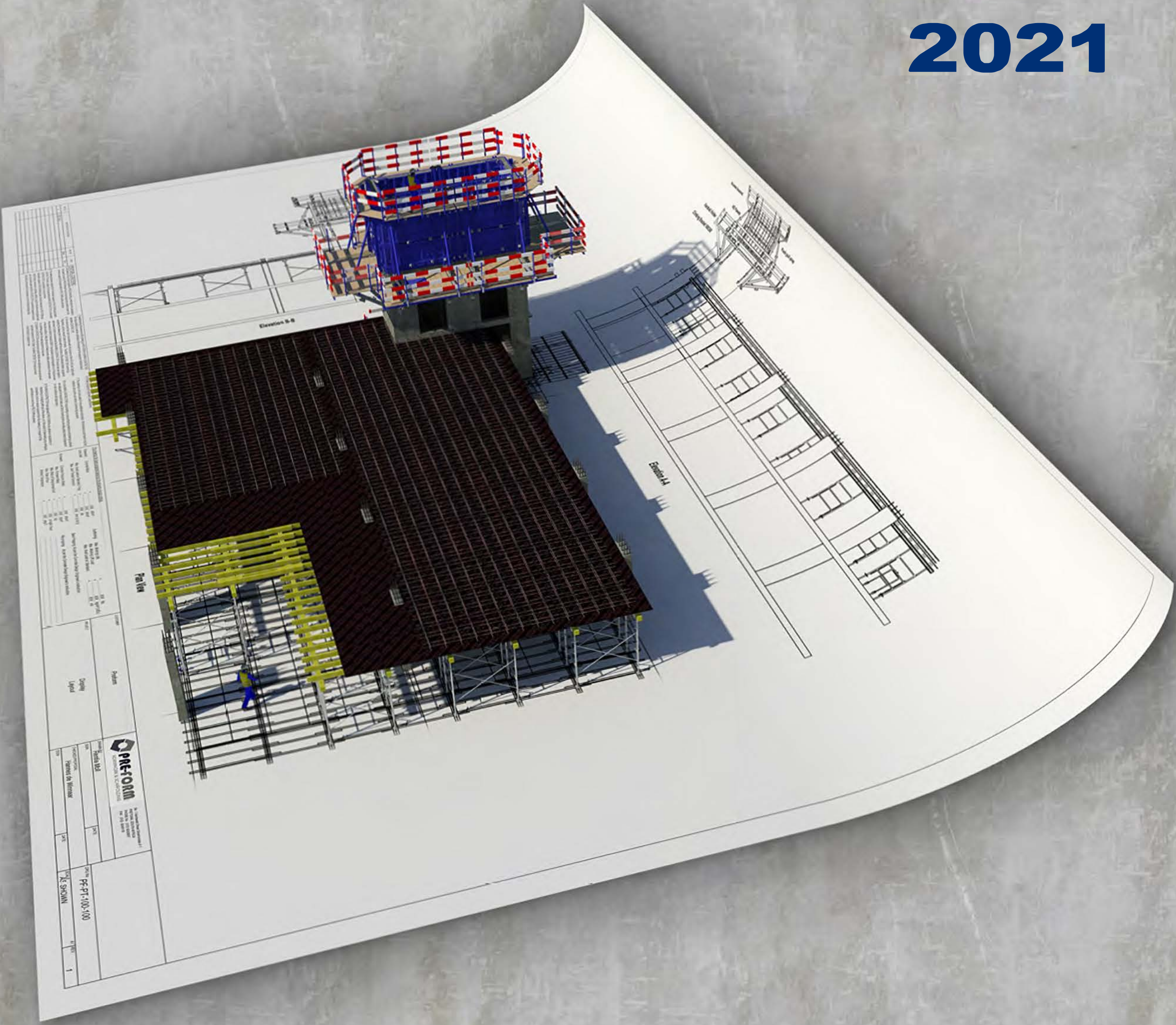
Formwork Manual 2021



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About Us

Pre-Form is widely recognized as one of the industry's leaders in design, manufacture, supply and erection of all types of formwork and scaffolding. We have almost 4 decades of experience and a combination of innovation, manufacturing quality and delivery that uniquely positions us in the South African and International markets.

Pre-Form operates from 2 premises in Pretoria. We strive to employ the best talent in the industry, therefor every member of our team is handpicked. All of our staff are dedicated to meeting and exceeding our customers expectations.

Being in formwork manufacturing for close to 40 years as well as doing supply and erection projects for the last 20 years, we understand the demands on time, quality and cost and we have delivered time and time again within those constraints.

Pre-Form's hire and contracting offering is unique to the market because we offer the widest range of custom solutions for every situation. **Pre-Form** is the leading South African formwork company that can deliver on the following:

- Detailed formwork design and program planning.
- Local manufacturing of standard and special formwork.
- Flexible project models ranging from sales, hires or complete supply and erect solutions.
- Innovation and product development of products and solutions that are unique to the South African market.

Pre-Form understands that it is important for our customers to maximize the investments already made in formwork assets. We will work with you to establish how best we can utilize your equipment in conjunction with ours, to maximize your return on investment.

Our on site advisers have a background in construction and project management which allows them to provide training programs regarding formwork and construction. As well as keeping up to date with optimal solutions to the ever changing site environment. Responsibilities could extend to formwork inspection and managing of the formwork's site budget.

Our manufacturing facilities specialize in both high volume formwork commodities as well as customized formwork. Therefor **Pre-Form** is able to deliver locally and internationally in demanding schedules on any big projects.

As part of our innovation drive we have built-up significant partnerships with key European suppliers and customers. As a testament to this fact, we have exported countless of containers of formwork since 1990.

Our technology and quality complies with AFNOR and other European norms and safety standards.
(EN1065, EN12813, EN13377, SANS0100, SANS1062, NZS3901)

We source products from India, China, Europe and New Zealand to provide low cost formwork and scaffolding. Our crane handled walling systems are sourced from Italy. We are currently South Africa's biggest independent importer of engineer grade timber formwork panels, plywood, girders and LVL beams.

We understand that choosing the correct formwork solution is critical to the overall success of our customers projects. **Pre-Form**'s formwork solution is more than just equipment. We deliver value through the entire lifecycle of the formwork from program planning, formwork design, manufacture, delivery and erection.

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Second Edition
2020/10/08

Preface:

The purpose of this first edition manual is to provide an introductory approach to the design of Pre-Form supplied formwork systems. The information is intended for use by formwork operation supervisors, site managers as well as temporary works designers.
Tables, graphs and simplified formulas allow the manager to design and plan formwork systems in a cost-effective, good-practice and safe manner, utilizing formwork systems and components which they are accustomed to.
If any assistance is required which is not covered in the manual, or to cross-reference information, please contact Pre-Form's Technical Department.

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Suggestions for additional content, please use the above contact details.

About Pre-Form's Technical Department:

Our design office uses state-of-the-art software technology (AutoCAD, Inventor, ANSYS, Prokon, 3DS Max, Revit, Robot, CCS, Navisworks, and other) to design and deliver the Perfect Formwork Solution.

We are committed to supply the most economical and safest solution for all our customers formwork requirements.

We offer the following design services:
1. Falsework and scaffolding designs and layouts;
2. Special requirement projects and precast moulds;
3. Back-propping designs and layouts;
4. Formwork related BIM (Building Information Modeling);
5. Assistance with buildability studies and construction processes/methods;
6. Finite element analysis reports;
7. Custom designs to comply with various standards, and
8. Cost and quantity estimation for in-tender phase projects.

The solution offering is more than a formwork design:
1. Complete method statements;
2. Quantity surveying;
3. Program and resource histograms (on request);
4. Detailed CCS worksheets;
5. Risk analysis and prevention plans, and
6. Quality assurance system implementation.

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Formwork Related Load, Pressure and Force Types

1. Load Types related to Formwork designs:

1.1. Dead Load from reinforced concrete density (DIN 1055):
- 1.1.1. For slab thickness less than 1m = 25 kN/m³
- 1.1.2. For slab thickness greater than 1m and beams = 26 kN/m³
- 1.1.3. Allowance for fresh concrete (heaping) = 1 kN/m³

1.2. Live Loads:
- 1.2.1. Construction Live Loads assumed as 20% of fresh concrete dead load, but not less than 1.5 kN/m² and not more than 5 kN/m². Self Weight of formwork is included in allowable Construction Live Load (DIN4421).
- 1.2.2. Access Live Loads for heavy human traffic and tools assumed as 1,6 kN/m².
- 1.2.3. Platform Live Loads assumed as 1 kN/m² where work is done without heavy tools and equipment.

1.3. Dynamic Live Loads:
- 1.3.1. Imposed Plant Loads, if such loads are expected load values must be supplied by manufacturer,
- 1.3.2. Concrete Skip impact Loads,
- 1.3.3. Concrete pipe dynamic movement during pumping,
- 1.3.4. Excessive heaping of concrete during concrete placement.

1.4. Horizontal Loads:
- 1.4.1. Minimum horizontal stability force (containment force), for example 15% for Sta-Flex.

1.5. Environmental Loads:
- 1.5.1. Snow and Ice loads (not applicable in South Africa),
- 1.5.2. Wind Loads;
  - 1.5.2.1. Generally 0.5kN/m² for $h<8$m and 0.8kN/m² for $8<h<20$m,
  - 1.5.2.2. If more accurate of greater heights formwork wind loads are required, refer to the Wind Pressure Section of this manual.
  - 1.5.2.3. The aerodynamic coefficient, C_p, for formwork will be simplified to 1.3 due to the geometry.

1.6. Hydrostatic Concrete Pressure:
- 1.6.1. 3 international methods are used for determining concrete pressure in vertical formwork;
  - 1.6.1.1. CIRIA report 108 (United Kingdom), (used by Pre-Form),
  - 1.6.1.2. ACI 347R (USA),
  - 1.6.1.3. DIN 18218 (Germany).

1.7. Formwork Self Weight:
- 1.7.1. Under normal construction conditions Formwork Weight Loads are included in the construction live loads, but special conditions require additional load consideration;
  - 1.7.1.1. where large imposed loads have to be supported, resulting in above average amount of support,
  - 1.7.1.2. great heights of support or access scaffolding,
  - 1.7.1.3. climbers on walls and cores,
  - 1.7.1.4. loading platforms,
  - 1.7.1.5. specialized formwork, etc.

2. Back Propping Loads

2.1. Two common types of loads are normally given, refer to the Back Propping section of this manual for more information and calculations:
- 2.1.1. Slab resistance as a percentage of initial dead and live loads, imposed by the fresh concrete pour,
- 2.1.2. Design Live Loads for what the slab was designed for.

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Vertical Formwork Related Slab and Beam Loads

1. Units and symbols:

1.1. F = total vertical load for an area due to the combined dead and live loads in kN;
1.2. F_d = dead load of the concrete and reinforcing for an area in kN;
1.3. F_l = live loads imposed by construction activities and form work for an area in kN;
1.4. ω = total load per unit length in kN/m;
1.5. P = total area load that the concrete will impose in kN/m²;
1.6. P_d = dead area load of concrete in kN/m³;
1.7. P_L = construction live area load in kN/m³;
1.8. ρ = density in kN/m³;
1.9. A = area of interest in kN/m²,
1.10. d = thickness or depth of slab in m;

2. Vertical loads imposed by fresh slab on support formwork during normal construction conditions casting:

2.1. Formulas:
2.1.1. F = dead load + live load = $\rho.d.A + P_L.A$ (kN) - Load in kN for d<250mm and d>1000
2.1.2. or F = dead load x 20% = $\rho.d.A \times 1.2$ (kN) - Load in kN for 250 < d < 1000mm
2.1.3. $P = \rho.d + P_L$ (kN/m²) - Pressure in kN/m²

2.2. Dead Load:
2.2.1. $F_d = \rho.d.A$ (kN)
2.2.2. $P_d = \rho.d$ (kN/m²)
2.2.3. ρ = 26kN/m², (25kN/m³ + 1kN/m³) if d < 1m ...1kN/m³ for heaping
2.2.4. ρ = 27kN/m², (26kN/m³ + 1kN/m³) if d > 1m ...1kN/m³ for heaping

2.3. Live Load:
2.3.1. $P_L = 1{,}2.P_d$ but $1{,}5 < P_L < 5$ kN/m²
2.3.2. Refer to "Construction Live Loads vs. slab thickness graph" at bottom right side of page.

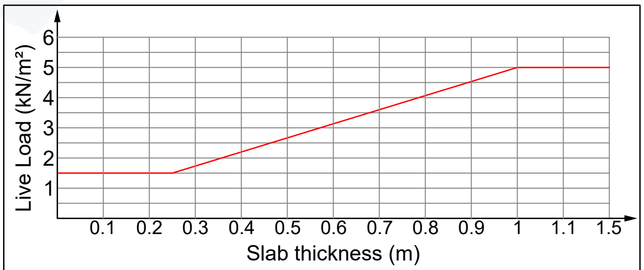
2.4. Other Loads:
2.4.1. The formulas stated and table is for normal construction conditions without excessive heaping during concrete placement. If dynamic or other type of loads are expected, it must be added.

