

ALTINAY FORMWORK STROY SERVICE

DESIGN BASICS



**GREEN CHOICE
WOOD**



<https://www.youtube.com/watch?v=gtSIF6tuz6c>



Rev-3				
Rev-2				
Rev-1				
Rev	Description	Date	Name	Check
	Date	Drawn	Check	Appr.
	10 Aug 2014	A.Bicanova	F.Yasar	F.Yasar
				J.Dusembayeva



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1133	1/1	DWG	00	A	UD	0100.3	00

RELATED STANDARDS

GENERAL STANDARDS	
Concrete Structures	DIN 1045
Timber Structures	DIN 1052
Aluminium Structures	DIN 4113
Steel Structures	DIN 18800
LOAD ASSUMPTIONS	
Load Assumptions (Bldg)	DIN 1055
Concrete Pressure	DIN 18218
Tolerances (Bldg)	DIN 18202
SPECIAL STANDARDS	
Working Platforms	DIN 4420
Shoring Systems	DIN 4420
Mobile Scaffolds	DIN 4422
Light Scaffolds Spindels	DIN 4425
Tie Rods	DIN 18216
Scaffold Couplers	DIN EN 74
Steel Probs with Extension	DIN EN 1065

Formwork
Code of Practice 2006

Workplace Health and Safety Queensland

Great state. Great opportunity.

INDUSTRY GUIDE FOR FORMWORK
CONSTRUCTION INDUSTRY SOUTH AUSTRALIA
JUNE 2012

PLYWOOD IN CONCRETE FORMWORK

The Formwork Experts

We enjoy to Share our knowledge

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GREEN CHOICE WOOD

Indian	
IS 14687-1999	Falsework for concrete structure guidelines
IRC 87-1984	Guidelines for the design and erection of falsework for road bridges
IS 2750-1964 (1995)	Specification for steel scaffoldings
International	
ACI 347-04	Guide to formwork for concrete
ACI 347.2 R-05	Guide for shoring / reshoring of concrete multi-story buildings
ACI SP-4	Formwork for concrete
BS 5975-2008	British standard code for practice for temporary works procedures and the permissible stress design of falsework
DIN 4420 & 4421	German standard for formwork
DIN 18218	Pressure of fresh concrete on vertical formwork
CIRIA Report 108	Concrete pressure on formwork

BEAM THEORY DESIGN BASICS
BOOK AL-22.5

INNOVATIVE WOOD MADE FORMS

ALTINAY® HH20S-10 BEAM 240 cm

8829.523.545.88

MECHANICAL BENDING OF WOOD DESIGN BASICS
BOOK AL-22.6

INNOVATIVE WOOD MADE FORMS

ALTINAY® HH20S-10 BEAM 240 cm

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Doka formwork engineering
Calculation Guide

The Formwork Experts

APA Concrete Forming
DESIGN/CONSTRUCTION GUIDE

<https://www.youtube.com/watch?v=gtSIF6tuz6c>

www.apawood.org



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LIBRARY

ENGINEERED WOOD PRODUCTS

FORMrite

Formwork Solutions Guide

truFORM

edgeFORM

CarterHottHarvey Woodproducts Australia

The natural solution for you.

Chapter 15 Formwork

Chapter 15

Guide to Concrete Construction

BRITISH STANDARD

BS 5975:1996
Incorporating Amendments Nos. 1 and 2

Code of practice for falsework

Document No. = IITK-GSDMA-Wind02-V5.0
= IITK-GSDMA-Wind04-V3.0
Final Report = B - Wind Codes
IITK-GSDMA Project on Building Codes

BSI
British Standards

meva

Formworkpress

Professional Formwork News XV/2009

Concrete Pressure: New Industry Standard

New Standards for Fresh Concrete Pressure Industry Standard in Force

Normative Values
Pressure influence factors
Setting Behaviour
Concrete pressure cured

On-Site Practice
Calculation method press on-site

Easy-to-Use Calculation Tools
Predicting concrete pressure accurately

Literature
Sources of information

SICHERHEIT ÜBER MICH!

ARBEITS- UND SCHUTZGERÜSTE

LVBG

meva

http://www.docin.com/p-107733967.html

ACI 347-04

Guide to Formwork for Concrete
An ACI Standard

Reported by ACI Committee 347

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1.3 - Achieving economy in formwork
1.4 - Control Documents

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2.2 - Loads
2.3 - Load effects
2.4 - Safety factors for accessories
2.5 - Shoring
2.6 - Bracing and lacing
2.7 - Foundations for formwork
2.8 - Settlement

3 - Construction, p. 347-9
3.1 - Safety precautions
3.2 - Construction practices and workmanship
3.3 - Tolerances
3.4 - Irregularities in formed surfaces
3.5 - Shoring and centering
3.6 - Inspections and adjustment of formwork
3.7 - Removal of forms and supports
3.8 - Shoring and finishing of masonry structures

4 - Materials, p. 347-16
4.1 - General

Lateral Pressures for Formwork Design

A review of the formulas to determine the pressure of fresh concrete

By M.K. HORD

Fresh concrete exerts pressure on vertical form surfaces. As an assessment of that pressure is needed for designing forms, the simplest theory, fresh concrete acts as a fluid exerting pressure equally in all directions at whatever point the measurement is made—essentially assuming a hydrostatic pressure effect. This is reasonable because the fresh concrete behaves much like a fluid at least briefly during vibration, or for a longer time if flowability of the mixture has been enhanced through use of admixtures or special proportioning and materials selection. But concrete is not a true fluid, and some method of evaluating the concrete's actual pressure is needed. Evaluating pressure has been a significant part of the work of ACI Committee 347, Formwork for Concrete. As early as 1958, Committee 347 (then Committee 423) studied available field measurements of lateral pressure on formwork and used the data to develop pressure formulas that could be safely used for form design. A report was published in 1958, and the formulas, with some modifications, were included in ACI's first formwork

Document No. = IITK-GSDMA-Wind02-V5.0
= IITK-GSDMA-Wind04-V3.0
Final Report = B - Wind Codes
IITK-GSDMA Project on Building Codes

IS: 875(Part3): Wind Loads on Buildings and Structures - Proposed Draft & Commentary

By
Dr. Prem Krishna
Dr. Krishen Kumar
Dr. N.M. Bhandari
Department of Civil Engineering
Indian Institute of Technology Roorkee

Holcim

Beton nach DIN EN 206-1 und DIN 1045-2
Holcim (Deutschland) AG

DEUTSCHE NORM

October 2008

DIN 18202

Toleranzen im Hochbau - Bauwerke
Tolerances in building construction - Buildings
Tolérances dans la construction immobilière - Bâtiements

Normative Values
Pressure influence factors
Setting Behaviour
Concrete pressure cured

On-Site Practice
Calculation method press on-site

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www.apawood.org

UNIT CONVERSION

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Metric System

Length/Uzunluk

	Yard	Foot	Inch	Meter/cm
1 Mile	1760	5280	6280	1609.3
1 Yard		3	36	0.9144
1 Foot	0.3333		12	0.3048
1 Inch	0.0278	0.083		2.54
1 Meter	1.0936	3.281	39.37	



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Instant Area Conversion

convert units easily

	Yard ²	Foot ²	Inch ²	Meter/cm ²
1 Mile ²	3097600	27878400	4014489600	2588881
1 Yard ²		9	1296	0.8361
1 Foot ²	0.1111		144	0.0929
1 Inch ²	0.0008	0.0069		6.4516
1 Meter ²	1.1960	10.76	1550	
1 Acre ²	4840	43546	6272850	4047



in	1"	2"	3"	4"	5"	6"
----	----	----	----	----	----	----

	mm	25.40	50.80	76.20	101.60	127.00	152.40
1/16"	1.587	26.99	52.39	77.79	103.19	128.59	153.99
1/8"	3.175	28.58	53.98	79.38	104.78	130.18	155.58
3/16"	4.761	30.16	55.56	80.96	106.36	131.76	157.16
1/4"	6.350	31.75	57.15	82.56	107.95	133.35	158.77
3/8"	9.525	34.93	60.33	85.73	111.13	136.53	161.93
1/2"	12.700	38.10	63.50	88.90	114.30	139.70	165.10
5/8"	15.875	41.28	66.68	92.08	117.48	142.88	168.29
3/4"	19.050	44.45	69.85	95.25	120.65	146.05	171.45
7/8"	22.225	47.63	73.03	98.43	123.83	149.23	174.63

Shape	Formula	Shape	Formula
Triangle 	$Area = \frac{1}{2}b \times h$ b = base h = height	Square 	$Area = a^2$ a = length of side
Rectangle 	$Area = w \times h$ w = width h = height	Parallelogram 	$Area = b \times h$ b = base h = vertical height
Trapezoid 	$Area = \frac{1}{2}(a+b) \times h$ h = vertical height a, b are the parallel sides	Circle 	$Area = \pi r^2$ r = radius
Ellipse 	$Area = \pi ab$ a = half of minor axis b = half of major axis	Sector 	$Area = \frac{1}{2}r^2\theta$ r = radius theta = angle in radians



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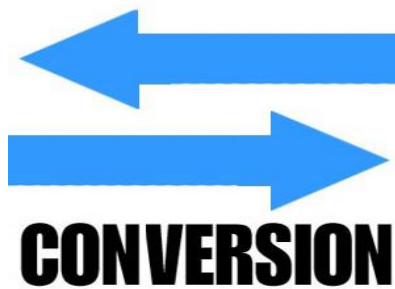
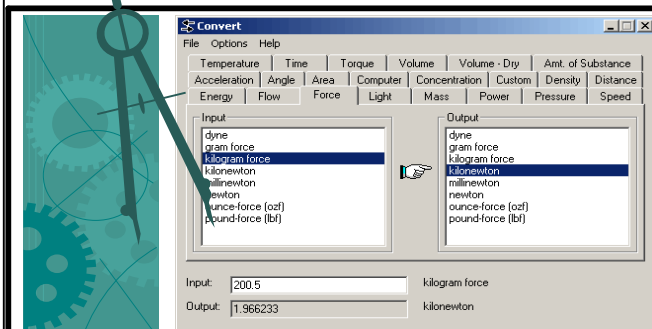
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<http://www.convert-me.com/ru/>

