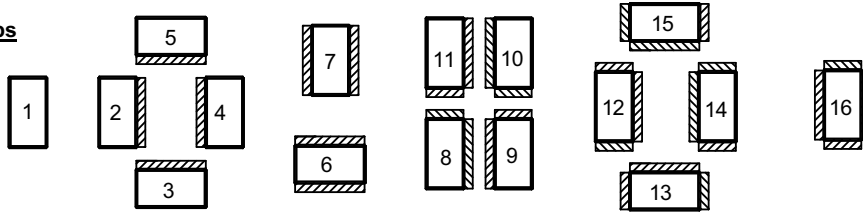


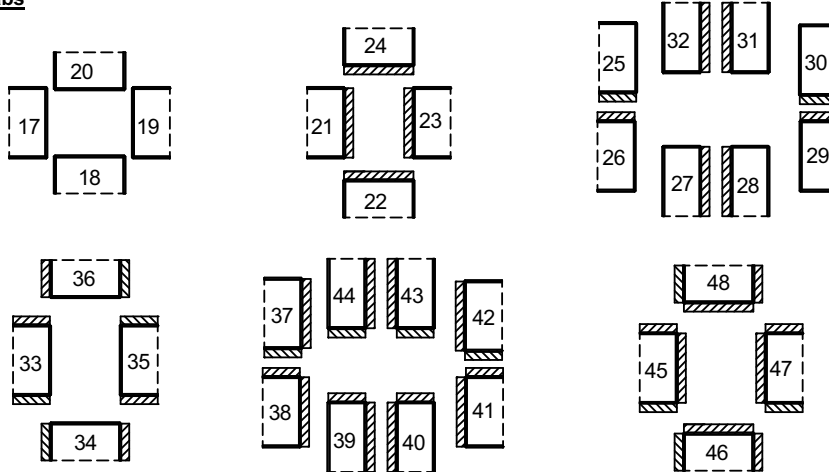
Freeware for Slab calculation and design " SLABS V2 1998"

Calculation according to the Pieper Martens method.
Design (reinforcement calculation) according to EC2.

4 way slabs



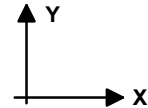
3 way slabs



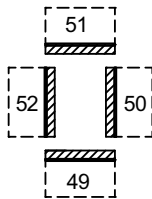
Slab Types 1-72

LX always parallel to X axis

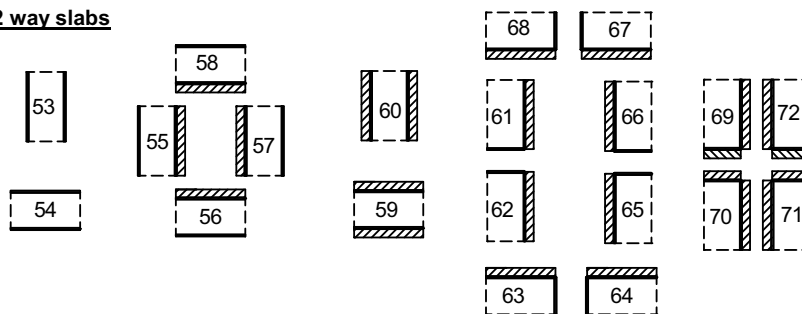
LY always parallel to Y axis



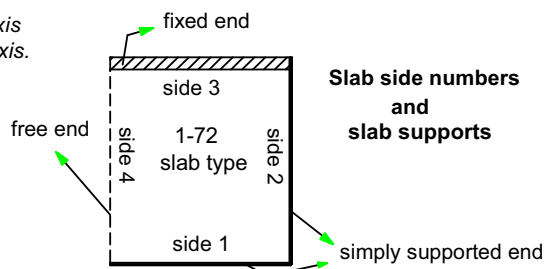
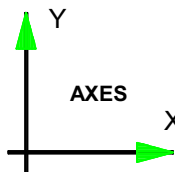
Cantilever Slabs