3. Tabulated concrete loads for slab thickness:

Vertical Wet Concrete Loads (kN/m²)			
Slab Thickness (m)	Dead Load (kN/m²)	Live Load (kN/m²)	Total Load (kN/m²)
0.17	4.4	1.5	5.9
0.2	5.2	1.5	6.7
0.25	6.5	1.5	8
0.3	7.8	1.6	9.4
0.35	9.1	1.8	10.9
0.4	10.4	2.1	12.5
0.45	11.7	2.3	14
0.5	13	2.6	15.6
0.55	14.3	2.9	17.2
0.6	15.6	3.1	18.7
0.65	16.9	3.4	20.3
0.7	18.2	3.6	21.8
0.75	19.5	3.9	23.4
0.8	20.8	4.2	25
0.85	22.1	4.4	26.5
0.9	23.4	4.7	28.1
0.95	24.7	4.9	29.6
1	26	5	31
DIN 1055 and DIN 4421			

Concrete weight alternative formula:
To calculate the force or weight of an area wet concrete, use the table to determine Total Load for a corresponding slab thickness.

1. Formula
   1.1. **F = P.A** (kN)
   1.2. eg. the weight of a 2 x 2m, and 400mm slab will be : F = 12.5 x (2 x 2) = 50 kN
2. Uses:
   2.1. Leg load,
   2.2. Prop Load,
   2.3. Total weight to be back propped,
   2.4. Counter balance block weight, etc.



Construction Live Load vs. Slab Thickness

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Hydrostatic Formwork Concrete Pressures

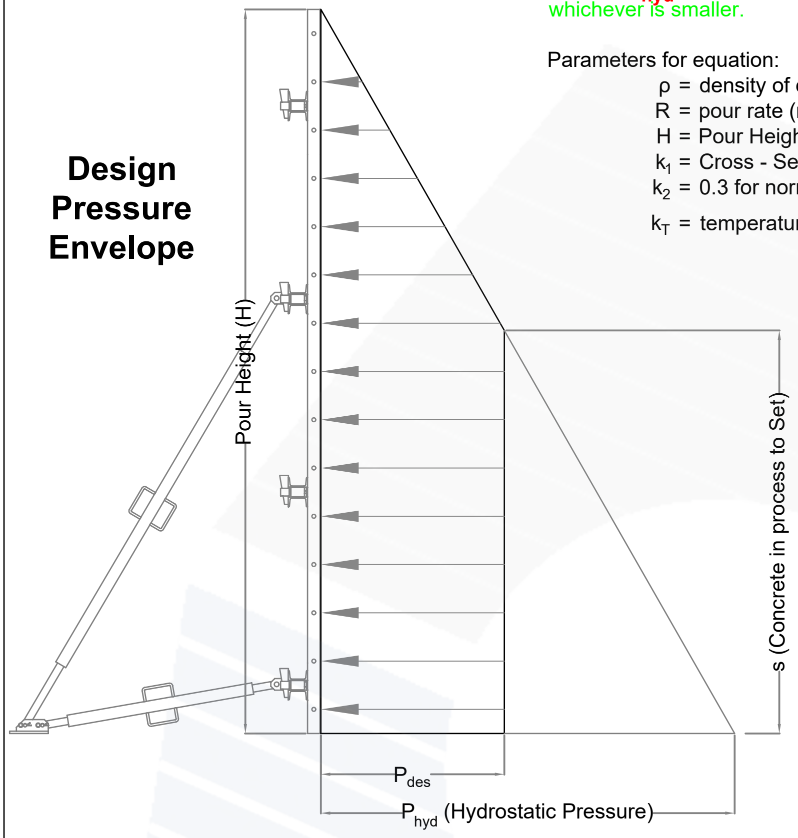
CIRIA Report 108

$P_{des} = \rho(k_1\sqrt{R} + k_2.k_T\sqrt{H - k_1\sqrt{R}})$ **... lateral design pressure**

or

$P_{hyd} = \rho H$ **... full hydrostatic pressure**

whichever is smaller.



Parameters for equation:

- ρ = density of concrete (kN/m^3);
- R = pour rate (m/h);
- H = Pour Height (m);
- k_1 = Cross - Section Coefficient*, (1 for walls and 1.5 for columns);
- k_2 = 0.3 for normal concrete, and 0.45 for concrete with setting retarders;
- k_T = temperature coefficient where: $k_T = (\frac{36}{T+16})^2$ °C.

***Note:**

k_1 = Cross-Section Coefficient.
k_1 in the CIRIA Report 108 is 1 for walls and 1.5 for columns.
If both edge lengths in plan are smaller than 2m, the cross-section are designated as a column.

Example:

Assume normal concrete of density 25kN/m^3, wall section, 3m shutters, with a pour rate of 2m/h at 10°C.

P_{des} = 25(1$\sqrt{2}$ + 0,3x1,349$\sqrt{3\text{-}1\sqrt{2}}$) = 48 kPa

or

P_{hyd} = ρH = 25x3 = 75 kPa

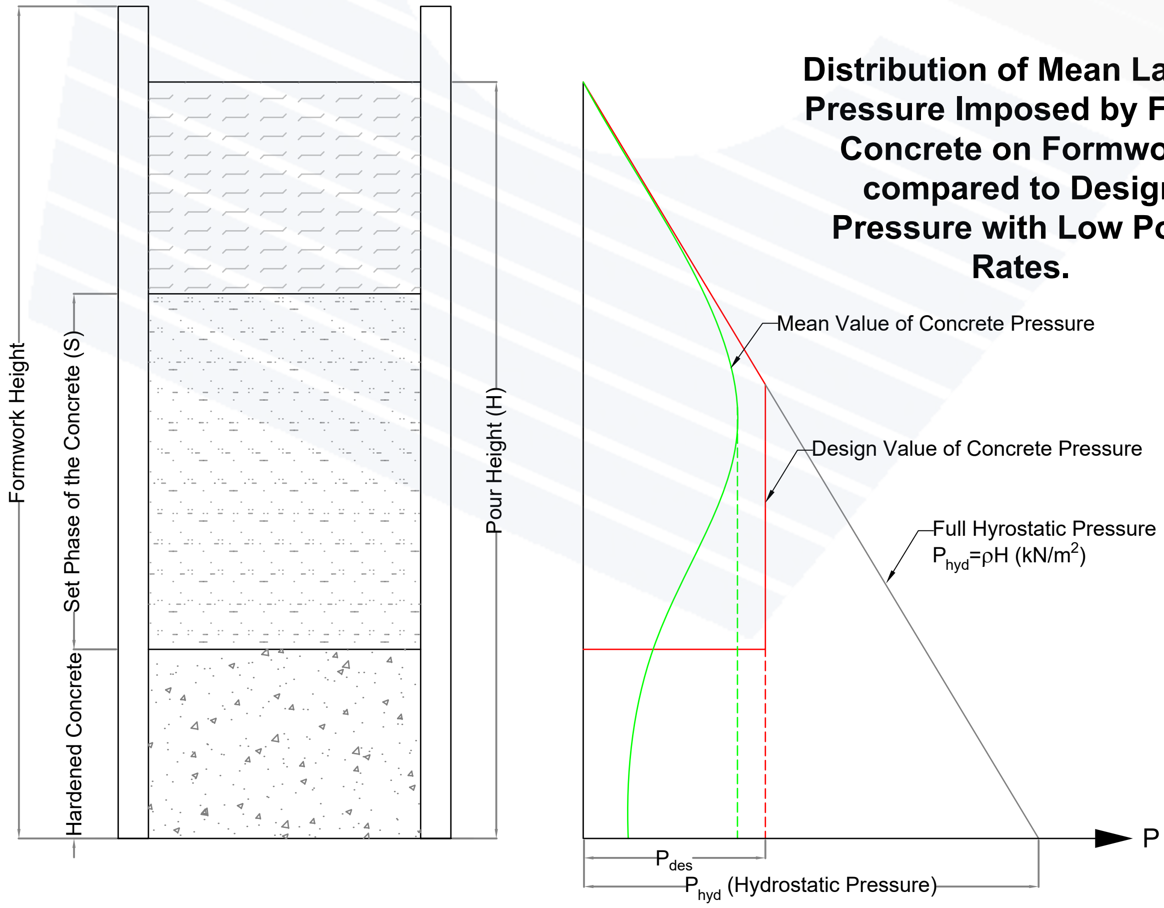
Pressure will be approximate 48 kPa.

How to determine s:

Formula: $s = (\rho H - P_{des})/\rho$

Example: s = ((25x3)-48)/25 = 1.08 m

Distribution of Mean Lateral Pressure Imposed by Fresh Concrete on Formwork compared to Design Pressure with Low Pour Rates.



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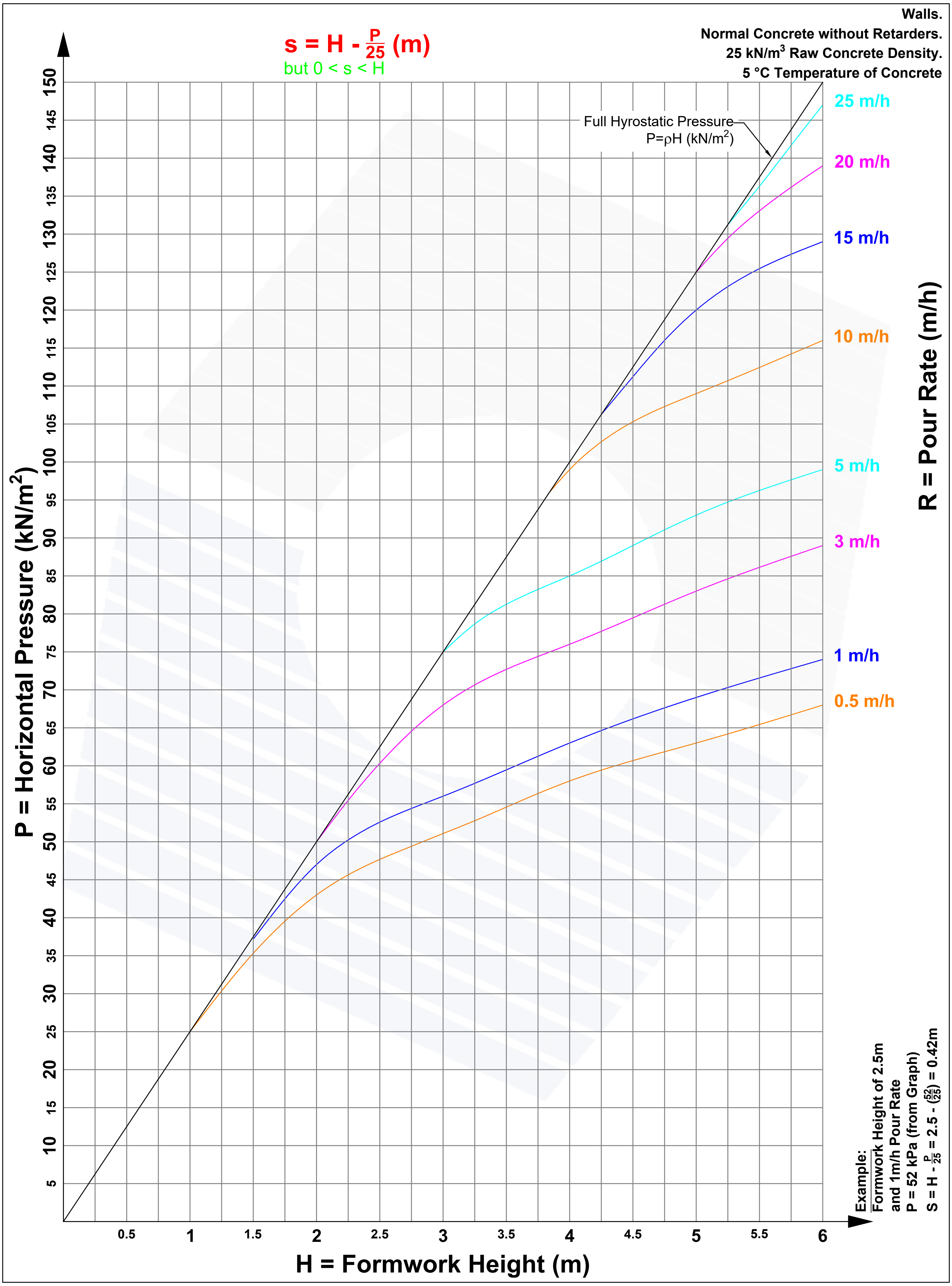
Horizontal Formwork Pressure on Walls (5°C)



Horizontal Formwork Pressure on Walls (10°C)