для РОССИЙСКОЙ НАЖМИТЕ ЗДЕСЬ

<http://www.appmeas.co.uk/free-engineering-unit-conversion-program.html>



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UNIT CONVERSION

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	Yard3	Foot3	Inch3	Meter3/Liter
1 Yard3		27 ft3	46656 in3	0.7646 m3
1 Foot3	0.0037 yd3		1728 in3	0.02832 m3
1 Inch3	0.0000215 yd3	0.0006 ft3		0.0000164 m3
1 Meter3	1.307 yd3	35.32 ft3	61023 in3	
1 Gallone (UK)	0.00595 yd3	0.1605 ft3	277.4 in3	4.546Lt
1 Gallone (US)	0.00495 yd3	0.1337 ft3	231 in3	3.785 Liter



Convert-me.Com

on the Web since 1996

Instant Area Conversion

convert units easily

<http://www.convert-me.com/en/convert/weight/>

	Pounds	Kilogram
1 Pound		0.4536 kg
1 Kilogram	2.2046 Lbs	
1 US Tone	2000.00 Lbs	907.20 kg
1 UK Ton	2240.00 Lbs	1016.00 kg
1 Mton	2204.60 Lbs	1000.00 kg
1 Ounce	0.0624 Lbs	0.0283 kg



Example #1

 Name: Cube
 $V = Bh$
 $V = (\text{Area of Square})(\text{height})$
 $V = (5)(5)(5)$
 $V = 125 \text{ cm}^3$

Example #2

 Name: Triangular Prism
 $V = Bh$
 $V = (\text{Area of Triangle})(\text{height})$
 $V = \frac{1}{2}(8)(5)(10)$
 $V = 200 \text{ cm}^3$

Example #3

 Name: Rectangular Prism
 $V = Bh$
 $V = (\text{Area of Rectangle})(\text{height})$
 $V = (3)(4)(12)$
 $V = 144 \text{ cm}^3$

Example #4

 Name: Hexagonal Prism
 $V_{\text{prism}} = Bh$
 $V_{\text{prism}} = (\text{Area of Hexagon})(h)$
 $V_{\text{prism}} = \left(\frac{1}{2}ap\right)h$
 $V_{\text{prism}} = \left(\frac{1}{2}(3\sqrt{3})(3\sqrt{3})\right)10$
 $V_{\text{prism}} = 540 \text{ cm}^3$

$\delta = \text{density}$
 $L = \text{beam length}$

<http://www.had2know.com/technology/l-beam-calculator-moments-engineering.html>
<http://www.had2know.com/technology/conversion-calculator-length-area-volume.html>



<http://www.fao.org/docrep/w5796e/w5796e06.htm>

http://www.onlineconversion.com/density_common.htm

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Units of Force Instant Conversion

convert units easily

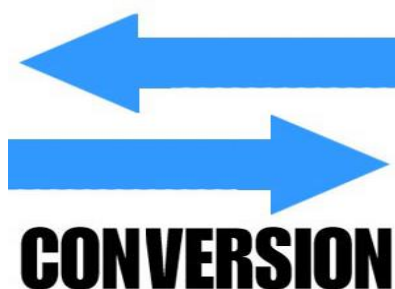
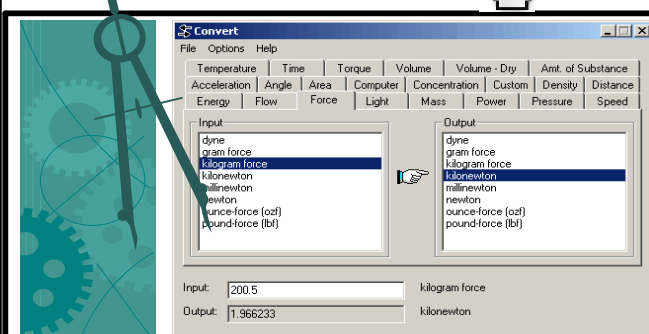
<http://www.convert-me.com/en/convert/force/>

	Newton	Pounds
1 Lbs	4.4482 N	
1 Kip	4448	1000 Lbs
1 N		0.2248 Lbs
1 kN		224.8 Lbs
1 lLbs/ft	0.0146 kN/m	
1 kN/m		68.6 kN/ft
1 ksi (kips/in2)	6.89 MN/m2	1000 psi
1 psi (Lbs/in2)	6.89 kN/m2	
1 psf (Lbs/ft2)	0.0479 kN/m2	
1 kN/m2		20.9 Lbs/ft2



The SI base unit for mass is the kilogram.
1 kilogram is equal to 9.80665002864 Newton.

<http://en.wikipedia.org/wiki/Kilogram-force>



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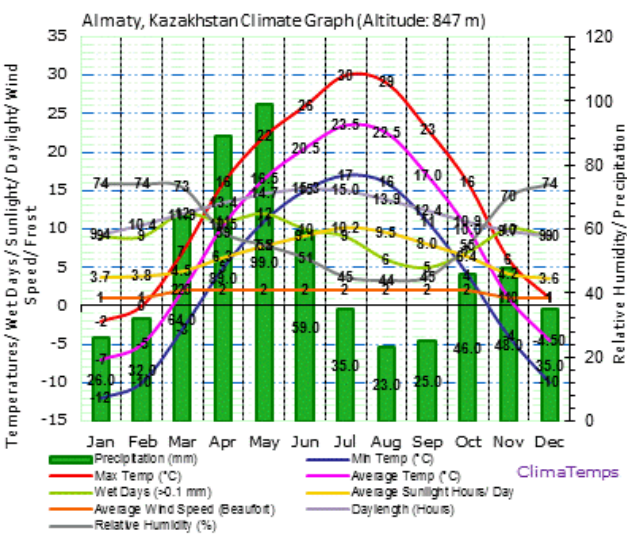
UNIT CONVERSION

Convert-me.Com Instant Temperature Conversion
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<http://www.convert-me.com/en/convert/temperature/>

<http://www.world-climates.com/city-climate-almaty-kazakhstan-asia/>

	Celcius	Fahrenheit
Celcius		9/5+32
	(x-32)5/9	



Temperature conversion scale: 104°F = 40°C, 95°F = 35°C, 86°F = 30°C, 77°F = 25°C, 68°F = 20°C, 59°F = 15°C, 50°F = 10°C, 41°F = 5°C, 32°F = 0°C.

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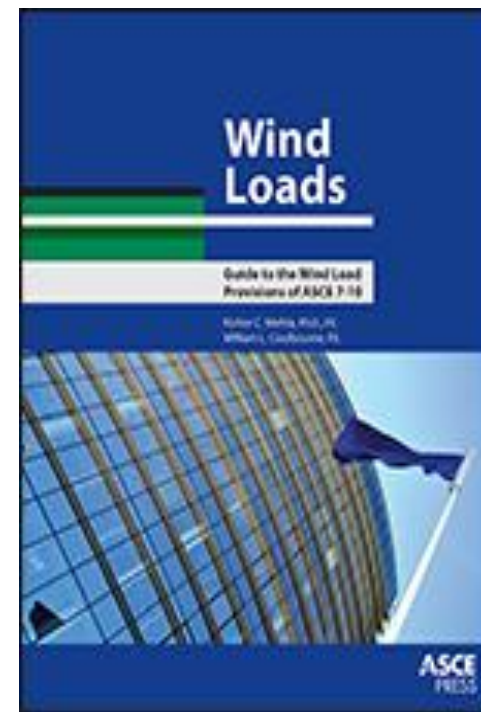
http://www.steelconstruction.info/Design_software_and_tools

HORIZONTAL LOADS-WIND LOADS (DIN 1055)

	m/s	km/hr	q (kN/m ²)	cp=1.3 kN/m ²
	WIND VELOCITY		DYNAMIC WIND PRESSURE	WIND PRESSURE w FOR WALL FORMWORK
0 to 8 m above grade	28.3	102	0.5	0.65
8 to 20m above grade	35.8	129	0.8	1.04
20 to 100m above grade	42	151	1.1	1.43
Over 100m	45.6	164	1.3	1.69

Wind pressure **w** is obtained by multiplying the dynamic wind pressure **p** with the coefficient **cp**

Generally for wall form work cp=1.3



Document No.: IITK-GSDMA-Wind02-V5.0
IITK-GSDMA-Wind04-V3.0
Final Report: B - Wind Codes
IITK-GSDMA Project on Building Codes

IS: 875(Part3): Wind Loads on Buildings and Structures
-Proposed Draft & Commentary

By
Dr. Prem Krishna
Dr. Krishen Kumar
Dr. N.M. Bhandari
Department of Civil Engineering
Indian Institute of Technology Roorkee
Roorkee

EN 1991
Eurocode 1: Actions on structures

Organised by European Commission: DG Enterprise and Industry, Joint Research Centre
with the support of CEN/TC250, CEN Management Centre and Member States

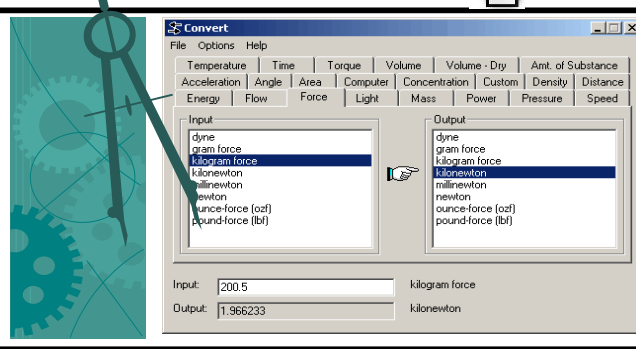
$$w_e = q_p(z_e) \cdot c_p$$

w_e	Wind pressure on surface in kN/m ²
$q_p(z_e)$	Peak velocity pressure in kN/m ² (old term: impact pressure)
z_e	Reference height, height above ground
c_p	Aerodynamic coefficient

Force of Wind

Height of cargo: 3.0 Meters
Width of cargo: 7.20 Meters
Wind speed: 12.0 Meters/sec.
Wind force: 207 Kilogram

Recent relevant data in yellow squares.
Designed by Kienrich Eustand, www.mobilcrane.com