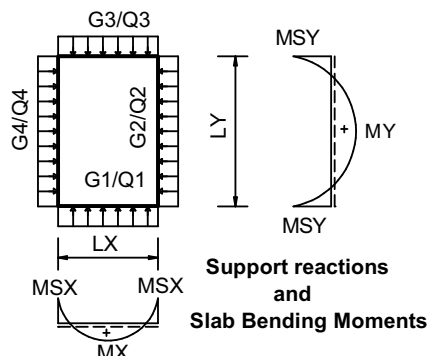
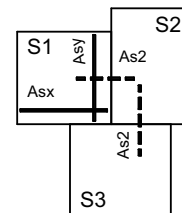
2 way slabs



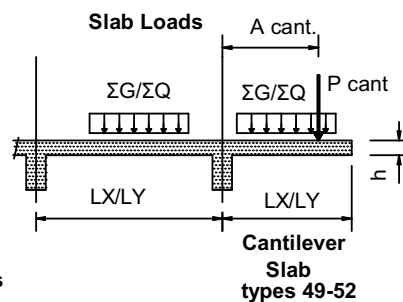
LX always parallel to X axis
LY always parallel to Y axis.



Slab reinforcement

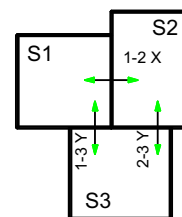


Support reactions and Slab Bending Moments



Cantilever Slab types 49-52

Support description



Freeware for the calculation and design of slabs: " SLABS V.2 1998"

Legend for symbols and notations

Symbol	Units	Comments
General Data		
FILE		file name (filename.PLA)
LEVEL		Name of level, e.g. "First floor"
MATERIAL		Concrete and Steel grade (e.g. C20-S400)
fck	MPa	Characteristic strength of concrete
τ_{RD}	MPa	Shear design strength
f _{yk}	MPa	Characteristic strength of steel
EPIKA	m	Reinforcement cover
G _c	KN/m ³	Concrete specific weight
γ_g		Dead load factor
γ_q		Live load factor
NP		Total number of slabs
NS		Total number of supports (in both directions)
ND		Total number of Beams loaded by the slabs. <i>(not mandatory)</i>
Geometrical Data		
SLAB		Slab number (e.g. S1, S2,.....S15)
TYPE	whole number	Slab type according to end support conditions Types 1-72. (See page with figures)
LX	m	Slab span parallel to "X"
LY	m	Slab span parallel to "Y"
H	m	Slab thickness
Slenderness check		
α		Coefficient for the slab span for the slenderness check
Lo	m	Slenderness length of slab $Lo = \alpha * L_{sl}$ where: $L_{sl} = \min(LX, LY)$ for 4-way and 2-way slabs of type 69-72. $L_{sl} = L$ of free side for the 3-way slabs. $L_{sl} = L$ of side which is perpendicular to the fixed end for cantilevers and 2-way slabs of type 61-68. $L_{sl} = L$ of side perpendicular to the supporting edges for the 2-way slabs of type 53-60.
h1	m	General slenderness limit, $h1 = Lo/30$, required $h1 \leq h$
h2	m	Special slenderness limit for slabs supporting sensitive to deflection walls, $h2 = Lo^2/150$, required $h2 \leq h$