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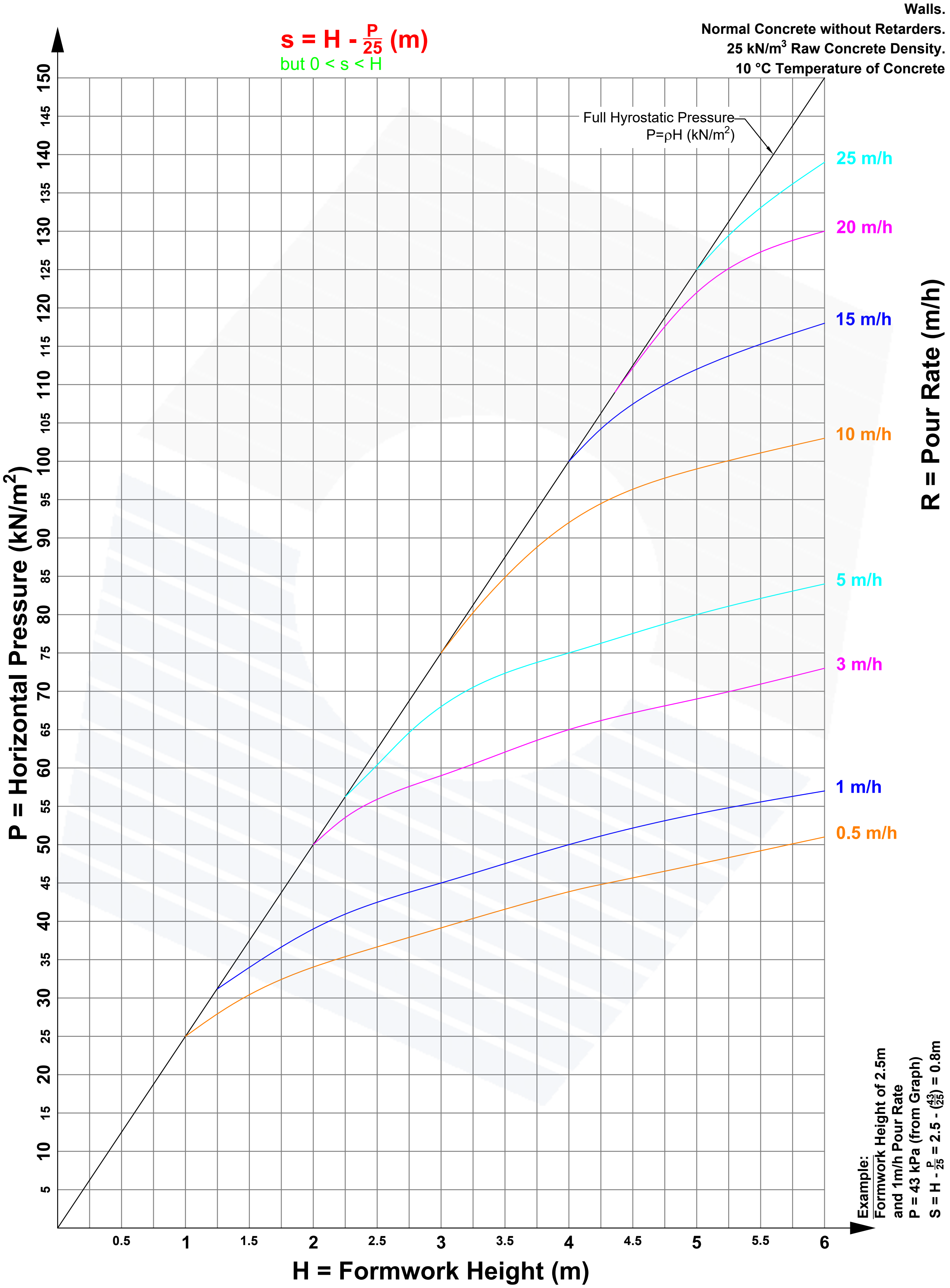

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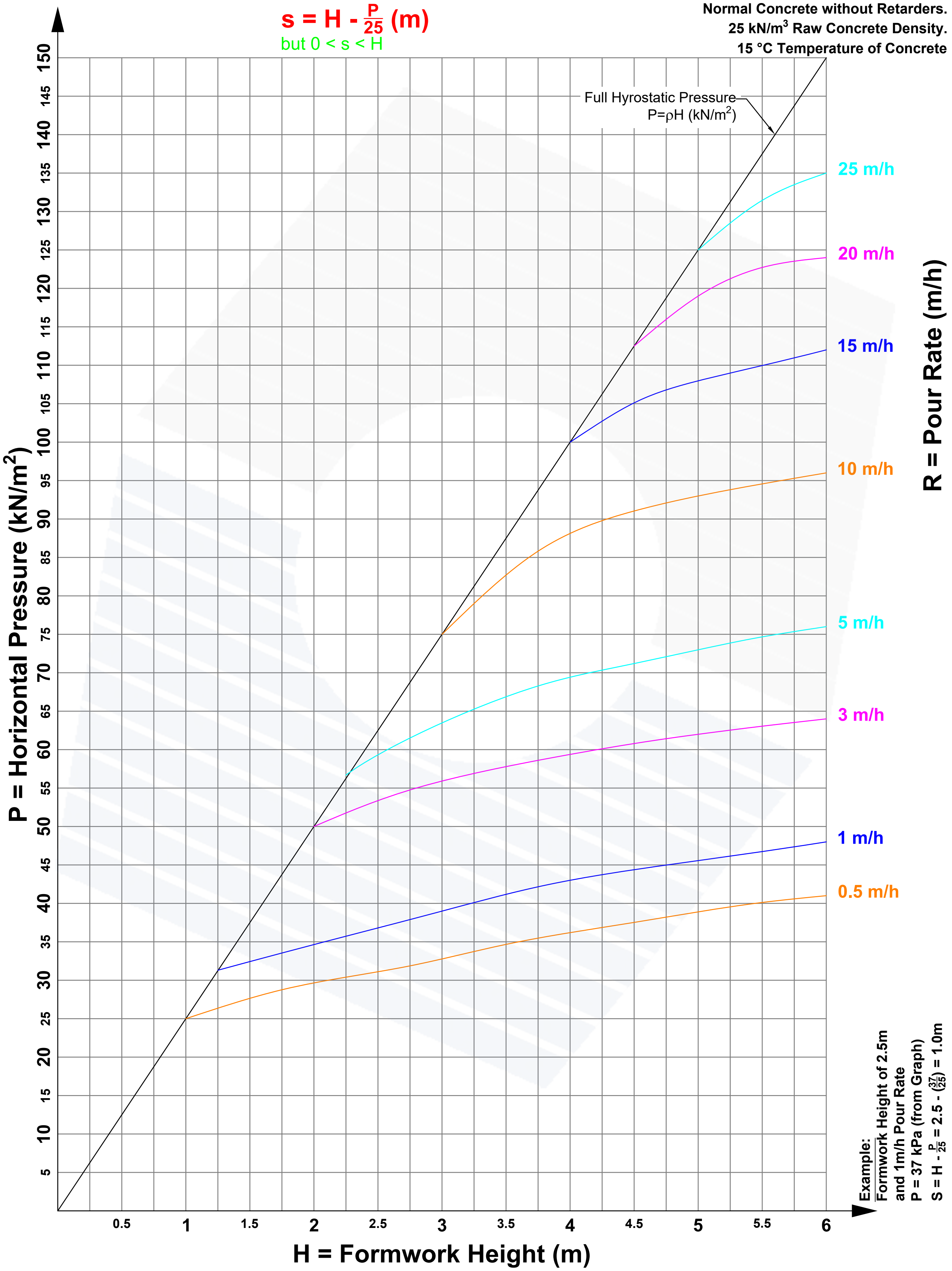
Horizontal Formwork Pressure on Walls (15°C)

Walls.
Normal Concrete without Retarders.
25 kN/m³ Raw Concrete Density.
15 °C Temperature of Concrete



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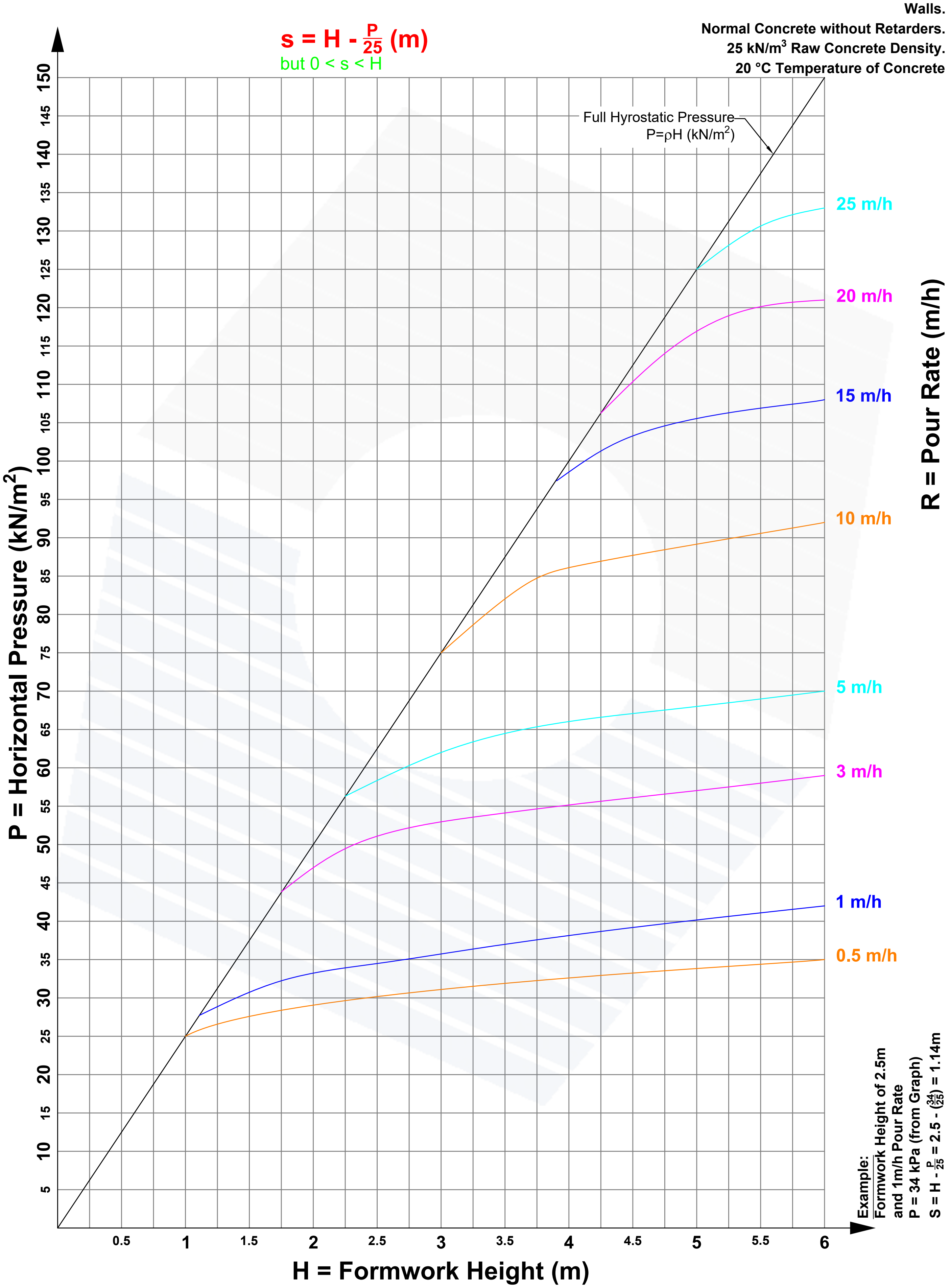
Horizontal Formwork Pressure on Walls (20°C)



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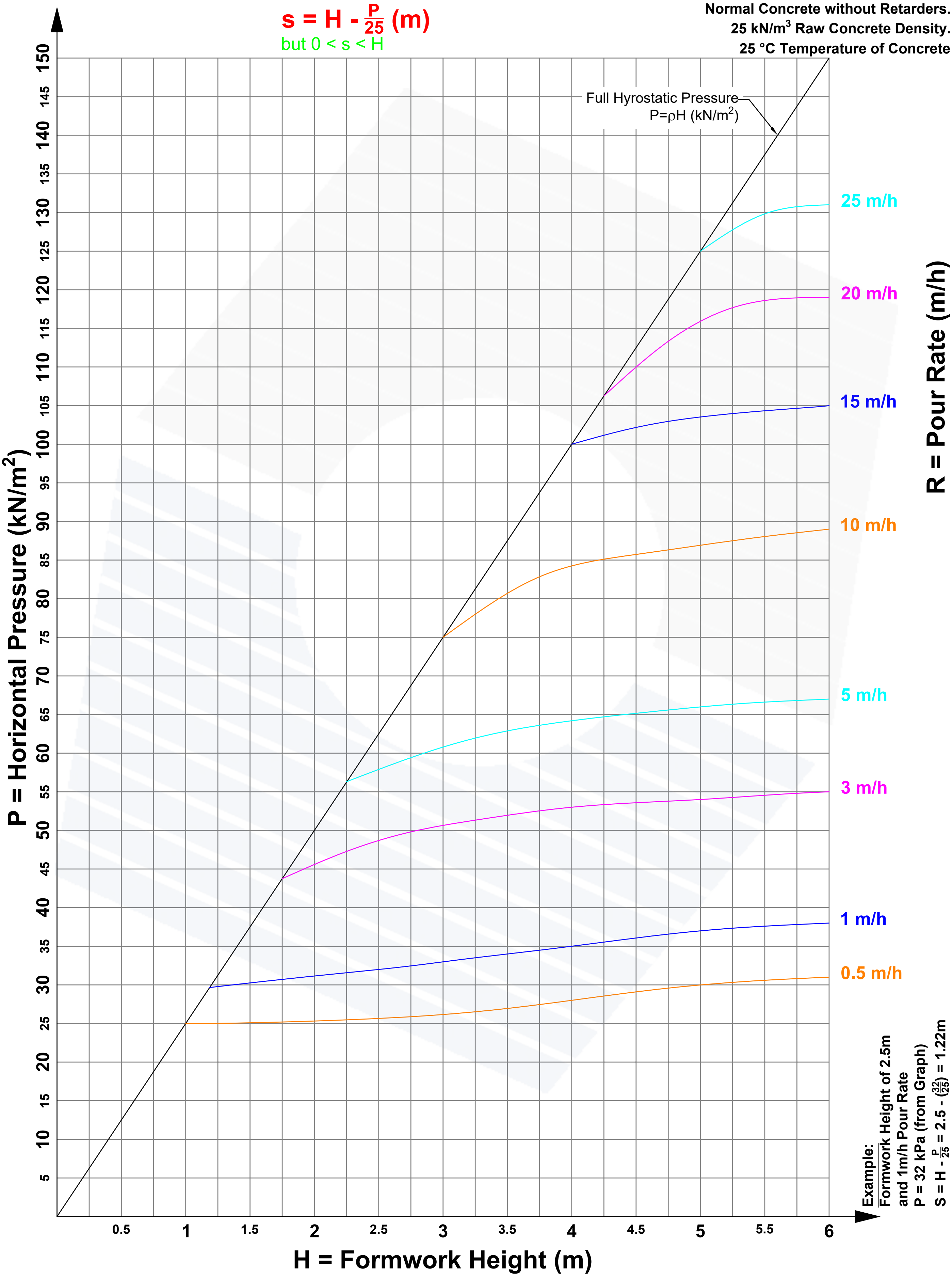
Horizontal Formwork Pressure on Walls (25°C)