CONVERSION

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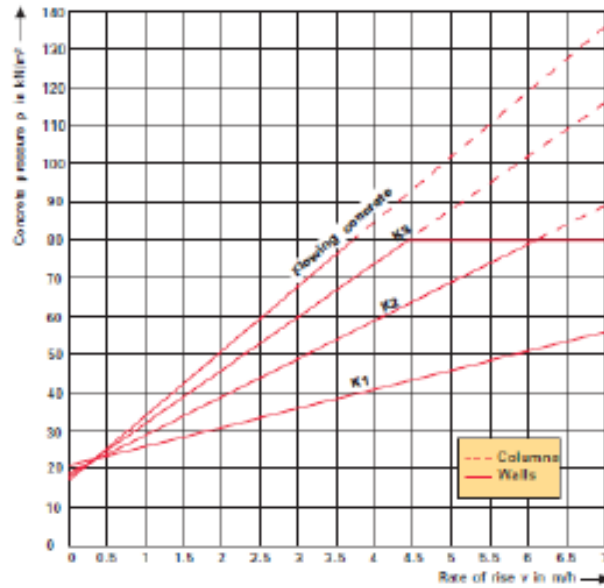
FRESH CONCRETE PRESSURE ON VERTICAL FORMWORK

DIN 18218
Concrete pressure

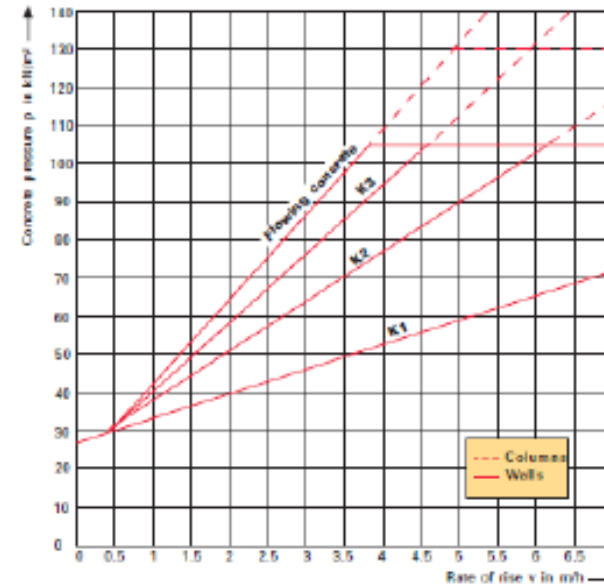
A

Examples for concrete pressures with differing concrete temperatures, with and without retarding agent.

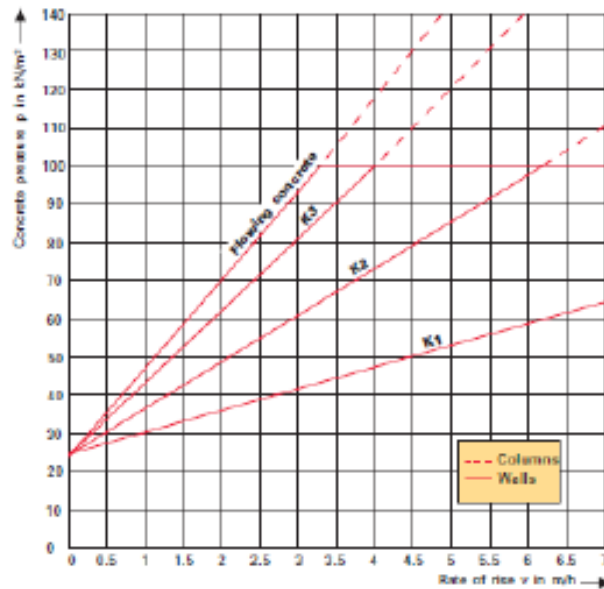
1. Concrete temperature 15 °C without retarding agent



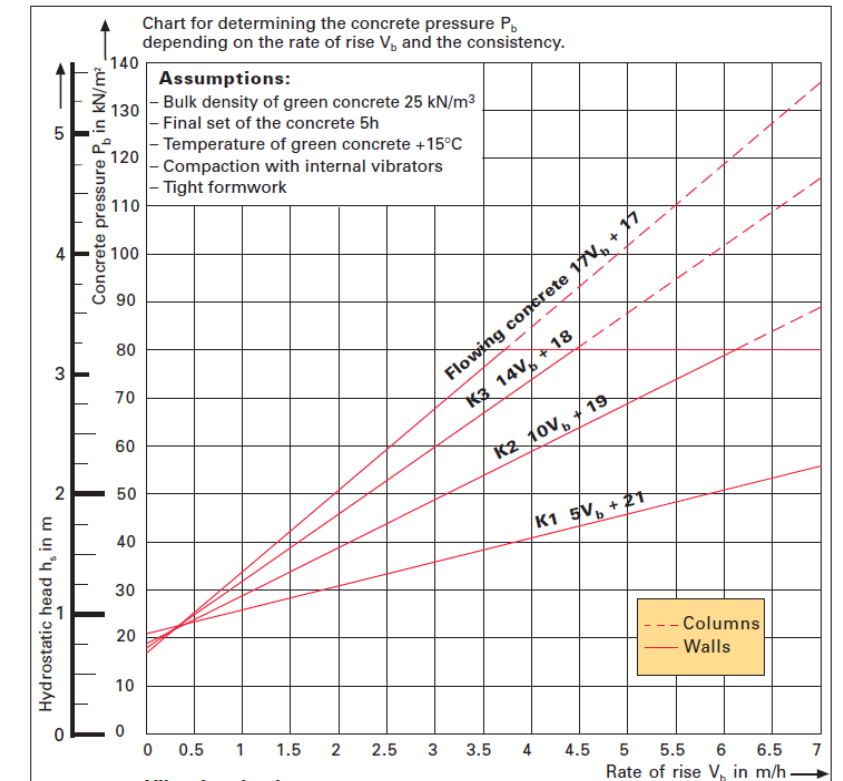
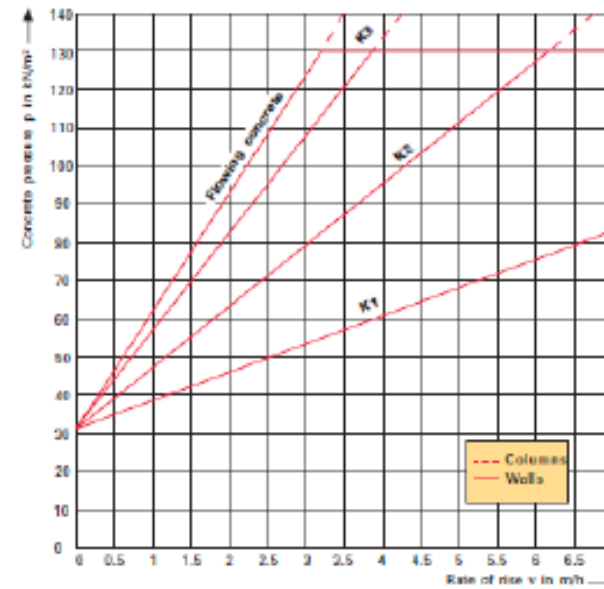
2. Concrete temperature 5 °C without retarding agent



3. Concrete temperature 15 °C with 5 h retarding agent



4. Concrete temperature 5 °C with 5 h retarding agent



Consistency range

	old	new
K1	$v = 1.45 - 1.26$	KS (stiff) $v \geq 1.20$
K2	$a \leq 40$ cm	KP (plastic) $a = 35 - 41$ cm
K3	$a = 41 - 50$ cm	KR (high slump) $a = 42 - 48$ cm
Flow. concr. a	$51 - 60$ cm	KF (flowing) $a = 49 - 60$ cm

V = compaction according to Walz a = slump



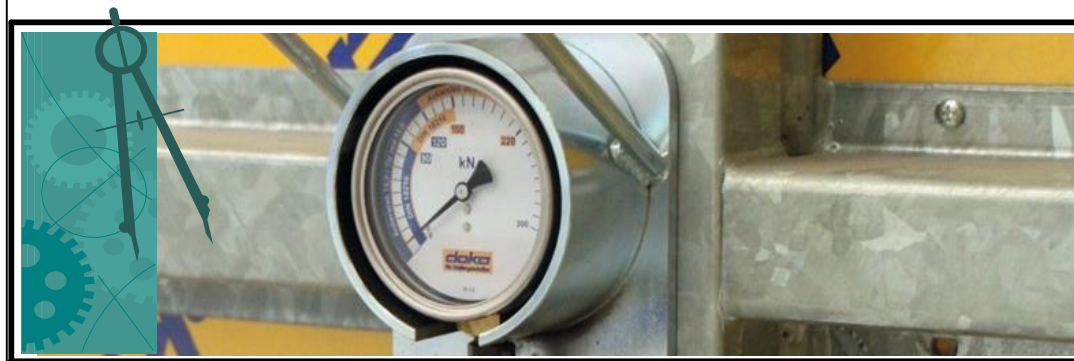
X Gün sonra ulaşılabilecek beton mukavemeti tahmini

Santigrad cinsinden Sertleşme sıcaklığı	Portland 45 Betonun X gün sonra ulaşılabileceği beton mukavemeti yüzdesi							
	1	2	3	5	7	10	14	28
0°C			20%	29%	35%	41%	45%	50%
5°C			30%	41%	49%	56%	60%	66%
10 °C	16%	32%	44%	59%	70%	80%	88%	96%
20 °C	29%	46%	58%	70%	80%	88%	94%	100%
30 °C	45%	64%	73%	83%	90%	96%	99%	101%

X Gün sonra ulaşılabilecek beton mukavemeti tahmini

Santigrad cinsinden	Portland 35 Betonun X gün sonra ulaşılabileceği beton mukavemeti yüzdesi							
	Number of Days							
	1	2	3	5	7	10	14	28
0°C			16%	26%	34%	42%	49%	58%
5°C			30%	41%	49%	56%	62%	71%
10°C		35%	42%	55%	65%	75%	85%	99%
20 °C	35%	45%	52%	63%	71%	80%	88%	100%
30 °C	42%	53%	61%	72%	80%	88%	95%	106%

http://www.peri.de/www/en/knowledge/formwork/load_monitor/formwork_load_monitorapp.cfm



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2

FRESH CONCRETE PRESSURE ON VERTICAL FORMWORK



Concrete consistency acc. to DIN 18218 (1980) or DIN 1045 (1978)	Slump [a] acc. to DIN 1045 (1978) Diameter in mm	Concrete consistency acc. to DIN 1045-2 / DIN EN 206-1 (2001)	Slump [a] acc. to DIN 1045-2 (2001) Diameter in mm
K1	-	F1	≤ 340
K2	≤ 400	F2	350 to 410
K3	410 to 500	F3	420 to 480
Flowable concrete ^a	500 to 600 ^a	F4	490 to 550
- ^b		F5	560 to 620
		F6	≥ 630
		SCC	≥ 700 ^c

^a Flowable concrete is defined acc. to the DAfStb-guideline for flowable concrete (1995).
^b The concrete consistencies F5, F6 and SCC are not covered by the DIN standard 18218 (1980).
^c For a slump [a] ≥ 700 mm the DAfStb-guideline "Self-compacting concrete" has to be considered.