Legend for symbols and notations

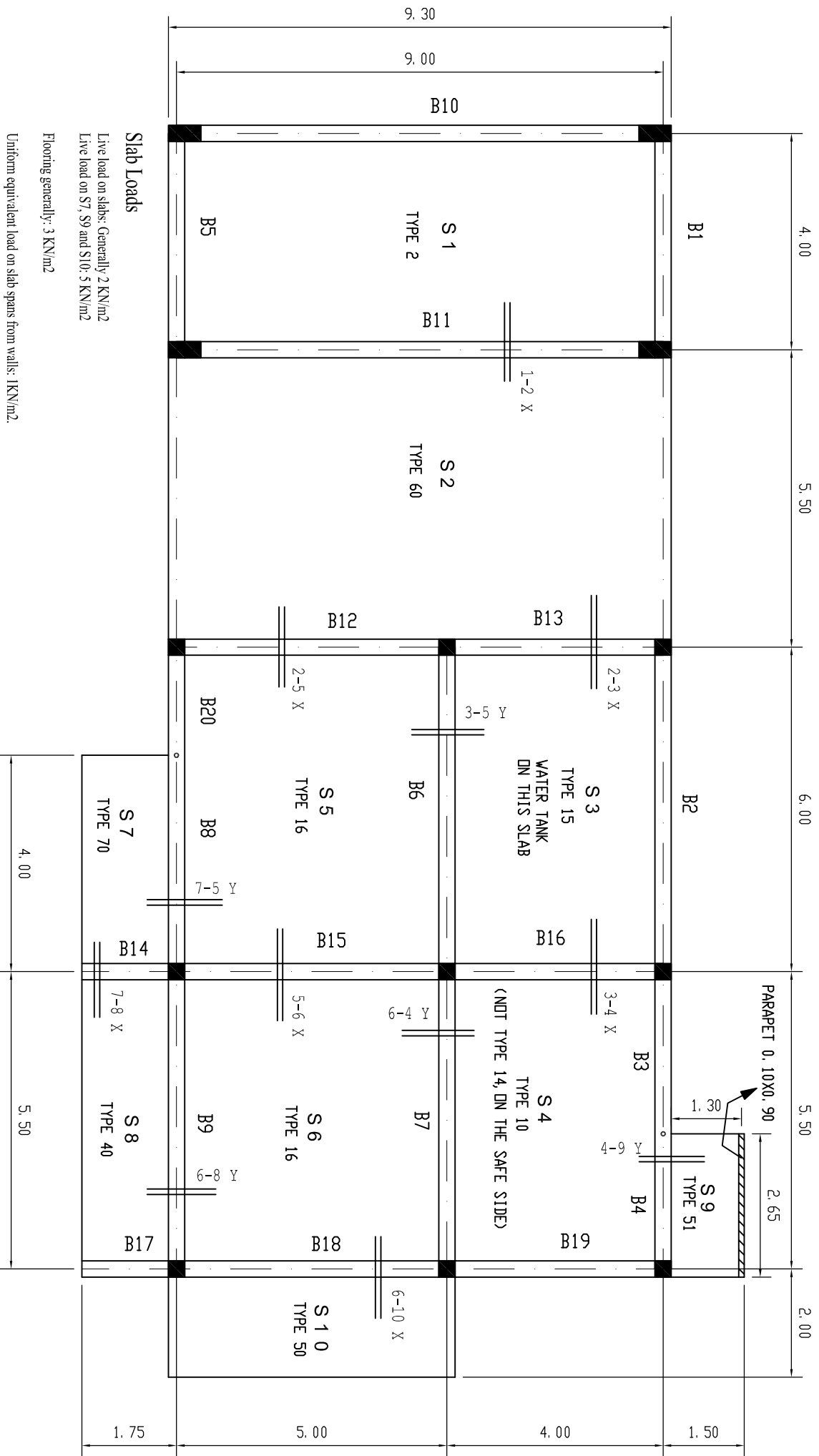
Symbol	Units	Comments
Slab loads		
Slab		Slab number (e.g. S1, S2,.....S15)
ΣG	KN/m ²	Total dead load (permanent load) $\Sigma G = \text{s.w.} + \text{flooring} + \text{walls} + \text{other dead}$
ΣQ	KN/m ²	Total live load $\Sigma Q = \text{live}$
s.w.	KN/m ²	Slab self weight
flooring	KN/m ²	Permanent load from flooring
walls	KN/m ²	Uniform equivalent load from walls supported by the slab
other dead	KN/m ²	Other permanent loads (e.g. water tanks, machinery etc)
live	KN/m ²	Live loads
Pcant.	KN/m	Linear load for cantilevers only. (Slabs of type 49-52). The linear load is parallel to the fixed end support. (e.g. parapet loads on balconies)
Acant.	m	Distance of cantilever's linear load from the fixed end support.
Support Description		
Support		Support number (e.g. SU1, SU2,.....SU15)
Slab 1	Whole number	Slab number which is adjacent to "Slab 2"
Slab 2	Whole number	Slab number which is adjacent to "Slab 1"
Direction	"X" or "Y"	Direction in which "Slab1" and "Slab2" are adjacent
		11-12 X means that slab11 is adjacent to slab12 in the X direction. 1-7 Y means that slab1 is adjacent to slab7 in the Y direction. 8-8 X is a valid data meaning that slab 8 has a fixed support perpendicular to the -X- direction (a strong beam or a wall)
Beam Loads		<i>Not mandatory, data can be omitted</i>
Beam		Beam number (e.g. B1, B2,.....B15)
s.w.	KN/m	self weight of beam
wall	KN/m	wall linear load supported directly on the beam
Slab a'..d'	Whole number	Slab number that loads the beam. (Each beam can be loaded at most by 4 different slabs with indexes a', b',c',d') (Sides a'...d' correspond to slabs a'...d')
Side a'..d'	Whole number	Code 1-4 for the slab side that loads the beam. (For the slab side codes see page with figures) e.g. Slab a' = 5 + Side a' = 3, Slab b'=12 + Side b'=1 means that the beam is loaded by the side 3 of slab5 and the side 1 of slab12.