Walls.
Normal Concrete without Retarders.
$25\ kN/m^3$ Raw Concrete Density.
25 °C Temperature of Concrete

$$s = H - \frac{P}{25}\ (m)$$

but $0 < s < H$



Horizontal Formwork Pressure on Walls (30°C)

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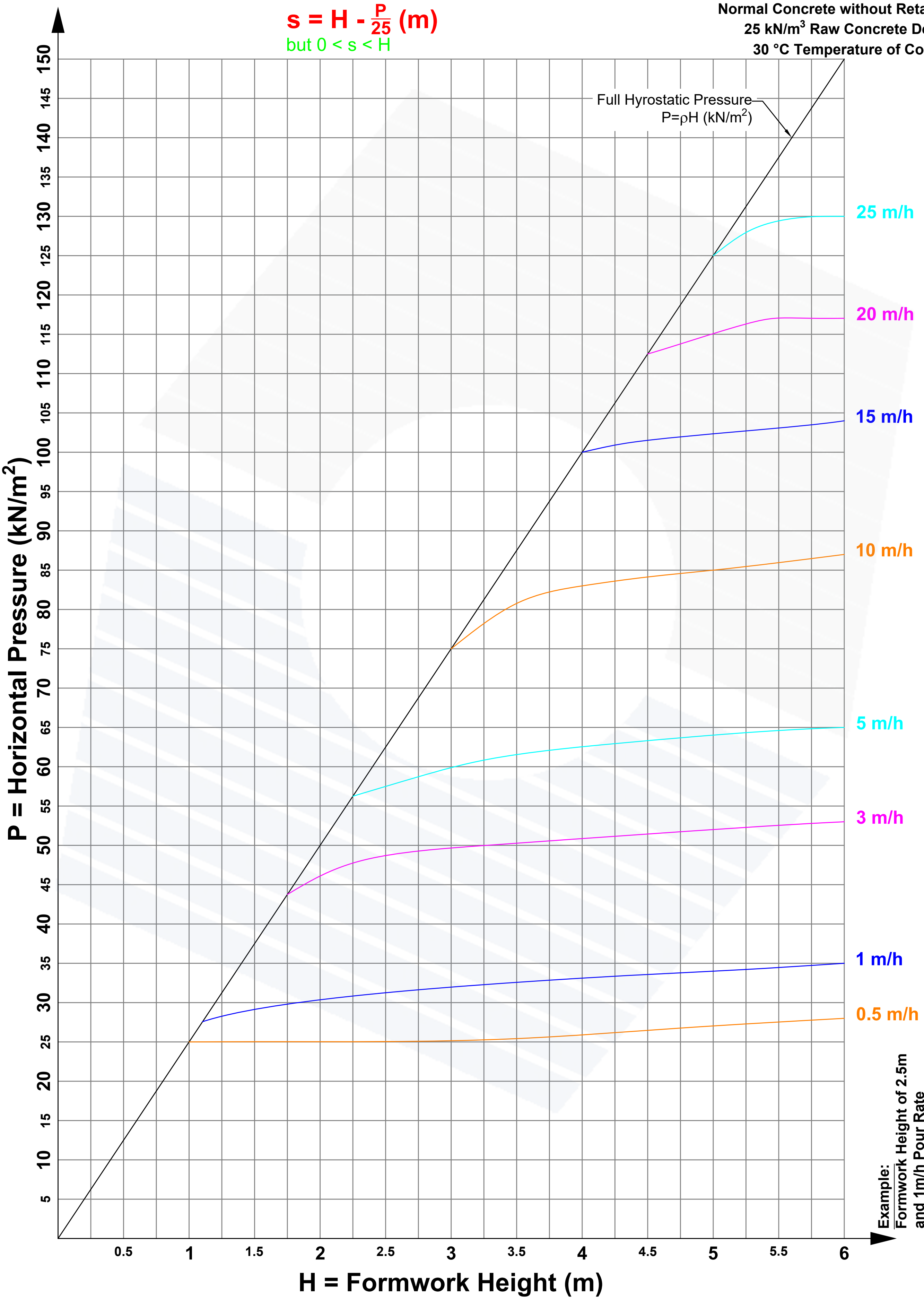
Walls.
Normal Concrete without Retarders.
25 kN/m³ Raw Concrete Density.
30 °C Temperature of Concrete

$$s = H - \frac{P}{25}\ (m)$$

but $0 < s < H$



Example:
Formwork Height of 2.5m
and 1m/h Pour Rate
P = 31 kPa (from Graph)
$S = H - \frac{P}{25} = 2.5 - (\frac{31}{25}) = 1.27m$

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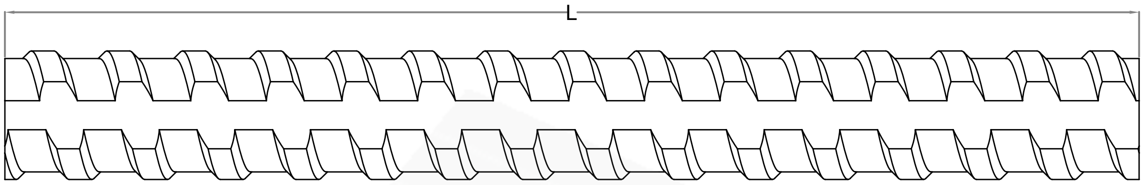
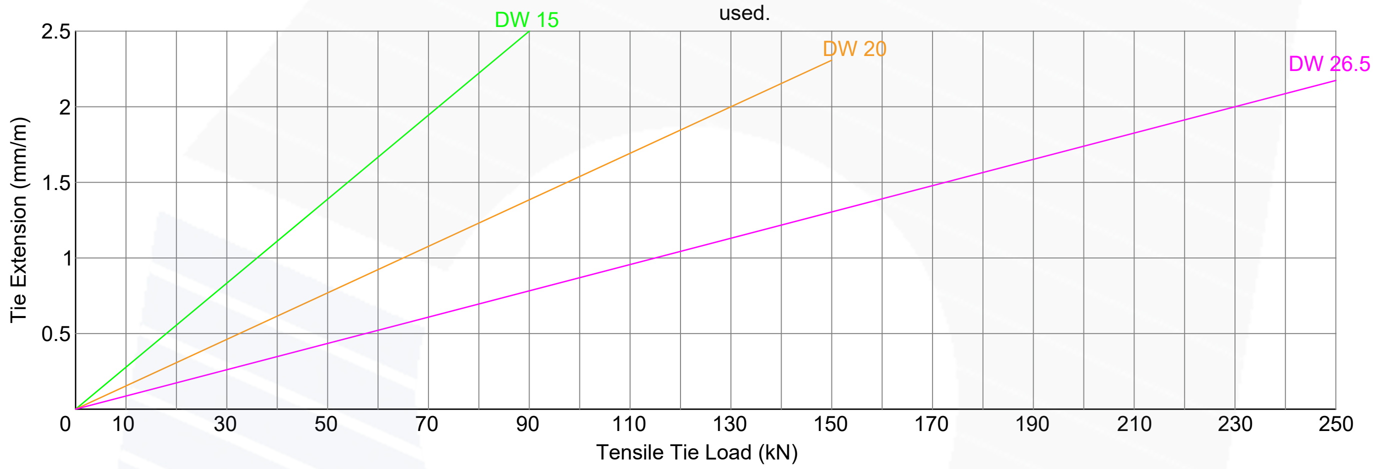
Tie Rods

Diwidag tie rods (DW 15; DW 20; DW 26.5)

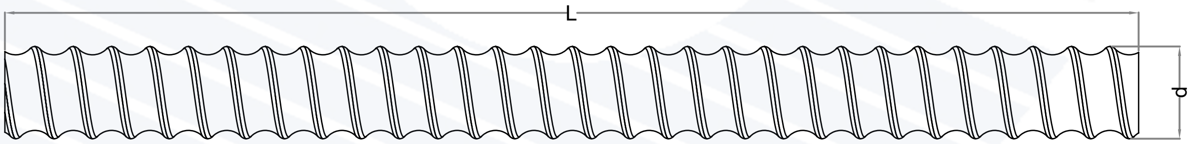


	DW 15	DW 20	DW 26.5
Nominal cross-section area (mm²)	177	314	551
Weight (kg/m)	1.5	2.6	4.5
Safe working load (kN)	90	150	250
Maximum diameter (mm)	18	23	31
Maximum shear (kN)	5	10	15

Note:
1. Shear force to a small extent allowed on Diwidag Bars.
2. Concrete strength must be at a minimum of 10MPa for the shear values.
3. If Diwidag rod is in shear, no large tensile forces are allowed.
4. If larger shear force are required use climbing anchor.
5. No welding or heat allowed.
6. Weldable Diwidag bar can be supplied on request.
7. If weakened by corrosion the Form Tie must be scrapped and not used.

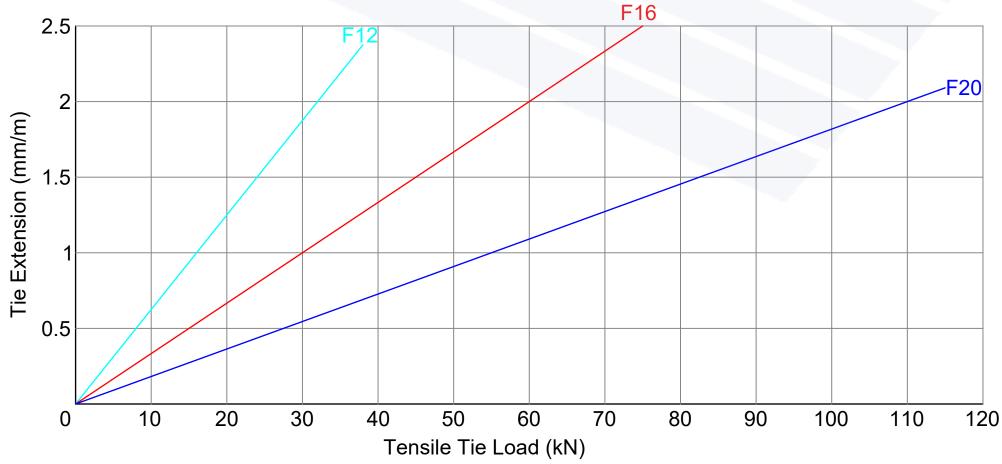


Form tie rods (F12; F16; F20)



	F12	F16	F20
Actual diameter (mm)	12.2	16.1	21.1
Weight (kg/m)	0.8	1.6	2.5
Safe working load (kN)	38	80	114
Nominal cross-section area (mm²)	78.5	145	269

Note:
1. No shear force permitted on Form Ties.
2. No welding or heat allowed.
3. If weakened by corrosion the Form Tie must be scrapped and not used.



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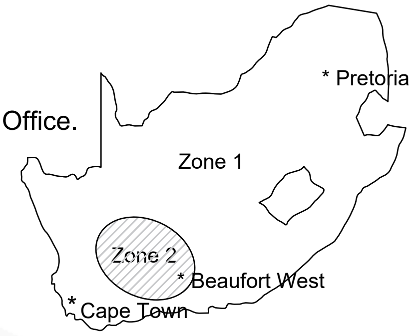
Wind pressure in South Africa

1. Regions:

Wind pressure calculations according to SANS 10160 section 5.5.
Values in the Wind Pressure Table were calculated for Zone 1 on the map.
Pressures for sites in Zone 2, and other regions, can be supplied by Preform Design Office.
Refer to Wind Classifications and values for more information.



2. Design requirements:

The simplified wind forces set out below may be adapted for design purposes, provided that the shutter complies with the following requirements:

2.1. it is rectangular in shape, and
2.2. its overall height does not exceed 200m above ground level, and
2.3. the ratio of its overall height to its lesser plan dimension does not exceed 4.