ONLINE CALCULATION DIN 18218 (1980)

Calculation for concrete pressure

Consistency class: **F1**

Assumptions:

- Outside temperature has no influence on concrete temperature.
- Max. pouring rate is $v = 7$ m/h
- Max. concrete height is $H = 10$ m
- Compacting is done with inside vibrators.
- Max. dipping depth of vibrators is less than h_s

End of solidification t_E at temperature T_{Ref} : h

Reference temperature T_{Ref} : °C

Concrete temperature while pouring T_{Einbau} : °C

Concrete height H: m

Density of fresh concrete γ_c : kN/m^3 **25**

Concrete pressure $\sigma_{nk,max}$: kN/m^2

Pouring rate v: m/h

CLICK HERE

www.paschal.de



ONLINE CALCULATION DIN 18218 (1980)

Formwork Load Monitor
based on DIN 18218:2010-01

boundary conditions **PERI DOMINO 250**

consistency class **F1**

final set t_E at $T_{C,Ref}$: 7 h

reference temperature $T_{C,Ref}$: 20 °C

pouring temperature $T_{C,pouring}$: 20 °C

pouring height H: 5 m

special conditions

calculation **include formwork**

formwork system **DOMINO 250**

mounting direction **vertical**

tie **DW15**

tolerance **line 6**

OK

maximum rate of rise **7.1 m/h**
 $h = 500 (250 + 250)$

CLICK HERE

http://www.peri.co.za/en/knowledge/formwork_load_monitor/formwork_load_monitorapp.cfm



ONLINE CALCULATION DIN 18218 (1980)

The Formwork Experts.
Doka Calculator for fresh concrete pressure
Calculating the permissible rate of placing and the maximum fresh-concrete pressure. **more**

Dokaflex 30 tec
Calculates and visualises the type and spacing of the formwork beams and props needed for using Dokaflex 30 tec efficiently. **more**

Dokaflex Optimisation
Optimises the spacing of Dokaflex 1-2-4 beams and props as per the requirements of your structure. **more**

Dokaflex 15
Calculates and visualises the type and spacing of the formwork beams and props needed for using Dokaflex 15 efficiently. **more**

Doka Calculator for fresh concrete pressure
Calculating the permissible rate of placing and the maximum fresh-concrete pressure. **more**

CLICK HERE

Doka Calculator for fresh concrete pressure
Calculating the permissible rate of placing and the maximum fresh-concrete pressure. **more**

www.doka.com

<http://www.doka.com/web/tools/apps/doka-apps.me.php>



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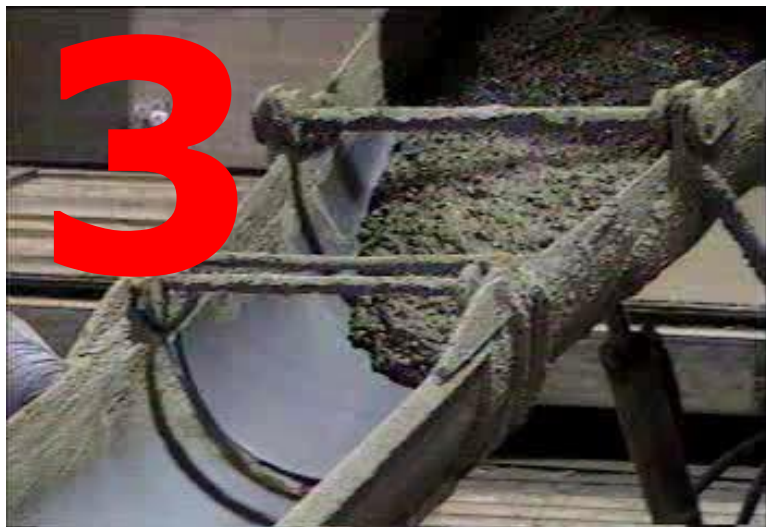


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Cement Basics-Types of Cement

» Types of Portland Cement

Portland cements are hydraulic cements composed primarily of hydraulic calcium silicates. ASTM C 150, *Standard Specification for Portland Cement*, recognizes eight types of Portland cement:

Type I and Type IA*

General purpose cements suitable for all uses where the special properties of other types are not required.

Type II and Type IIA*

Type II cements contain no more than 8% tricalcium aluminate (C₃A) for moderate sulfate resistance. Some Type II cements meet the moderate heat of hydration option of ASTM C 150.

What's a Type I/II cement?

Portland cements that meet Type II requirements also must meet all of the requirements of Type I cements, except those for compressive strength.

Type I/II cements meet both the C₃A requirements of Type II cement and the compressive strength requirements of Type I cements.

Type III and Type IIIA*

Chemically and physically similar to Type I cements except they are ground finer to produce higher early strengths.

Type IV

Used in massive concrete structures where the rate and amount of heat generated from hydration must be minimized. It develops strength slower than other cement types.

Type V

Contains no more than 5% C₃A for high sulfate resistance.

*Air-entraining cements

» Types of Blended Cements

Blended hydraulic cements are produced by intimately and uniformly intergrinding or blending two or more types of fine materials. The primary materials are portland cement, ground granulated blast furnace slag, fly ash, silica fume, calcined clay, other pozzolans, hydrated lime, and pre-blended combinations of these materials.

ASTM C 595, *Specification for Blended Hydraulic Cements*, recognizes five primary classes of blended cement:

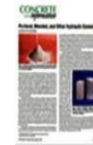
Type IS-Portland blast furnace slag cement

Type IP and Type P-Portland-pozzolan cement

Type I(PM)-Pozzolan-modified portland cement

Type S-Slag cement

Type I(SM)-Slag-modified portland cement



This information was excerpted from PCA's *Portland, Blended, and Other Hydraulic Cements*, a 32-page publication covering numerous cement types and their physical properties.

» Types of Hydraulic Cements

All portland and blended cements are hydraulic cements. "Hydraulic cement" is merely a broader term. ASTM C 1157, *Performance Specification for Hydraulic Cements*, is a performance specification that includes portland cement, modified portland cement, and blended cements. ASTM C 1157 recognizes six types of hydraulic cements:

Type GU-general use

Type HE-high early strength

Type MS-moderate sulfate resistance

Type HS-high sulfate resistance

Type MH-moderate heat of hydration

Type LH-low heat of hydration

This information was excerpted from PCA's *Portland, Blended, and Other Hydraulic Cements*, a 32-page publication covering numerous cement types and their physical properties.

Other resources for information on Portland cement production and technology:

Cement Specification Emphasizes Performance

ASTM C 1157, which now includes both blended and Portland cements, moves away from requirements on chemical composition

Portland Cement Characteristics-1998

Results of a survey of cement manufacturers compiles information on currently available cements

Prescriptive vs. Performance Specifications for Cements

A description of the differences and some of the potential benefits and drawbacks of each

CONCRETE TYPES AND CONSISTENCY

A

Concrete consistency acc. to DIN 18218 (1980) or DIN 1045 (1978)	Slump [a] acc. to DIN 1045 (1978) Diameter in mm	Concrete consistency acc. to DIN 1045-2 / DIN EN 206-1 (2001)	Slump [a] acc. to DIN 1045-2 (2001) Diameter in mm
K1	–	F1	≤ 340
K2	≤ 400	F2	350 to 410
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Flowable concrete ^a	500 to 600 ^a	F4	490 to 550
– ^b		F5	560 to 620
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^a Flowable concrete is defined acc. to the DAfStb-guideline for flowable concrete (1995).

^b The concrete consistencies F5, F6 and SCC are not covered by the DIN standard 18218 (1980).

^c For a slump [a] ≥ 700 mm the DAfStb-guideline "Self-compacting concrete" has to be considered.

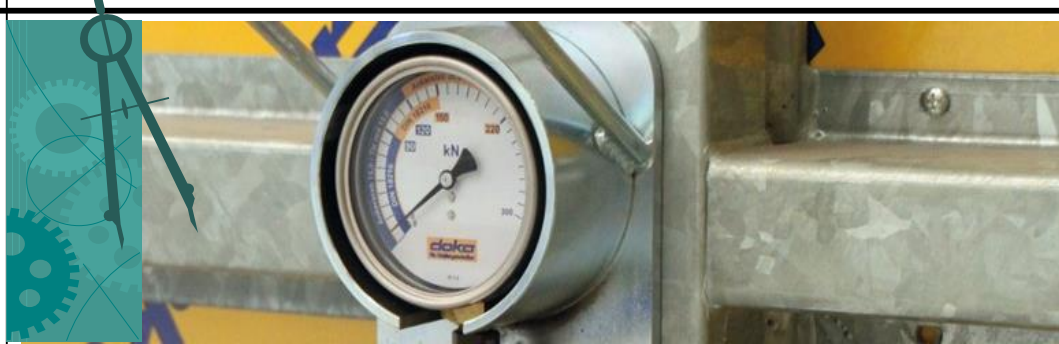


Consistency means amount of water needed to prepare a plastic mix. Consistency test is done using Vicat's apparatus. Consistency of cement should be less than 30%. Consistency test is used to find the amount of water to be mixed with cement. It is necessary to find the consistency because amount of water present in the cement paste may affect the setting time. Standard consistency is indicated by the vicat plunger reading (5 to 7) from the bottom of mould (IS 4031 (part 4) 1988)

The **concrete slump test** is an empirical test that measures the workability of fresh concrete.

More specifically, it measures the consistency of the concrete in that specific batch. This test is performed to check the consistency of freshly made concrete. Consistency is a term very closely related to workability. It is a term which describes the state of fresh concrete. It refers to the ease with which the concrete flows. It is used to indicate the degree of wetness. Workability of concrete is mainly affected by consistency i.e. wetter mixes will be more workable than drier mixes, but concrete of the same consistency may vary in workability. It is also used to determine consistency between individual batches.

