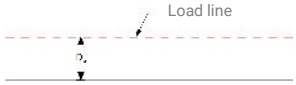


Distance to the edge of the concrete D_x ___

Distance to the edge of the concrete D_y ___
(if the load falls on the corner of the plate)



6b. For line load:



Line load, kN: _____

Distance to the edge of the concrete D_x ___