If all 3 requirements are not met, refer to the Wind Pressure in South Africa Table.

Pressure and wind speed for a 10 year return period on wall formwork

Site Altitude (m)	Height above ground, z (m)	Terrain Category 1			Terrain Category 2			Terrain Category 3			Terrain Category 4		
		V_z (km/h)	q_z (kN/m²)	P_w (kN/m²)	V_z (km/h)	q_z (kN/m²)	P_w (kN/m²)	V_z (km/h)	q_z (kN/m²)	P_w (kN/m²)	V_z (km/h)	q_z (kN/m²)	P_w (kN/m²)
0	5	133.49	0.82	1.07	121.82	0.69	0.89	86.83	0.35	0.45	84.24	0.33	0.43
	10	141.26	0.92	1.20	129.60	0.78	1.01	95.90	0.43	0.55	84.24	0.33	0.43
	15	145.15	0.98	1.27	134.78	0.84	1.09	104.98	0.51	0.66	84.24	0.33	0.43
	20	147.74	1.01	1.31	138.67	0.89	1.16	111.46	0.58	0.75	84.24	0.33	0.43
	50	158.11	1.16	1.50	150.34	1.05	1.36	129.60	0.78	1.01	111.46	0.58	0.75
	100	165.89	1.27	1.66	159.41	1.18	1.53	143.86	0.96	1.25	129.60	0.78	1.01
	150	169.78	1.33	1.73	165.89	1.27	1.66	152.93	1.08	1.41	139.97	0.91	1.18
	200	173.66	1.40	1.82	169.78	1.33	1.73	159.41	1.18	1.53	158.11	1.16	1.50
500	5	133.49	0.77	1.00	121.82	0.64	0.83	86.83	0.33	0.42	84.24	0.31	0.40
	10	141.26	0.86	1.12	129.60	0.73	0.94	95.90	0.40	0.52	84.24	0.31	0.40
	15	145.15	0.91	1.18	134.78	0.78	1.02	104.98	0.48	0.62	84.24	0.31	0.40
	20	147.74	0.94	1.23	138.67	0.83	1.08	111.46	0.54	0.70	84.24	0.31	0.40
	50	158.11	1.08	1.40	150.34	0.98	1.27	129.60	0.73	0.94	111.46	0.54	0.70
	100	165.89	1.19	1.55	159.41	1.10	1.43	143.86	0.89	1.16	129.60	0.73	0.94
	150	169.78	1.25	1.62	165.89	1.19	1.55	152.93	1.01	1.31	139.97	0.85	1.10
	200	173.66	1.30	1.69	169.78	1.25	1.62	159.41	1.10	1.43	158.11	1.08	1.40
1000	5	133.49	0.73	0.95	121.82	0.61	0.79	86.83	0.31	0.40	84.24	0.29	0.38
	10	141.26	0.82	1.06	129.60	0.69	0.89	95.90	0.38	0.49	84.24	0.29	0.38
	15	145.15	0.86	1.12	134.78	0.74	0.97	104.98	0.45	0.59	84.24	0.29	0.38
	20	147.74	0.89	1.16	138.67	0.79	1.02	111.46	0.51	0.66	84.24	0.29	0.38
	50	158.11	1.02	1.33	150.34	0.92	1.20	129.60	0.69	0.89	111.46	0.51	0.66
	100	165.89	1.13	1.46	159.41	1.04	1.35	143.86	0.85	1.10	129.60	0.69	0.89
	150	169.78	1.18	1.53	165.89	1.13	1.46	152.93	0.96	1.24	139.97	0.80	1.04
	200	173.66	1.23	1.60	169.78	1.18	1.53	159.41	1.04	1.35	158.11	1.02	1.33
1500	5	133.49	0.69	0.89	121.82	0.57	0.74	86.83	0.29	0.38	84.24	0.27	0.36
	10	141.26	0.77	1.00	129.60	0.65	0.84	95.90	0.35	0.46	84.24	0.27	0.36
	15	145.15	0.81	1.06	134.78	0.70	0.91	104.98	0.43	0.55	84.24	0.27	0.36
	20	147.74	0.84	1.09	138.67	0.74	0.96	111.46	0.48	0.62	84.24	0.27	0.36
	50	158.11	0.96	1.25	150.34	0.87	1.13	129.60	0.65	0.84	111.46	0.48	0.62
	100	165.89	1.06	1.38	159.41	0.98	1.27	143.86	0.80	1.04	129.60	0.65	0.84
	150	169.78	1.11	1.45	165.89	1.06	1.38	152.93	0.90	1.17	139.97	0.76	0.98
	200	173.66	1.16	1.51	169.78	1.11	1.45	159.41	0.98	1.27	158.11	0.96	1.25
2000	5	133.49	0.65	0.84	121.82	0.54	0.70	86.83	0.27	0.36	84.24	0.26	0.33
	10	141.26	0.72	0.94	129.60	0.61	0.79	95.90	0.33	0.43	84.24	0.26	0.33
	15	145.15	0.76	0.99	134.78	0.66	0.86	104.98	0.40	0.52	84.24	0.26	0.33
	20	147.74	0.79	1.03	138.67	0.70	0.91	111.46	0.45	0.59	84.24	0.26	0.33
	50	158.11	0.91	1.18	150.34	0.82	1.07	129.60	0.61	0.79	111.46	0.45	0.59
	100	165.89	1.00	1.30	159.41	0.91	1.20	143.86	0.75	0.89	129.60	0.61	0.79
	150	169.78	1.05	1.36	165.89	1.00	1.30	152.93	0.85	1.10	139.97	0.71	0.92
	200	173.66	1.09	1.42	169.78	1.05	1.36	159.41	0.92	1.20	158.11	0.91	1.18

PRE-FORM (PTY) LTD

Wind Terrain Classification

3. Terrain Categories:

3.1. Terrain Category 1:

Exposed smooth terrain with no obstructions and in which the height of any obstruction is less than 1,5m. This is category includes open sea coasts, lake shores, treeless plains with little vegetation other than short grass.

3.2. Terrain Category 2:

Open terrain with widely spaced obstructions (more than 100m apart) having heights and plan dimensions generally between 1,5m and 10m. This category includes large airfields, open parklands, farmlands and undeveloped outskirts of towns and suburbs, with trees. This is the category on which the regional basic wind speed V is based.

3.3. Terrain Category 3:

Terrain having numerous closely spaced obstructions generally having the size of domestic houses. This category includes suburbs, towns and industrial areas, fully or substantially developed.

3.4. Terrain Category 4:

Terrain with numerous large, tall, closely-spaced obstructions. This category includes large city centres.

4. Local topography:

Where the local topography, and large buildings, is such that increases in wind speeds may occur as a result of funneling or other effects, adjust the design wind speed accordingly, on the basis of appropriate metrological advice or tests.

Values:

V_z	from SABS 0160 Drg. 11701-EC/00-07
K_r	from SABS 0160 Drg. 11703-EC/00-07
k_z	from SANS10160 Table 5
k_p	from SANS 10160 section 5.5.3.1
C_p	generally 1,3 for wall formwork

Formulae:

- $v_z = k_z K_r v$ ...m/s
- $q_z = k_p v_z^2$ ...kN/m²
- $P_w = q_z C_p$ ...kN/m²

Note:
1 m/s = 3.6 km/h

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End Reaction Compressive Pressure Load Limits

Top / Bottom	32mm Timber	50mm Timber	HT20 Beam	LVL Beam	140_{AA} IPE Beam	Rapid Waler
HT20 Beam	4kN	10kN	16kN	16kN	16kN	16kN
2 x HT20 Beams	8kN	15kN	16kN	22kN	22kN	22kN
LVL Beam	11kN	15kN	16kN	50kN	50kN	50kN
2 x LVL Beams	11kN	15kN	22kN	50kN	54kN	100kN
140_{AA} IPE Beam	11kN	15kN	16kN	50kN	54kN	54kN
2 x 140_{AA} IPE Beams	11kN	15kN	22kN	50kN	54kN	97kN
Rapid Waler	11kN	15kN	20kN	50kN	54kN	244kN
Fork Head	11kN	15kN	22kN	50kN	54kN	65kN
Form Soldier	11kN	15kN	22kN	50kN	54kN	85kN
20 MPa Concrete[1]	11kN	15kN	22kN	50kN	54kN	244kN

EN 13377:2002 (HT20); Clause 14.3.2 of SANS 10162 Part 1 (Steel sections). For higher loads contact Pre-Form Technical Department. For loads near edges, consult designer of the concrete element for point load allowance.

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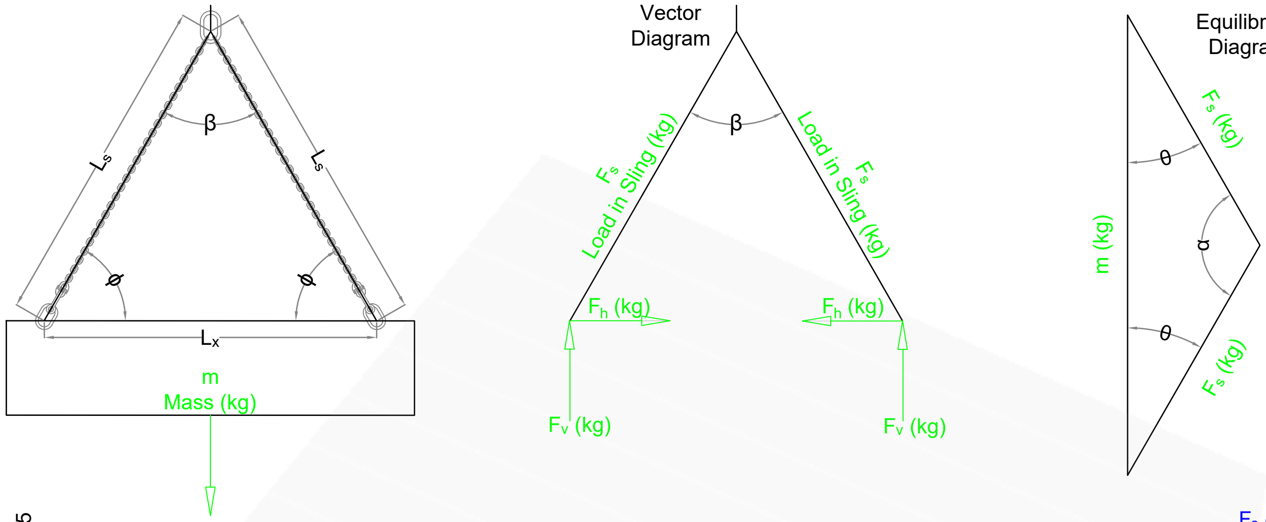
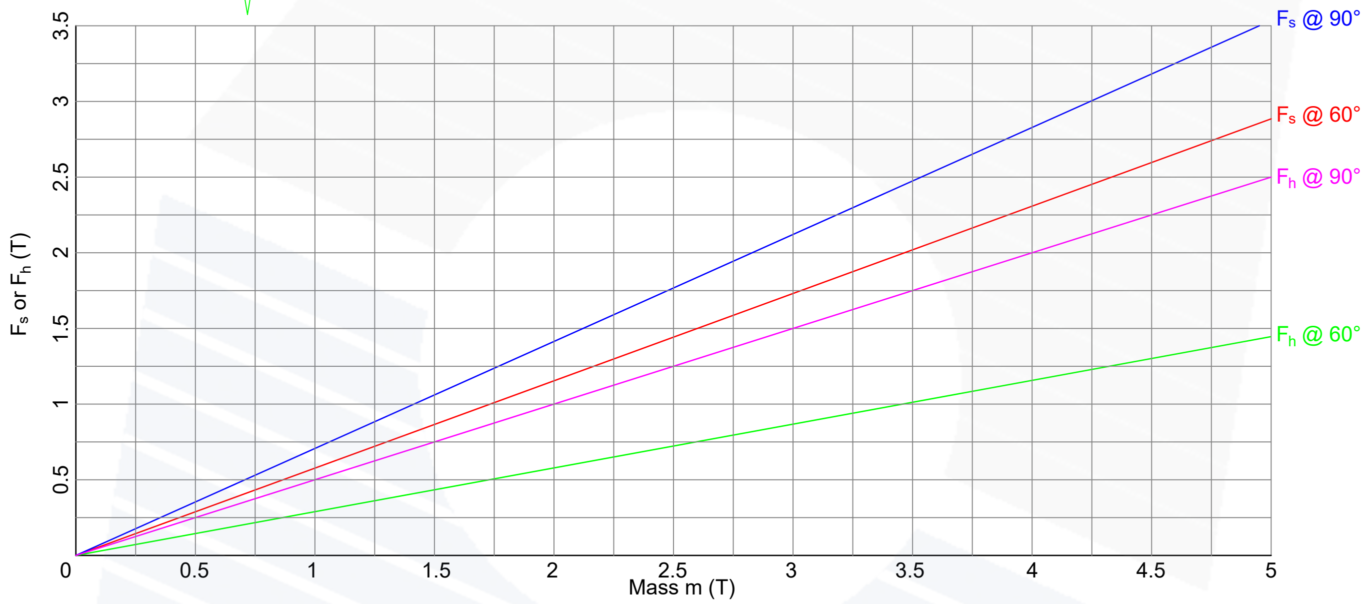
Double Branch Straight Sling Forces and Lengths





1. Force Formulas
   - 1.1. $\theta = (\beta/2)$
   - 1.2. $\alpha = 180° - \beta$
   - 1.3. $F_s = (\frac{m}{\text{Sin}\theta}).\text{Sin}\alpha$ ...(kg)
   - 1.4. $F_h = F_s.\text{Sin}\theta$ ....(kg)
   - 1.5. $F_v = m/2$ ......(kg)

2. Load Factors
   - 2.1. β = 60°
     - 2.1.1. $2F_s = 1.7m$ ....(kg)
     - 2.1.2. $\therefore F_s = 0.85m$ ....(kg)
   - 2.1. β = 90°
     - 2.1.1. $2F_s = 1.4m$ ....(kg)
     - 2.1.2. $\therefore F_s = 0.85m$ ....(kg)

Use formulas, table above or Load Factors to determine forces.