The test is popular due to the simplicity of apparatus used and simple procedure. Unfortunately, the simplicity of the test often allows a wide variability in the manner that the test is performed. The slump test is used to ensure uniformity for different batches of similar concrete under field conditions, ^{[1]:127,128} and to ascertain the effects of plasticizers on their introduction. ^{[1]:134} In India this test is conducted as per IS specification.



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1B Structural Design in Wood

FORMWORK LINING MATERIAL

Formwork and concrete form types[edit]
Formwork comes in several types:

Traditional timber formwork. The formwork is built on site out of timber and plywood or moisture-resistant particleboard. It is easy to produce but time-consuming for larger structures, and the plywood facing has a relatively short lifespan. It is still used extensively where the labour costs are lower than the costs for procuring reusable formwork. It is also the most flexible type of formwork, so even where other systems are in use, complicated sections may use it.

<http://en.wikipedia.org/wiki/Formwork>

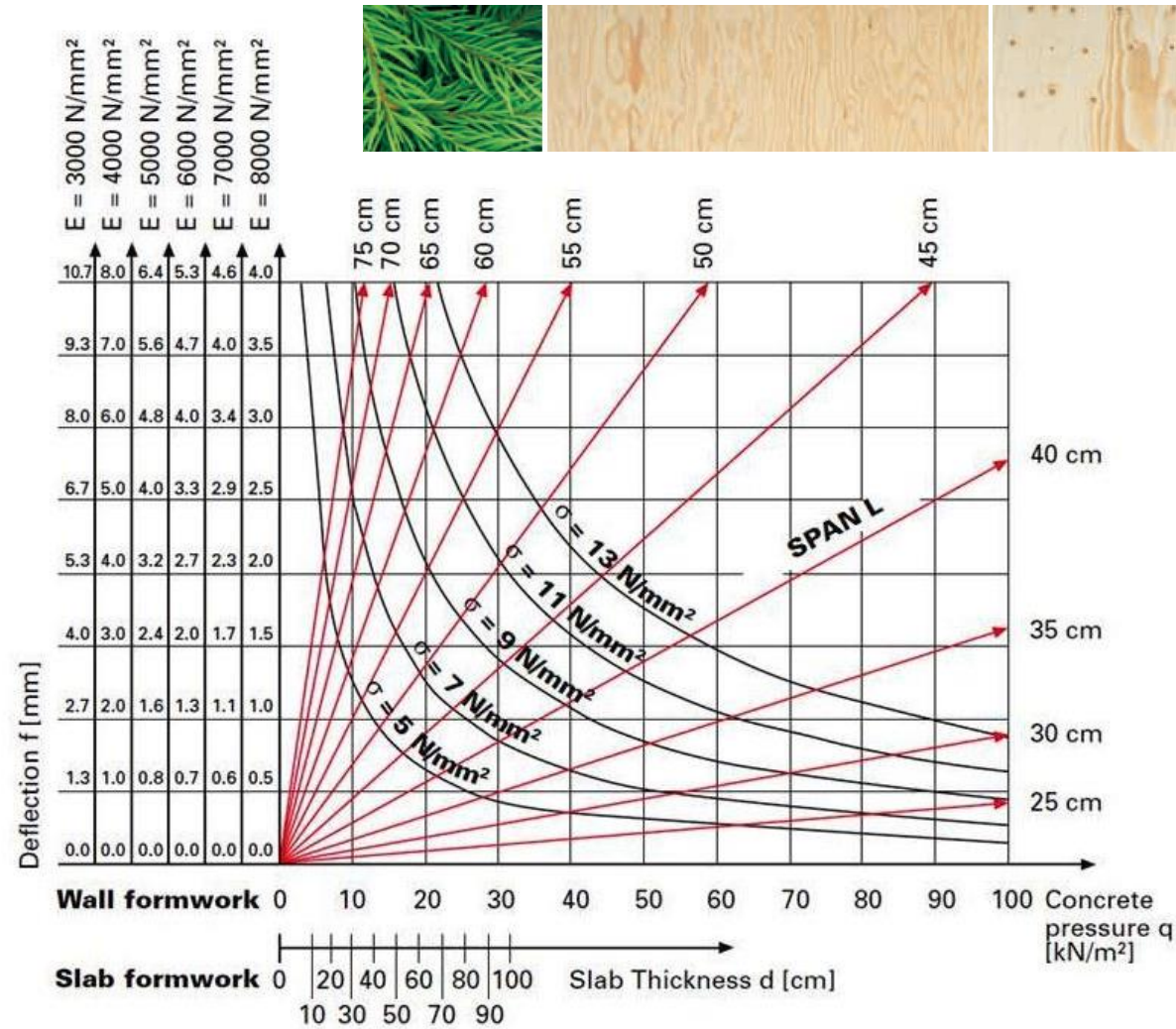
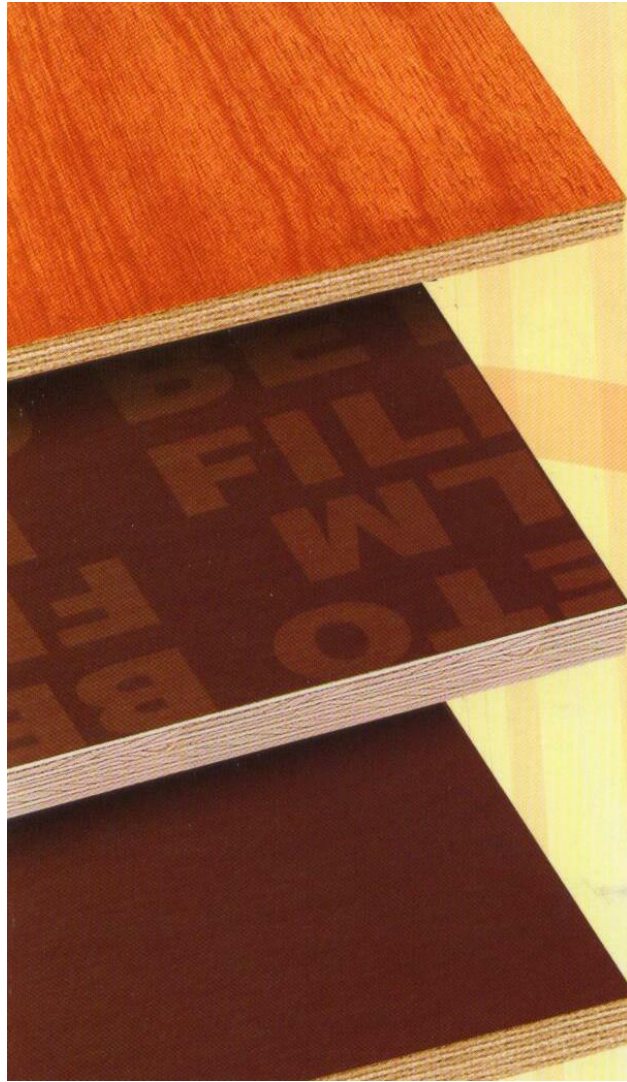


TABLE 3.1: BASIC WORKING STRESSES AND ELASTIC MODULI OF FORMWORK PLYWOOD (MPa)

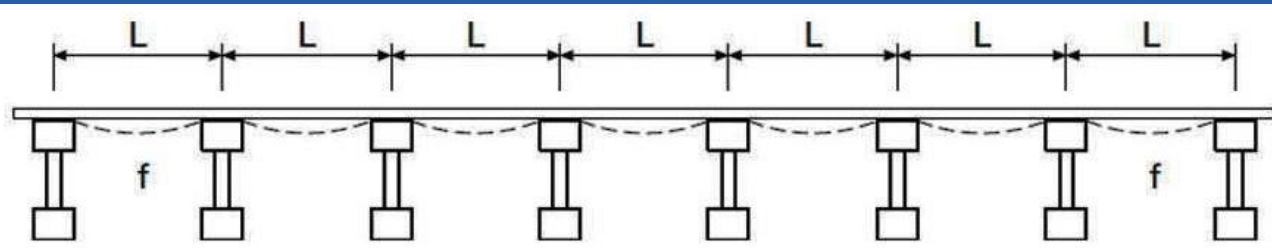
Stress Grade	Stress Value MPa					Modulus of Elasticity E	Modulus of Rigidity G
	Bending F_b	Tension F_t	Shear F_s	Compression F_c			
F11	11.0	6.6	1.80	8.3		10500	525
F14	14.0	8.4	2.05	10.5		12000	625
F17	17.0	10.2	2.30	12.8		14000	700
F22	22.0	13.2	2.30	16.5		16000	800
F27	27.5	16.5	2.30	20.6		18500	925

The above basic working stresses must be modified with the appropriate factors from AS 1720 for the concrete formwork application to establish actual design stresses. The duration of load factor K_1 has been taken as 1.65 from AS 1720.



TABLE 3.2: SECTION PROPERTIES, MOMENT OF INERTIA (I) AND SECTION MODULUS (Z) FOR STANDARD PLYWOOD FORMWORK CONSTRUCTIONS PER 1mm WIDTH

Identification Code	Nominal Plywood Thickness (mm)	Plywood Face Grain Parallel to Span		Plywood Face Grain Perpendicular to Span	
		Moment of Inertia (I) mm ⁴ / mm	Section Modulus (Z) mm ³ / mm	Moment of Inertia (I) mm ⁴ / mm	Section Modulus (Z) mm ³ / mm
12-10-5	12	70	11.0	80	15.5



The modulus of elasticity and the permissible tension is based on the grade and moisture content of the plywood.

Maximum deflection $f = 0.0068 \times q \times L^4 / E \times I$

Maximum Moment $M = 0.1071 \times q \times L^2$



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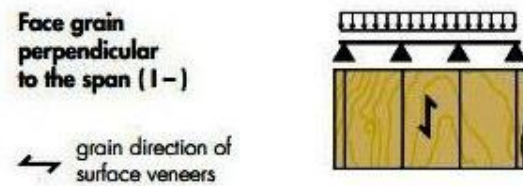
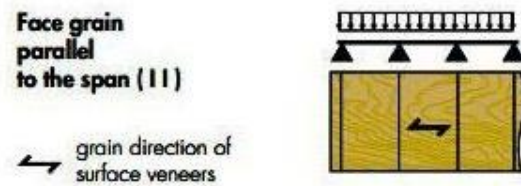
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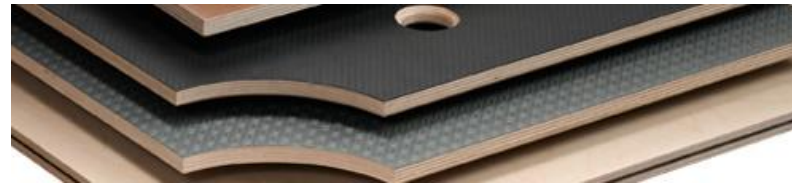
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FORMWORK LINING MATERIAL



UPM Plywood Properties



Plywood is a wooden panel composed of thin cross-bonded veneers glued together. For greater strength properties the veneers are laid crosswise, i.e. the grain directions of two consecutive layers form a 90° angle.