Legend for symbols and notations

Symbol	Units	Comments
Slab Calculation		
Slab		Slab number (e.g. S1, S2,.....S15)
Type		Slab type
e		The ratio of the slab's spans calculated as follows: For the 4-way slabs: $e=L_{max}/L_{min}$ For the 3-way slabs: $e=L$ of side perpendicular to free side/ L of free side For 2-way slabs types 61-68: $e=L$ of side perpendicular to the fixed end/ L of the other side For the 2-way types 69-72: $e=L_{min}/L_{max}$ For the rest of the slab types $e=0$ (No need to be defined)
F_x, F_y		Coefficients for the span bending moments (M_x and M_y respectively).
F_{sx}, F_{sy}		Coefficients for the support initial bending moments (M_{sx} and M_{sy} respectively)
M_x, M_y	KNm	Final span bending moments (Parallel to directions -X- και -Y- respectively)
M_{sx}, M_{sy}	KNm	Support initial bending moments (Parallel to directions -X- και -Y- respectively)
Bending Moment formulas for M_x, M_y, M_{sx}, M_{sy}		For the 4-way slabs: $M_i=((\gamma_g \cdot \Sigma G) + (\gamma_q \cdot \Sigma Q)) \cdot L_{min}^2 / f_i$ For the 3-way and 2-way slabs of type 61-72: $M_i=((\gamma_g \cdot \Sigma G) + (\gamma_q \cdot \Sigma Q)) \cdot L_x \cdot L_y / f_i$ For the 2-way slabs of type 53-60: $M_i=((\gamma_g \cdot \Sigma G) + (\gamma_q \cdot \Sigma Q)) \cdot L^2 / f_i$ (L the supported span) For cantilevers: $M_i=((\gamma_g \cdot \Sigma G) + (\gamma_q \cdot \Sigma Q)) \cdot L^2 / f_i + \gamma_g \cdot P_{cant} \cdot A_{cant}$
Span reinforcement		
Slab		Slab number (e.g. S1, S2,.....S15)
min A_{sx}	mm^2	Minimum required by the code span reinforcement in -X- direction
req. A_{sx}	mm^2	Span reinforcement required by the calculation in the -X- direction
final A_{sx}	mm^2	The final required span reinforcement in the -X- direction final $A_{sx} = \max \{ \min A_{sx}, \text{req } A_{sx} \}$.
min A_{sy}	mm^2	Minimum required by the code span reinforcement in -Y- direction
req. A_{sy}	mm^2	Span reinforcement required by the calculation in the -Y- direction
final A_{sy}	mm^2	The final required span reinforcement in the -Y- direction final $A_{sy} = \max \{ \min A_{sy}, \text{req } A_{sy} \}$.
Support bending moments and reinforcement		
Support		The support description (e.g. 1-2 X means that S1 is adjacent to S2 parallel to the -X- direction) In the case that 1 slab is a cantilever then the software adds the symbol "*" at the end of the description(e.g. 12-13 Y*)
M_{s1}, M_{s2}	KNm	The initial support bending moments
$M_{sfin.}$	KNm	The final support bending moment calculated as follows: If $L_1/L_2 > 5$ or $L_1/L_2 < 0.2$ then $M_{sfin.} = \max(M_{s1}, M_{s2})$ where L_1, L_2 the slab spans in the direction in which they are adjacent. If the above condition is not valid then $M_{sfin.} = \max \{ (M_{s1} + M_{s2}) / 2, 0.75 \cdot \max(M_{s1}, M_{s2}) \}$
min A_{s2} , req A_{s2} , final A_{s2}	mm^2	The minimum required by the code, the required by the calculation and the final support reinforcement.