1. Length Formulas
   - 1.1. $\phi = \frac{180-\beta}{2}$
   - 1.2. $L_s = \frac{Lx}{\text{Sin}\beta}.\text{Sin}\phi$

or
   - 1.3. β = 15°
     - 1.3.1. $L_s = 0.261\ L_x$
   - 1.4. β = 30°
     - 1.4.1. $L_s = 0.518\ L_x$
   - 1.5. β = 45°
     - 1.5.1. $L_s = 0.765\ L_x$
   - 1.6. β = 60°
     - 1.6.1. $L_s = L_x$
   - 1.7. β = 75°
     - 1.7.1. $L_s = 1.218\ L_x$
   - 1.8. β = 90°
     - 1.8.1. $L_s = 1.414\ L_x$

Use formulas or table below to determine set sling lengths.

	L_x (m) - Lifting Point Distance																	
	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3	3.25	3.5	3.75	4	4.25	4.5	4.75	5
β - Sling Angle	**L_s (m) - Sling Length**																	
15°	0.20	0.26	0.33	0.39	0.46	0.52	0.59	0.65	0.72	0.78	0.85	0.91	0.98	1.04	1.11	1.17	1.24	1.31
30°	0.39	0.52	0.65	0.78	0.91	1.04	1.16	1.29	1.42	1.55	1.68	1.81	1.94	2.07	2.20	2.33	2.46	2.59
45°	0.57	0.77	0.96	1.15	1.34	1.53	1.72	1.91	2.10	2.30	2.49	2.68	2.87	3.06	3.25	3.44	3.64	3.83
60°	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00
75°	0.91	1.22	1.52	1.83	2.13	2.44	2.74	3.04	3.35	3.65	3.96	4.26	4.57	4.87	5.17	5.48	5.78	6.09
90°	1.06	1.41	1.77	2.12	2.47	2.83	3.18	3.54	3.89	4.24	4.60	4.95	5.30	5.66	6.01	6.36	6.72	7.07

Timber Platforms, Handrail Holders and Railing Posts

PRE-FORM (PTY) LTD

Timber Scaffold Plank/Board Span Spacing

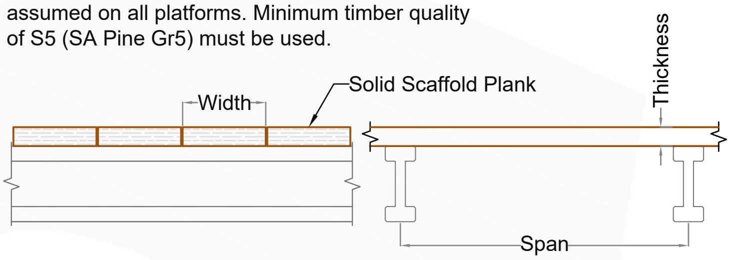
Scaffold Groups as per DIN 4420-1:2006

Scaffold Group	Min. platform width (m)	Live load (kN/m²)	Description and areas of application
1	0.5	0.75	Inspection activities with light weight tools. No storage of materials. Walkways with light traffic. Retrieve platforms.
2	0.6	1.5	Work activities that do not require storage of material or heavy tools. Access platforms.
3	0.6	2	Platforms for persons and tools. Tools and materials must not be put on platform with lifting device. Climber platforms.
4	0.9	3	Platforms for persons and materials loaded with lifting device. Klik-Klak platforms.
5	0.9	4.5	Same use as Scaffold Group 4 but with higher load permitted.
6	0.9	6	Same use as Scaffold Group 4 but with higher load permitted.

Max spans for scaffold plank as platforms (m) - DIN 4420-3:2006-01

Scaffold Group	Plank Width (mm)	Plank Thickness (mm)				
		30	35	40	45	50
1, 2, 3	200	1.25	1.5	1.75	2.25	2.5
	240, 280	1.25	1.75	2.25	2.5	2.75
4	200	1.25	1.5	1.75	2.25	2.5
	240, 280	1.25	1.75	2	2.25	2.5
5	200, 240, 280	1.25	1.25	1.5	1.75	2
6	200, 240, 280	1	1.25	1.25	1.5	1.75

A minimum service load of 0.75kN/m² should be assumed on all platforms. Minimum timber quality of S5 (SA Pine Gr5) must be used.



Upright Post Support Spacing

1. Timber railing design as per SABS 0136-2001.
2. Minimum timber quality of S5 (SA Pine Gr5) must be used.
3. Ø48.3mm Scaffold tube design as per SANS 10162-2005.
4. C_p of 1.3 will be used in wind pressure.
5. Wind pressure, P_w, will be assumed 1.7kPa.
6. A horizontal load of F = 0.3kN will be used in calculations.
7. For other railing material not shown in table, the allowable spans and cantilever must be calculated.

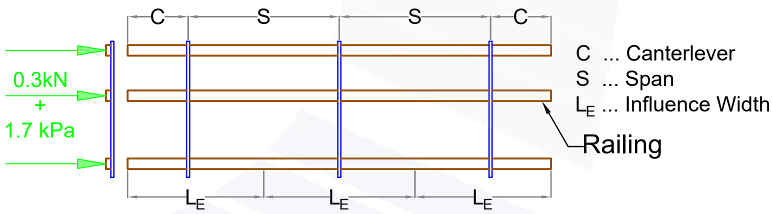
Railing material	Maximum Span (m)	Maximum Canterlever (m)	Influence Width (m)
114 x 38mm S5 Structural Grade SA Timber	3.6	1.2	3.6
280 x 32mm Scaffold Board	2.7	0.9	2.7
280 x 50mm Scaffold Board	4.7	1.7	4.7
Ø48.3 x 2.5mm S355 Scaffold Tube	5	1.3	5

Railing

This table is not for closed up (no-gap) configurations. Where the railings are closed up with plyboard, sheeting or mesh that will increase the wind loadings on the railings.

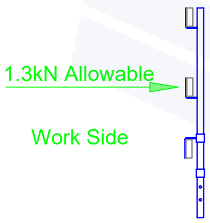
Influence Width and Span

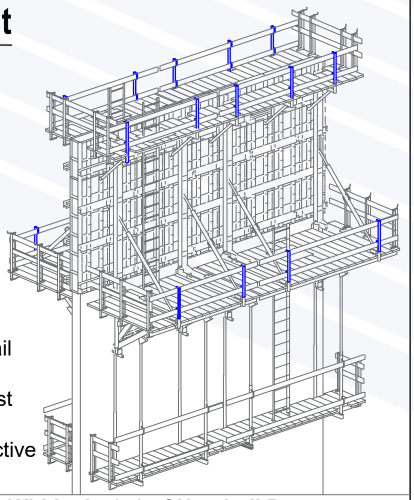
It is important to distinguish between Span and Influence Width. The table show the maximum Influence Width and Maximum Span.



Rapid Handrail Post

RW117390





Post Spacing

1. 1.3kN allowed on handrail (Wind load).
2. Railing configuration must comply with both tables regarding span and effective width.

Maximum Effective Widths L_E (m) of Handrail Post

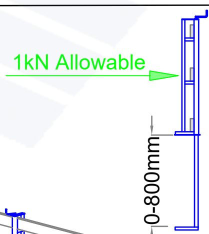
Railing material	0-50m above ground (q_z=1kN/m²)	50-100m above ground (q_z=1.3kN/m²)
114 x 38mm S5 Structural Grade SA Timber	3.6	2.9
280 x 32/50mm Scaffold Board	1.6	1.2
Closed up (no gap) configuration	1	0.8
Ø48.3 x 2.5mm S355 Scaffold Tube	5	5

Adjustable Handrail Holder

FF103360

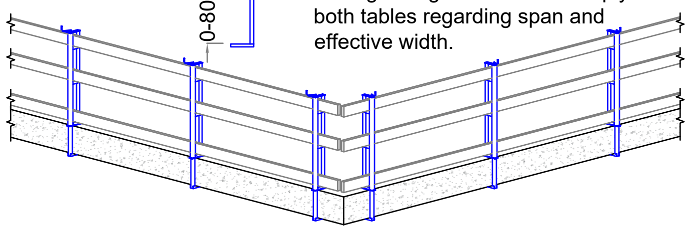
Maximum Effective Widths L_E (m) of Handrail Holders

Railing material	0-50m above ground (q_z=1kN/m²)	50-100m above ground (q_z=1.3kN/m²)
114 x 38mm S5 Structural Grade SA Timber	2.9	2.3
280 x 32/50mm Scaffold Board	1.2	0.9
Closed up (no gap) configuration	1	0.8
Ø48.3 x 2.5mm S355 Scaffold Tube	5	5



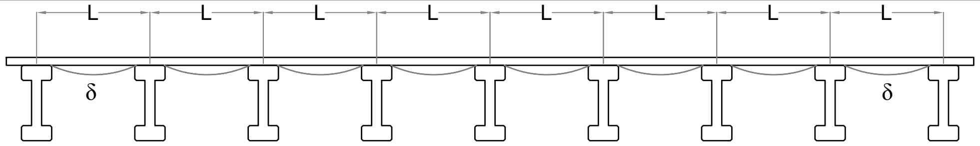
Handrail Holder Spacing

1. 1kN allowed on handrail (Wind load).
2. Wider sections will have more wind resistance, due to larger area, thus resulting in a smaller allowable Effective Width.
3. Railing configuration must comply with both tables regarding span and effective width.