<http://www.wisaplywood.com/en/plywood-and-veneer/plywood/plywood-properties/Pages/default.aspx>

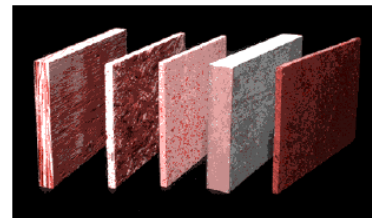
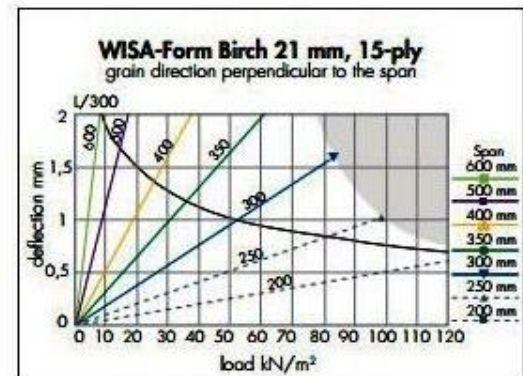
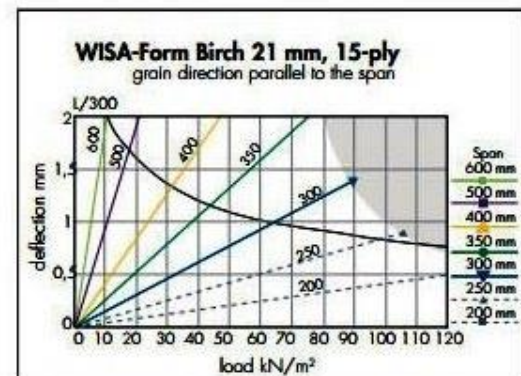
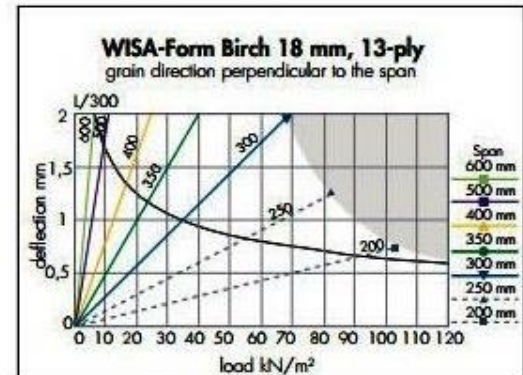
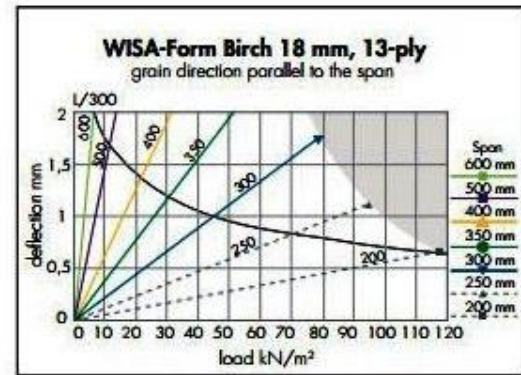
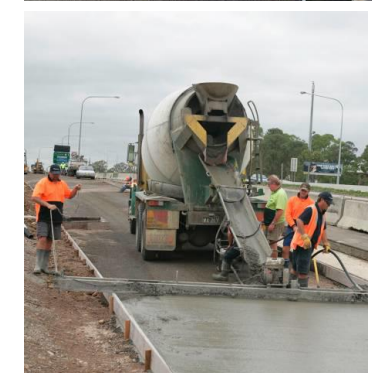
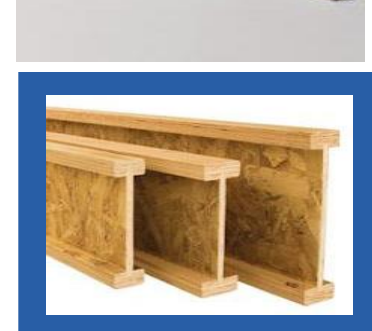


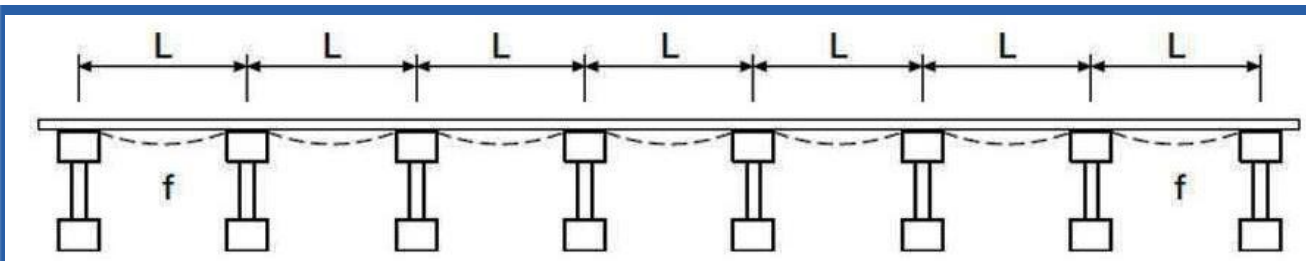
Figure 10-3. Examples of various composite products. From left to right: plywood, OSB, particleboard, MDF, and hardboard.



Moisture content 27 %, short time loading
 Partial safety factor for the material is 1.3. Partial safety factor for the loads is 1.2
 (according to the Handbook of Finnish Plywood, 2004).
 Deflection limit L/300 of the span
 Support width is not taken into account in calculations

Table 2-3. Standard plywood products

Plywood	EN 315		Finnish plywood		No of plies	Weight*** kg/m²	Combi, Combi mirror		Conifer (thin veneers)		Conifer (thick veneers)	
	thickness mm	tolerance mm	thickness mm	tolerance** mm			Face	Core	No of plies	Weight*** kg/m²	No of plies	Weight*** kg/m²
4	3.5	4.3	3.5	4.1	3	2.7	Birch	Birch	3	2.1		
6.5	5.9	6.9	6.1	6.9	5	4.4	Birch	Birch	5	3.4		
9	8.3	9.5	8.8	9.5	7	6.1	Birch	Birch	7	4.7	3	4.1
12	11.2	12.6	11.5	12.5	9	8.2	Birch	Birch	9	6.2	5/4	5.5
15	14.2	15.7	14.3	15.3	11	10.2	Birch	Birch	11	7.8	5	6.9
18	17.1	18.7	17.1	18.1	13	12.2	Birch	Birch	13	9.4	7/6	8.3
21	20.0	21.8	20.0	20.9	15	14.3	Birch	Birch	15	10.9	7	9.7
24	22.9	24.9	22.9	23.7	17	16.3	Birch	Birch	17	12.5	9/8	11.0
27	25.2	28.4	25.2	26.8	19	18.4	Birch	Birch	19	14.0	11/9	12.4
30	28.1	31.5	28.1	29.9	21	20.4	Birch	Birch	21	15.6	13/10	13.8
35	33.5	36.1	33.5	35.5	25	23.8						
40	38.4	41.2	38.8	41.2	29	27.2						
45	43.3	46.4	43.6	46.4	32	30.6						
50	48.1	51.5	48.5	51.5	35	34.0						



The modulus of elasticity and the permissible tension is based on the grade and moisture content of the plywood.

Maximum deflection $f=0.0068xqxL^4/ExI$

Maximum Moment $M=0.1071qL^2$



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Moments and Bending Moments of Inertia, Area, Mass

I-Beam Calculator

Moments and Bending Moments of Inertia, Area, Mass

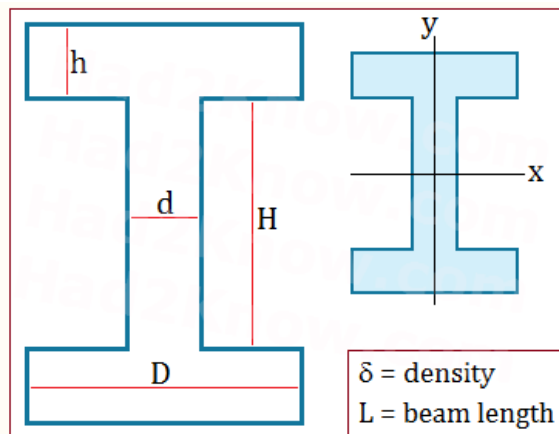
<http://www.had2know.com/technology/i-beam-calculator-moments-engineering.html>



I-beams, also called "wide flange" or W-beams, are preferred in construction because their I-shape allows them to withstand strong shearing and bending forces. See also Hollow Rectangular Beams. To calculate loads and forces on an I-beam, you need to know the cross-sectional area, the moments of inertia in the x- and y-directions, as well as the bending moments of inertia (aka area moments of inertia) in the x- and y-directions.

Using the image above as a guide, enter the dimensions of the I-beam into the calculator. D is the width of the flange, d is the width of the web (center support column), H is the height of the web, and h is thickness of the flange. In the calculator, L is the total length of the beam and δ is the density of the material.

For the calculator, enter distances in centimeters and the density in kg/cm³. Remember 100 cm = 1 meter and 1000 grams = 1 kg. Use the Had2Know conversion calculator if needed.