Legend for symbols and notations

Symbol	Units	Comments
Slab support reactions and shear check		
Slab		Slab number (e.g. S1, S2,.....S15)
G1..G4	KN/m	Slab support reactions from dead loads at the sides with codes 1, 2, 3 and 4. The reactions are calculated according to the code and are given with their unfactored value. (they are not multiplied by the dead load factor γ_g).
Q1..Q4	KN/m	Slab support reactions from live loads at the sides with codes 1, 2, 3 and 4. The reactions are calculated according to the code and are given with their unfactored value. (they are not multiplied by the live load factor γ_q .)
V1..V4	KN	Slab shearing forces from dead and live loads at the sides with codes 1, 2, 3 and 4. The Shearing forces are calculated by the formulas: $V_i = \gamma_g \cdot G_i + \gamma_q \cdot Q_i$
VRD _x , VRD _y	KN	The slab shear strength at the -X- and -Y- directions. Bending reinforcement is ignored (conservative assumption on the safe side). The effective slab thickness for the most loaded direction is calculated as $d = h - E_{PIKA}$ while for the less loaded direction the effective slab thickness is calculated as $d' = d - 0.012 \text{ m}$.
Final Beam loads		
Beam		Beam number (e.g. B1, B2,.....B15)
ΣG_b	KN/m	Final unfactored permanent beam load ready to be introduced to a space frame software and factored accordingly. $\Sigma G_b = s.w. + wall + G_{b1} + G_{b2} + G_{b3} + G_{b4}$
ΣQ_b	KN/m	Final unfactored live beam load ready to be introduced to a space frame software and factored accordingly. $\Sigma Q_b = Q_{b1} + Q_{b2} + Q_{b3} + Q_{b4}$
s.w.	KN/m	Beam's self weight
wall	KN/m	wall linear load supported directly on the beam
G _{b1} ..4	KN/m	The slab reactions from permanent loads on the beam. The indexes b1, b2, b3, b4 correspond to the loading slabs indexes a', b', c', d'.
Q _{b1} ..4	KN/m	The slab reactions from live loads on the beam. The indexes b1, b2, b3, b4 correspond to the loading slabs indexes a', b', c', d'.



Slab Loads

Live load on slabs: Generally 2 KN/m²

Live load on S7, S9 and S10: 5 KN/m²

Flooring generally: 3 KN/m²

Uniform equivalent load on slab spans from walls: 1KN/m².

Other permanent (dead) loads: Water tank on S3 10KN/m²

Parapet on S9: Peant=3.8 KN/m at a distance acant=1.30 m from the support.

EXAMPLE.PLA

Walls directly supported on beams B11, B12, B13, B14 : 5KN/m

Walls directly supported on the rest of the beams : 10 KN/m

Self weight of beams generally: 3.2 KN/m