PRE-FORM (PTY) LTD

21mm Plywood - Tension Stress and Spacing

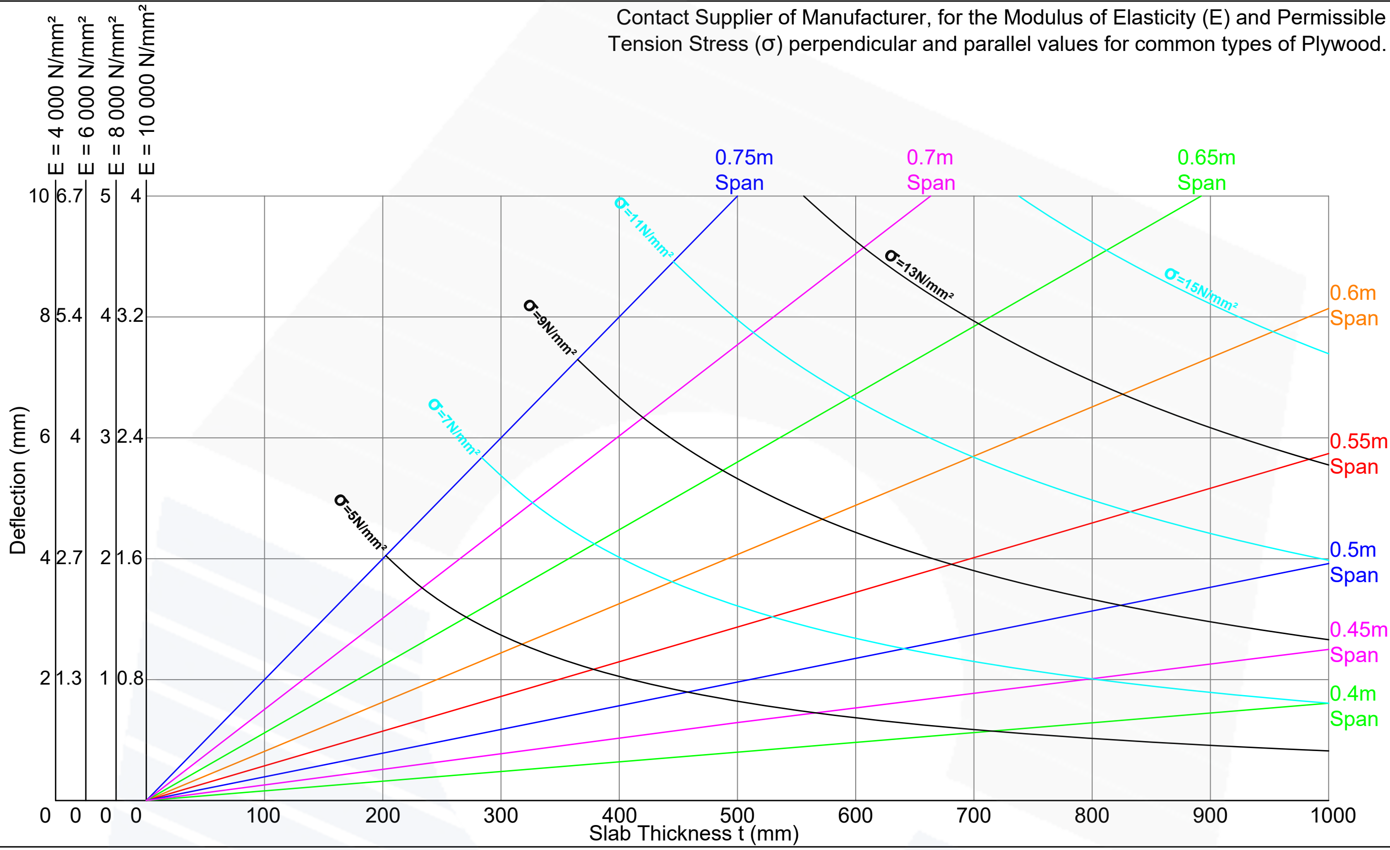


$$M = 0.1071qL^2$$

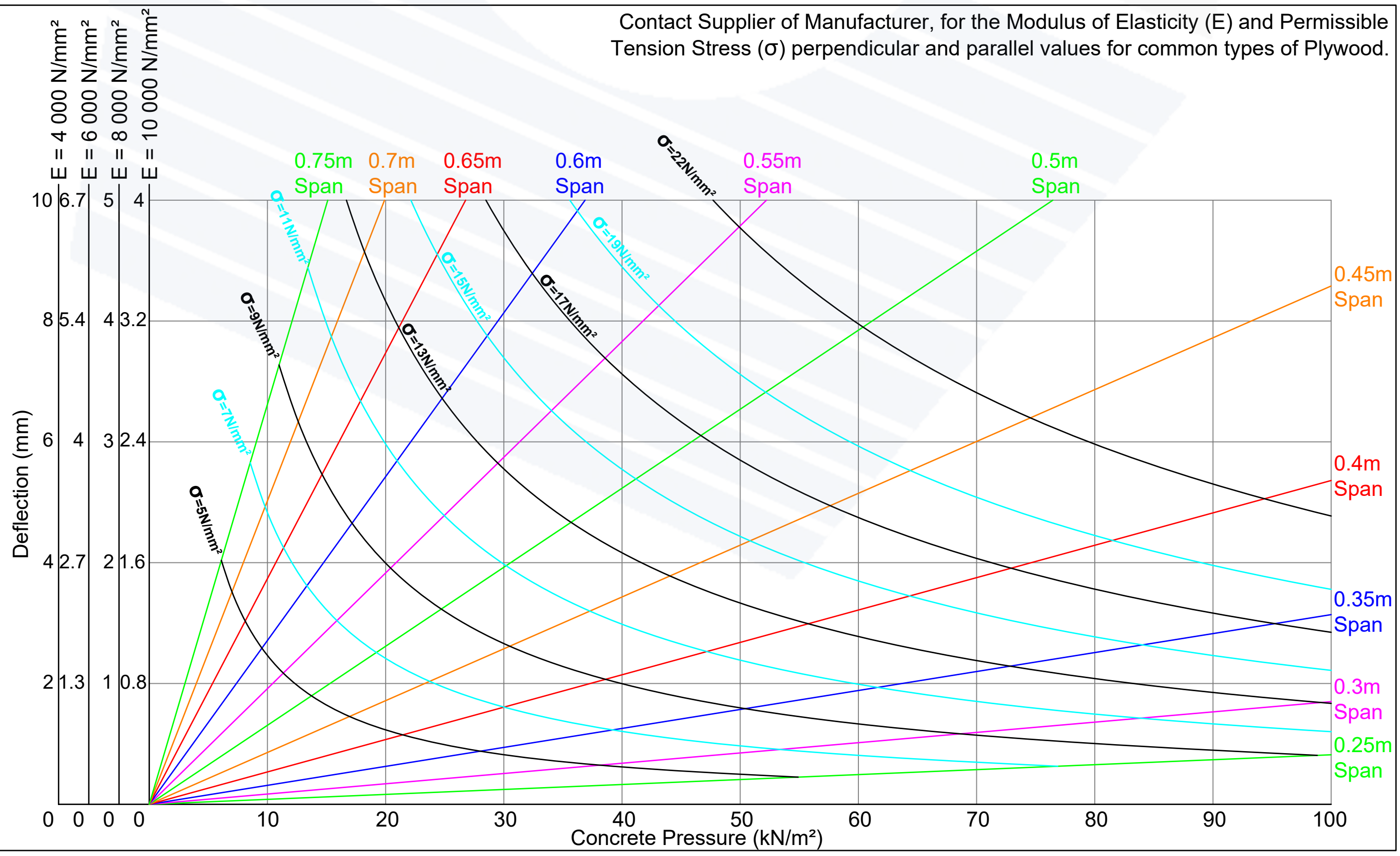
$$\delta = \frac{kqL^4}{EI} \quad ...k = 0.00646$$

$$L = \sqrt{\frac{\frac{I\sigma}{y}}{0.1071q}}$$

Contact Supplier of Manufacturer, for the Modulus of Elasticity (E) and Permissible Tension Stress (σ) perpendicular and parallel values for common types of Plywood.



Contact Supplier of Manufacturer, for the Modulus of Elasticity (E) and Permissible Tension Stress (σ) perpendicular and parallel values for common types of Plywood.



PRE-FORM (PTY) LTD

Beam Mechanical Properties

Mechanical Properties of Pre-Form Supplied Beams								
HT20 according to EN13377 Steel IPE's according to SANS 1062 Part 1 LVL according to NZS 3910		Single HT20	Double HT20	Single LVL 170x74mm	Double LVL 170x74mm	Single 140$_{AA}$ IPE	Double 140$_{AA}$ IPE	Form Soldier 300x150mm
Maximum Moments (kNm)	M_{MAX}	5	8	10	18	18*	36*	40
Maximum Shear (kN)	V_{MAX}	11	18	32	58	108*	194*	42
Maximum Localized Compression (kN)	R	48	86	65	104	108	216	85
Flexural Rigidity (kNm²)	EI	486	874	242	484	814	1624	5790
Mass (kg/m)	m	4.6	9.2	6.7	13.4	10.1	20.2	±24
Moment of Inertia ($10^6 mm^4$)	I	45	83	30.3	60.6	4.07	8.1	29

* Please refer to tables below.

Factored Moment Resistance, M_r, with ω_2=1 (Simply-Supported Beams). SANS1062:Part 1, Clause 13.5

Designation	L_u (m)	Unbraced length (KL) of compressive flange (m)							
		0	1	2	3	4	5	6	7
IPE$_{AA}$ 100	0.868	8.61	8.3	5.88					
IPE 100	0.925	10.6	10.6	7.88	5.34				
IPE$_{AA}$ 120	0.97	12.9	12.9	9.17	5.75				
IPE 120	1.03	16.4	16.4	12.7	8.69				
IPE$_{AA}$ 140	1.09	18.3	18.3	13.8	8.64	6.11			
IPE 140	1.15	12.8	23.8	19.4	13.6	9.8			
IPE$_{AA}$ 160	1.21	25.7	25.7	20.8	13.7	9.55			
IPE 160	1.27	33.5	33.5	28.5	21.1	15			
IPE$_{AA}$ 180	1.34	35.1	35.1	30	20.9	14.3	10.9		
IPE 180	1.4	44.8	44.8	39.7	30.6	21.6	16.7		
IPE$_{AA}$ 200	1.46	47.5	47.5	42.5	32	21.7	16.4		
IPE 200	1.52	59.7	59.7	54.7	43.5	31.6	24.2	19.7	
254 x 146 x 31 kg/m	2.16	107	107	107	94.8	78	58.6	45.5	37.2

1. This graph is only for when maximum moment doesn't occur at end(s) of beam, e.g. simple supported beams.
2. L_u = unbraced length up to which tabulated moments, M_r, for unbraced length L = 0 are acceptable.
3. Web resistance and deflection limits must be checked.
4. Moment resistance values are tabulated for slenderness ratio less than 300, and span/dept ratios less or equal to 30.
5. Grade 300W steel.

Factored Web Resistance of I-Sections. SANS1062:Part 1, Clause 14.3.2

Designation	t_w (mm)	Interior Loads			End Reactions				
		Web Yielding		Web Crippling	Web Yielding		Web Crippling	Web Shear, V_r	
		Br_1 (kN/mm)	Br_2 (kN)	Br_3 (kN)	Br_4 (kN/mm)	Br_5 (kN)	Br_6 (kN)	Elastic (kN)	Plastic (kN)
IPE$_{AA}$ 100	3.6	1.57	38.9	116	0.81	14.6	45.5	62.6	52.2
IPE 100	4.1	1.78	56.1	151	0.923	21	58.6	73.1	60.9
IPE$_{AA}$ 120	3.8	1.65	43.8	130	0.855	16.4	50.3	79.2	66
IPE 120	4.4	1.91	66.5	174	0.99	24.9	67.5	94.1	78.4
IPE$_{AA}$ 140	3.8	1.65	47.4	130	0.855	17.8	50.3	92.5	77.1
IPE 140	4.7	2.04	77.8	198	1.06	29.2	77	117	97.7
IPE$_{AA}$ 160	4	1.74	53.8	144	0.9	20.2	55.8	111	92.9
IPE 160	5	2.18	88.8	225	1.13	33.3	87.1	143	119
IPE$_{AA}$ 180	4.3	1.87	64	166	0.97	24	64.5	135	113
IPE 180	5.3	2.31	102	252	1.19	38.2	97.9	170	142
IPE$_{AA}$ 200	4.5	1.96	72.4	182	1.01	27.1	70.6	157	131
IPE 200	5.6	2.44	114	282	1.26	42.8	109	200	166
254 x 146 x 31 kg/m	6.1	2.65	126	334	1.37	47.2	130	237	228

1. Grade 300W steel.

Web Resistance Calculations:

N = Stiff Bearing Length, mm.

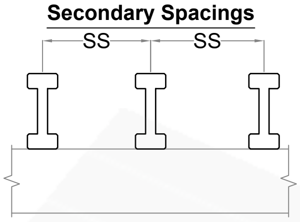
Factored Web Resistance for Interior Loads is the lesser of:
$Br = NBr_1 + Br_2$ (web yielding) and $Br = Br_3$ (web crippling).

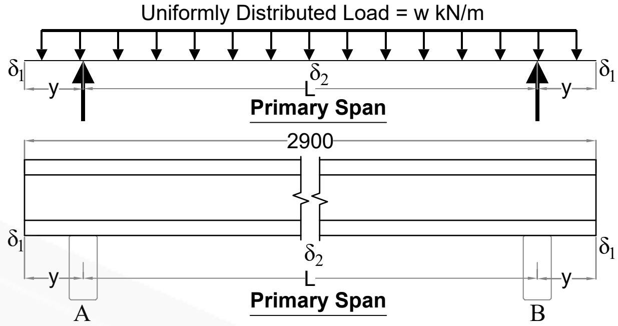
Factored Web Reisistance for End Reactions is the lesser of:
$Br = NBr_4 + Br_5$ (web yielding) and $Br = Br_6$ (web crippling).

PRE-FORM (PTY) LTD

Secondary Beam Spacing for HT20 profile Beams

Slab Thickness (mm)	Total Load (kN/m²)	Secondary Beam Spacing (m) 0.4	0.5	0.625	0.675
		UDL on Beam (kN/m)			
170	5.9	2.4	3.0	3.7	4.0
200	6.7	2.7	3.4	4.2	4.5
250	8	3.2	4.0	5.0	5.4
300	9.4	3.7	4.7	5.9	6.3
350	10.9	4.4	5.5	6.8	7.4
400	12.5	5	6.2	7.8	8.4
450	14	5.6	7.0	8.8	9.5
500	15.6	6.2	7.8	9.8	10.5
550	17.2	6.9	8.6	10.7	11.6
600	18.7	7.5	9.4	11.7	12.6
650	20.3	8.1	10.1	12.7	13.7
700	21.8	8.7	10.9	13.7	14.7
750	23.4	9.4	11.7	14.6	15.8
800	25	10.0	12.5	15.6	16.8
850	26.5	10.6	13.3	16.6	17.9
900	28.1	11.2	14.0	17.6	19.0
950	29.6	11.9	14.8	18.5	20.0
1000	31	12.4	15.5	19.4	20.9





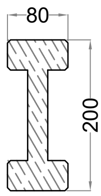
To determine allowable Secondary Beam spacing not in the table:
From graph choose Applied load within the safe area, then use:

$SS = \frac{w}{q}$ m (q is the Total Load from the table for slab thickness)

Example:
For a 1000mm slab the Total Load (q) will be 31 kN/m² from the table,
Choose Primary beam spacing (L), eg. 1.6 m
From graph, 14 kN/m with a deflection of 2.4mm is in safe zone,