I-Beam Engineering Calculator	
D =	<input type="text" value="8"/> cm
d =	<input type="text" value="2.7"/> cm
H =	<input type="text" value="12"/> cm
h =	<input type="text" value="4"/> cm
L =	<input type="text" value="100"/> cm
δ =	<input type="text" value="0.55"/> kg/cm ³
<input type="button" value="Compute I-Beam Properties"/> <input type="button" value="Clear"/>	
Cross-Sectional Area =	<input type="text" value="96.4"/> cm ²
Beam Volume =	<input type="text" value="9640"/> cm ³
Beam Mass =	<input type="text" value="5302"/> kg
Moment of Inertia I_x =	<input type="text" value="4463184"/> kg·cm ²
Moment of Inertia I_y =	<input type="text" value="4438189.23167"/> kg·cm ²

<http://www.engineersedge.com/calculators.htm> <http://www.onlinestructuraldesign.com/calculations>



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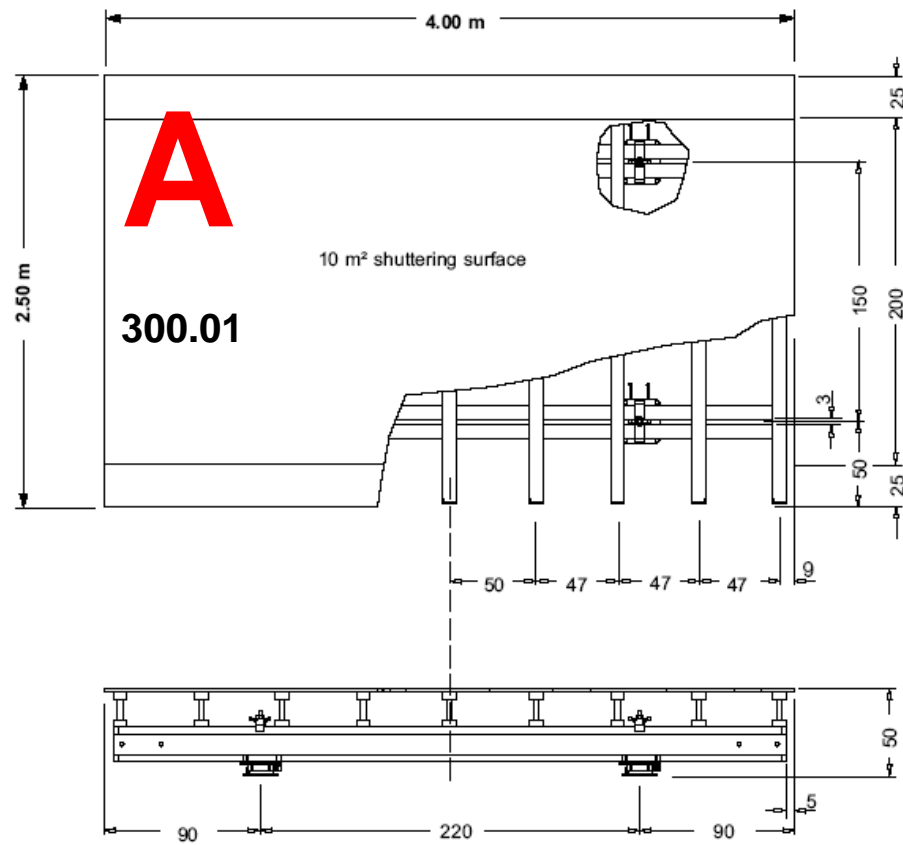
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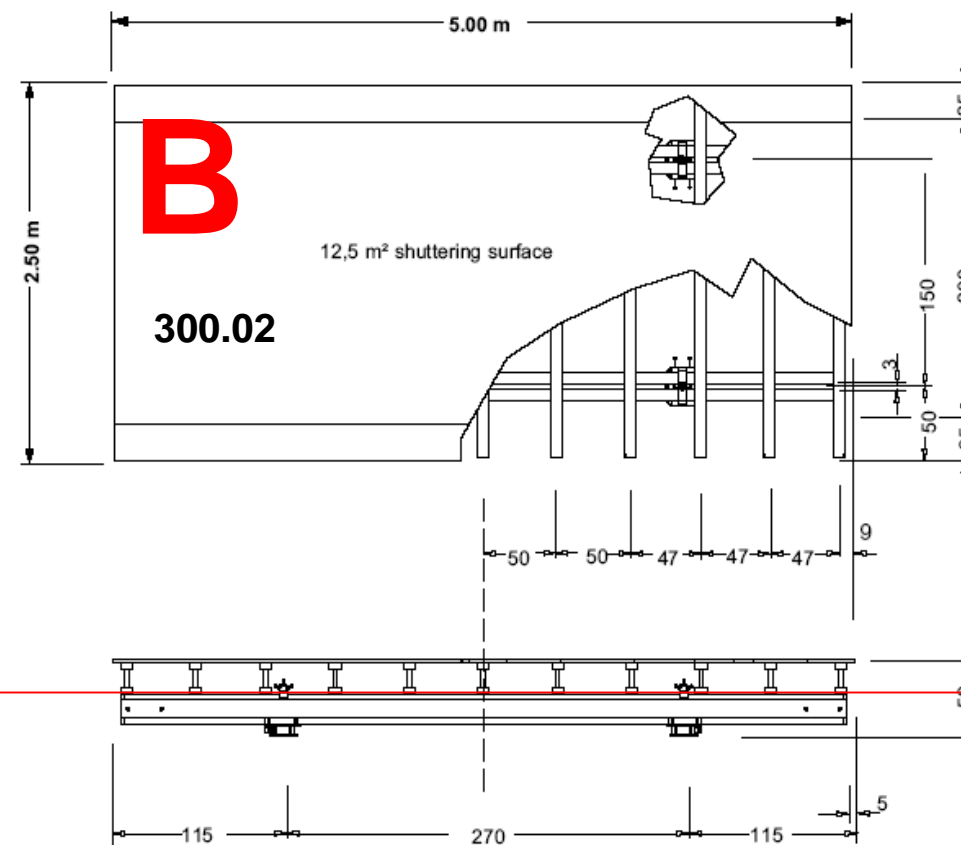
Балка Деревянная для монолитного строительства от производителя

Для системы перекрытий разборно-переставной опалубки

H 20 Floor Table 2.5 x 4.0 m



H 20 Floor Table 2.5 x 5.0 m



WEIGHT=5.00 kg/m

H20-Mechanical Characteristics:

Elastic Module:	E=105,000 kg/cm ²
Resistance Module:	W=460 cm ³
Inertia Module:	J=4600 cm ⁴
Fir wood bending R:	Z=1,20 kN/cm ²
Bending Moment:	M=5,00 kNm
Shearing Force:	T=11 kN
Weight:	Pm=5,0 Kg/m



LOAD ASSUMPTIONS:

Weight of concrete:	26.00 kN/m ²
Dead load table:	0.40 kN/m ²
Live Load:	



Slab Thickness: T (cm)	Probe Load A (kN) Slab=2.50X4.00	Probe Load A (kN) Slab=2.50X5.00
10	10.90	13.60
15	14.10	17.70
20	17.40	21.70
25	20.60	25.80
30	24.00	30.00
35	27.90	34.90
40	31.80	
45	35.70	



NOTES

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SLAB 2.50X4.00 mt
SLAB 2.50X5.00 mt

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SLAB FORM WORKS

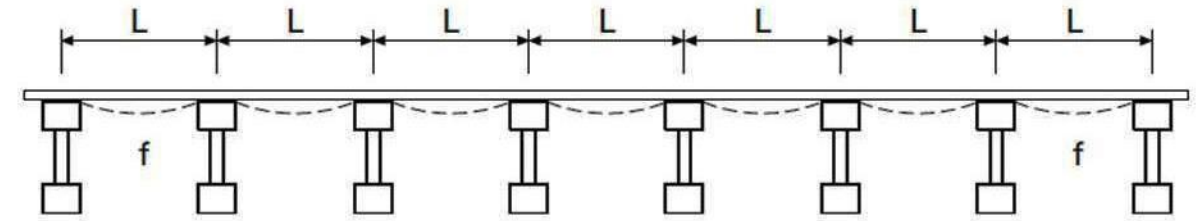
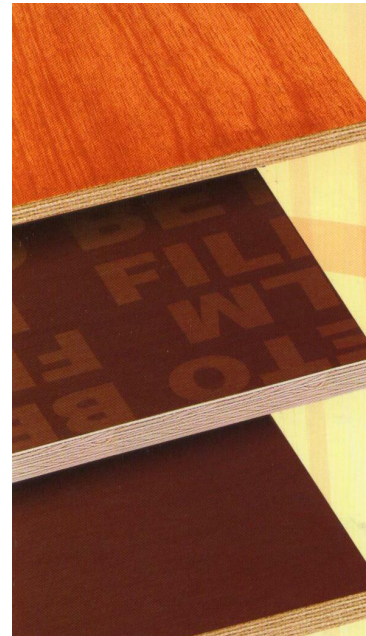
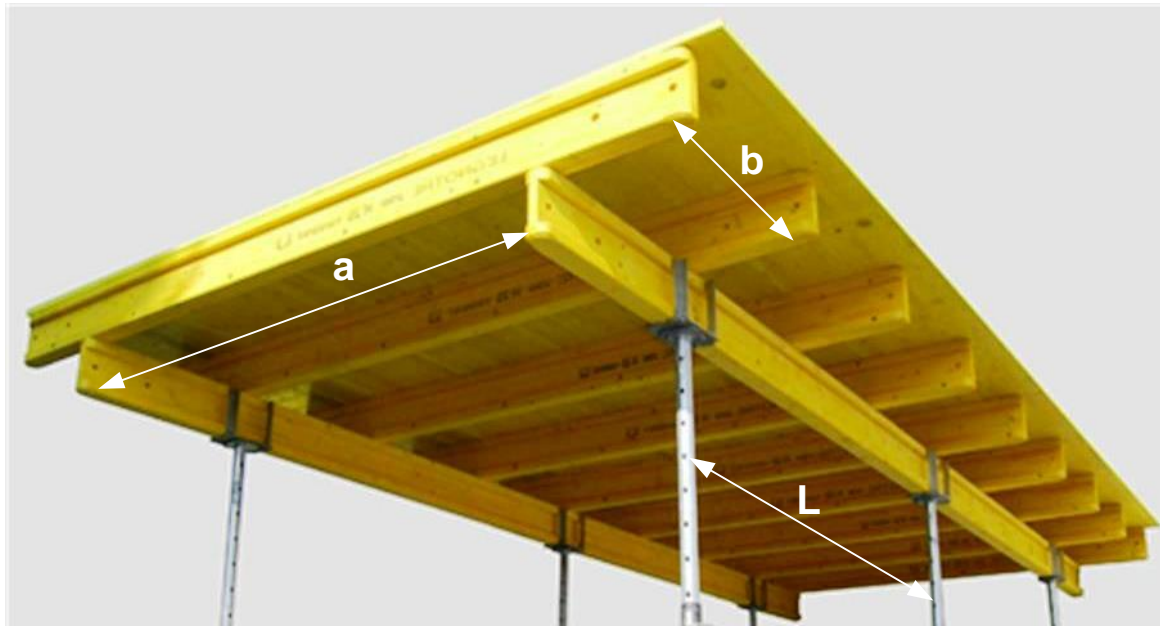
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Балка Деревянная для монолитного строительства от производителя

Для системы перекрытий разборно-переставной опалубки

READY SLABS FOR ANY SIZE



The modulus of elasticity and the permissible tension is based on the grade and moisture content of the plywood (see page 8).

$$\text{Maximum deflection } f = \frac{0.0068 \cdot q \cdot L^4}{E \cdot I}$$

$$\text{Maximum Moment } M = 0.1071 \cdot q \cdot L^2$$

(valid for at least 3 bays)



SLAB FORM WORK		SPAN BETWEEN LOWER BEAMS (m)													
Slab cm	Load kN/m ²	Upper grid distances b=(m)				Span between probes									
		0.5	0.625	0.675	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	3.00	3.50	
		Lower grid distances a=(m)													
10	4.35	3.67	3.40	3.33	3.20	2.91	2.70	2.48	2.29	2.14	2.02	1.92	1.69	1.44	
12	4.87	3.47	3.22	3.15	3.03	2.75	2.55	2.34	2.17	2.03	1.91	1.81	1.51	1.29	
14	5.39	3.30	3.07	3.00	2.89	2.62	2.43	2.22	2.06	1.93	1.81	1.63	1.36	1.17	
16	5.91	3.17	2.94	2.88	2.77	2.52	2.33	2.12	1.97	1.84	1.65	1.49	1.24	1.06	
18	6.43	3.05	2.83	2.77	2.67	2.42	2.23	2.04	1.89	1.71	1.52	1.37	1.14	0.98	
20	6.95	2.95	2.74	2.68	2.58	2.34	2.15	1.96	1.81	1.58	1.41	1.27	1.06	0.90	
22	7.47	2.86	2.66	2.60	2.50	2.27	2.07	1.89	1.68	1.47	1.31	1.18	0.98	0.84	
24	7.99	2.79	2.59	2.53	2.43	2.21	2.00	1.83	1.57	1.38	1.22	1.10	0.92	0.79	
26	8.51	2.72	2.52	2.47	2.37	2.16	1.94	1.72	1.48	1.29	1.15	1.03	0.86	0.74	
28	9.03	2.65	2.46	2.41	2.32	2.10	1.88	1.62	1.39	1.22	1.08	0.97	0.81	0.70	
30	9.61	2.59	2.41	2.36	2.27	2.04	1.82	1.53	1.31	1.14	1.02	0.92	0.76	0.65	
35	11.17	2.47	2.29	2.24	2.16	1.89	1.58	1.31	1.13	0.98	0.88	0.79	0.66	0.56	
40	12.73	2.36	2.19	2.15	2.05	1.73	1.38	1.15	0.99	0.86	0.77	0.69	0.58	0.49	
45	14.29	2.27	2.11	2.05	1.93	1.54	1.23	1.03	0.88	0.77	0.68	0.62	0.51	0.44	
50	15.85	2.20	2.01	1.95	1.83	1.39	1.11	0.93	0.79	0.69	0.62	0.56	0.46	0.40	
55	17.41	2.13	1.92	1.86	1.68	1.26	1.01	0.84	0.72	0.63	0.56	0.51	0.42	0.36	
60	18.97	2.05	1.84	1.74	1.55	1.16	0.93	0.77	0.66	0.58	0.52	0.46	0.39	0.33	
65	20.53	1.97	1.71	1.61	1.43	1.07	0.86	0.71	0.61	0.54	0.48	0.43	0.36	0.31	
70	22.09	1.90	1.59	1.49	1.33	1.00	0.80	0.66	0.57	0.50	0.44	0.40	0.33	0.28	

Dead weight of formwork weight:	a=0.35 kN/m ²
Weight of concrete:	b=25 kN/m ³ xd(m)
Changing Load:	p=0.20xb (1.50 ≤ p ≤ 4,24 kN/
Total load:	g=a+b+c
Maximal deflection moment	5.00 kN
Moment of Inertia Ix:	4613 cm ⁴
Maximal deflection:	f=1/500

NOTES



Rev	Description	Date	Name	Check
Rev-3				
Rev-2				
Rev-1				
Date	Drawn	Check	Appr.	Scale
26 Dec 2011	A.Bicanova	F.Yasar	F.Yasar	J.Dusembaeva

FORM WORK SYSTEMS		ALTINAY LIBRARY	
SLAB SIZING		TOMORROW WORLD TODAY	
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		8829	1/1
Symbol	Unit No	Cat	Type+Format
DWG	00	A	UD
Serial No	Rev		
0100.3	00		



HH20S

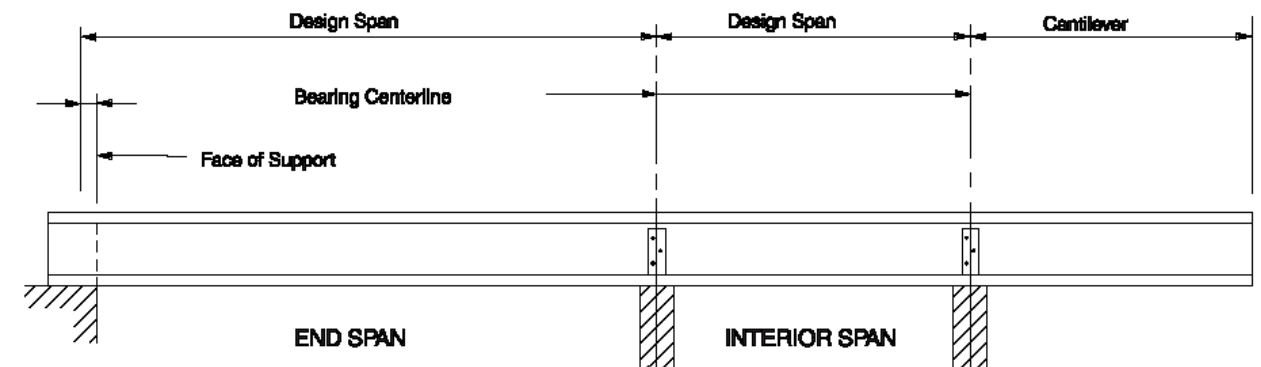
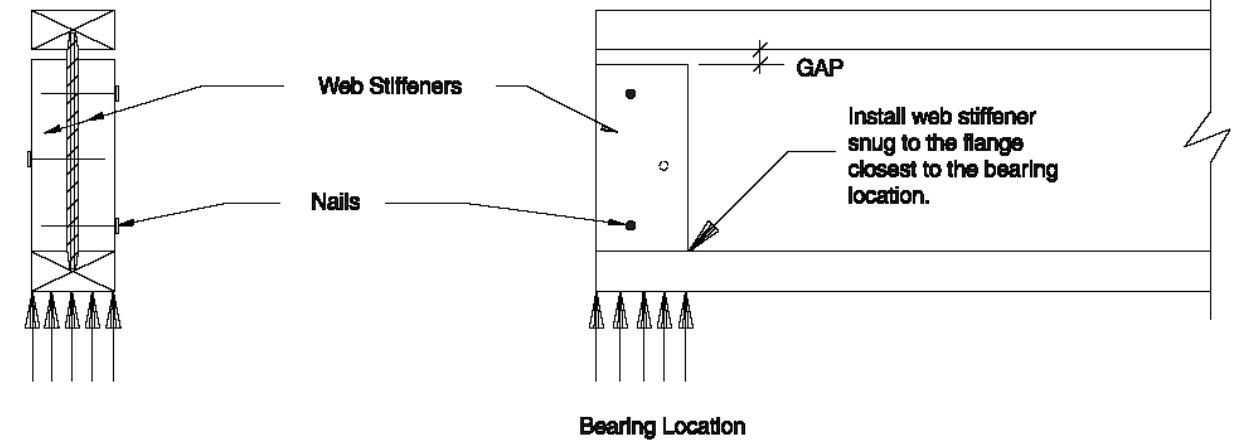
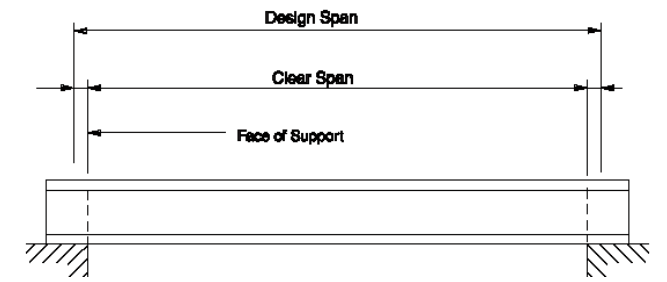
HH16S

HH12S

FORM WORK GIRDERS

STANDARD FLANGE, DOUBLE WEB, LONG LIFE, SELF WEDGING

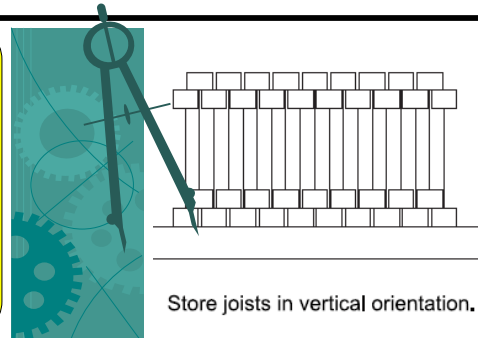
	H20S	HH16S	HH12S
Permitted shear force-Q (kNewton)	13.00	11.00	8.50
Permitted bending moment (kNm)	7.00	5.00	4.00
Moment of Inertia (Iv=cm4)			
Weight (kg)	5.90		



TOMORROW NEW FORMWORK TODAY



NOTES



Rev-3					
Rev-2					
Rev-1					
Rev	Description	Date	Name	Check	
	Date	Drawn	Check	Appr.	Scale
	26 Dec 2011	A.Bicanova	F.Yasar	F.Yasar	J.Dusembaeva

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		8829	1/1	DWG	00	A	UD	0100.3	00	