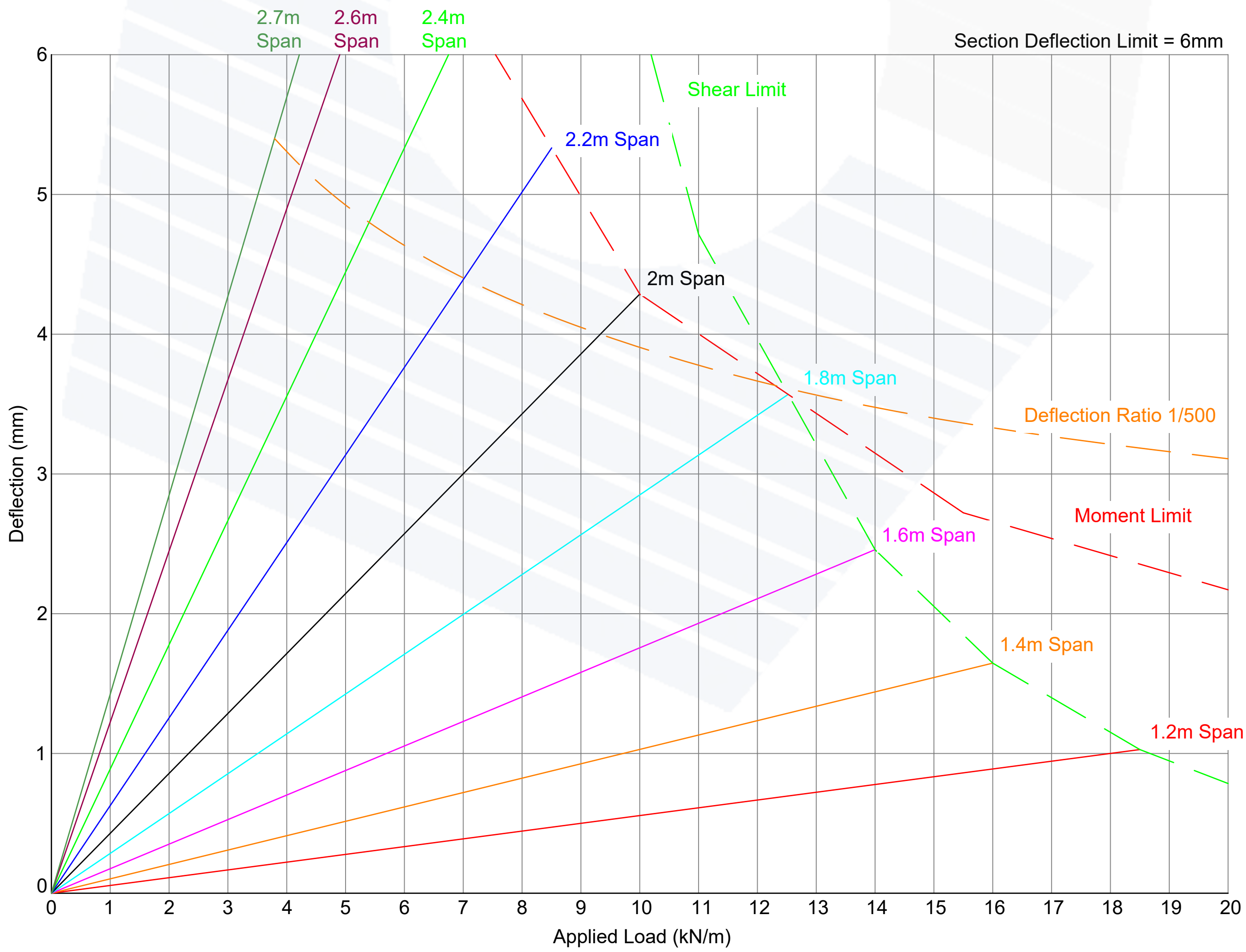
$$SS = \frac{w}{q} = \frac{14}{31} = 450 \text{ mm}$$

A 450 mm beam spacing is still in the safe zone for a 1.6 m span.
(Note that the carrying capacity of support, plywood and compressive resistance of beam must be checked).



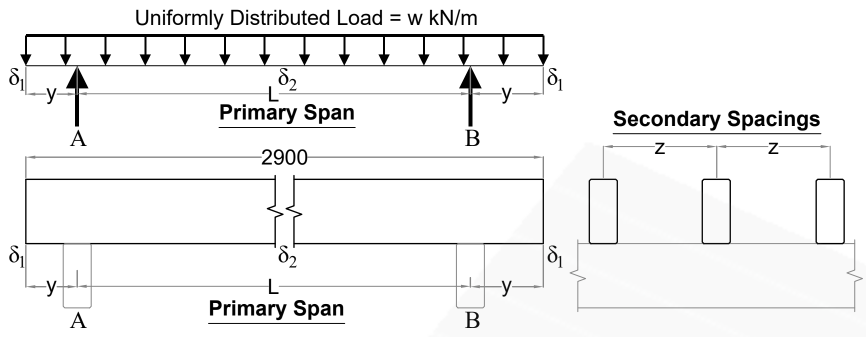
Mechanical Properties

Max Moments = M_{Max} = 5 kNm
Max Shear = V_{Max} = 11 kN
Max Compression = R = 48 kN
Flexural Rigidity = EI = 486 kNm^2
Mass = m = 4.6 kg/m



PRE-FORM (PTY) LTD

Secondary Beam Spacing for 170x74 LVL



Slab Thickness (mm)	Total Load (kN/m²)	Secondary Beam Spacing (m)			
		0.4	0.5	0.625	0.675
		UDL on Beam (kN/m)			
170	5.9	2.4	3.0	3.7	4.0
200	6.7	2.7	3.4	4.2	4.5
250	8	3.2	4.0	5.0	5.4
300	9.4	3.7	4.7	5.9	6.3
350	10.9	4.4	5.5	6.8	7.4
400	12.5	5	6.2	7.8	8.4
450	14	5.6	7.0	8.8	9.5
500	15.6	6.2	7.8	9.8	10.5
550	17.2	6.9	8.6	10.7	11.6
600	18.7	7.5	9.4	11.7	12.6
650	20.3	8.1	10.1	12.7	13.7
700	21.8	8.7	10.9	13.7	14.7
750	23.4	9.4	11.7	14.6	15.8
800	25	10.0	12.5	15.6	16.8
850	26.5	10.6	13.3	16.6	17.9
900	28.1	11.2	14.0	17.6	19.0
950	29.6	11.9	14.8	18.5	20.0
1000	31	12.4	15.5	19.4	20.9

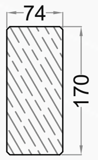
To determine allowable Secondary Beam spacing not in the table:
From graph choose Applied load within the safe area, then use:

$z = \frac{w}{q}$ m (q is the Total Load from the table for slab thickness)

Example:
For a 1000mm slab the Toal Load (q) will be 31 kN/m² from the table,
Choose Primary beam spacing, eg. 1.6 m
From graph, 12.6 kN/m with a deflection of 4.5mm is in safe zone,

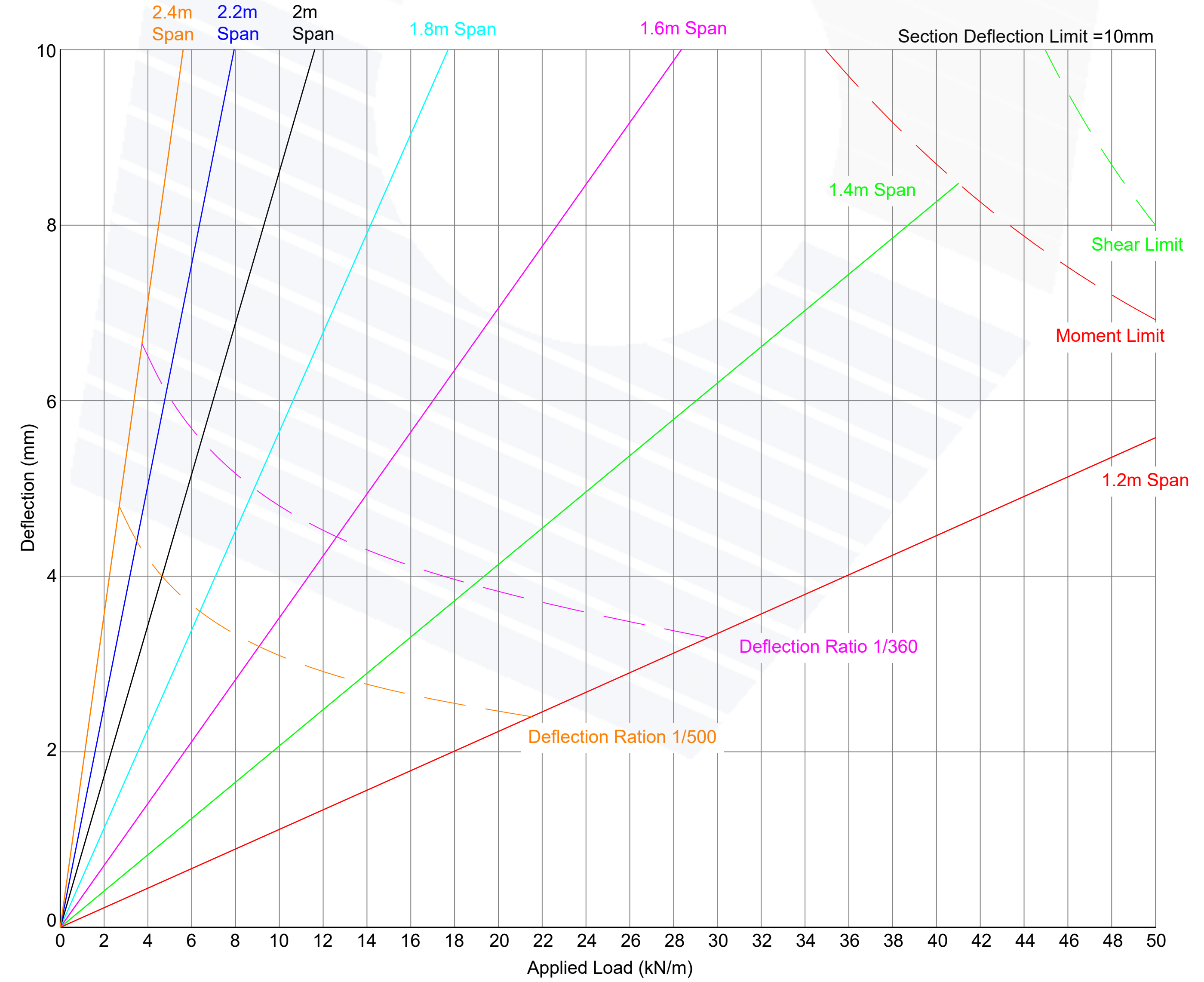
$z = \frac{w}{q} = \frac{12.6}{31} = 400$ mm

A 400 mm beam spacing is still in the safe zone for a 1.6 m span.
(Note that the carrying capacity of support, plywood and compressive resistance of beam must be checked).



Mechanical Properties

Max Moments = M_{Max} = 10 kNm
Max Shear = V_{Max} = 32 kN
Max Compression = R = >65 kN
Flexural Rigidity = EI = 242 kNm²
Mass = m = 6.7 kg/m



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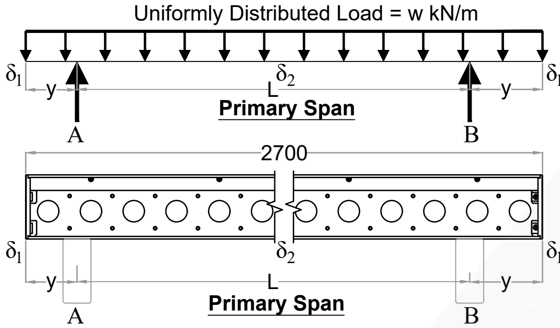
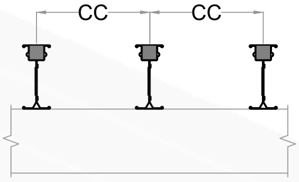
Secondary Beam Spacing for ST150



Secondary Spacings



Slab Thickness (mm)	Total Load (kN/m²)	Secondary Beam Spacing (m)			
		0.4	0.5	0.625	0.675
		UDL on Beam (kN/m)			
170	5.9	2.4	3.0	3.7	4.0
200	6.7	2.7	3.4	4.2	4.5
250	8	3.2	4.0	5.0	5.4
300	9.4	3.7	4.7	5.9	6.3
350	10.9	4.4	5.5	6.8	7.4
400	12.5	5	6.2	7.8	8.4
450	14	5.6	7.0	8.8	9.5
500	15.6	6.2	7.8	9.8	10.5
550	17.2	6.9	8.6	10.7	11.6
600	18.7	7.5	9.4	11.7	12.6
650	20.3	8.1	10.1	12.7	13.7
700	21.8	8.7	10.9	13.7	14.7
750	23.4	9.4	11.7	14.6	15.8
800	25	10.0	12.5	15.6	16.8
850	26.5	10.6	13.3	16.6	17.9
900	28.1	11.2	14.0	17.6	19.0
950	29.6	11.9	14.8	18.5	20.0
1000	31	12.4	15.5	19.4	20.9

To determine allowable Secondary Beam spacing not in the table:

From graph choose Applied load within the safe area, then use:

$CC = \frac{w}{q}$ m (q is the Total Load from the table for slab thickness)

Example:
For a 400mm slab the Toal Load (q) will be 12.5 kN/m² from the table,
Choose Primary beam spacing, eg. 2 m
From graph, 8.5 kN/m with a deflection of 4 mm is in safe zone,

$CC = \frac{w}{q} = \frac{8.5}{12.5} = 680$ mm

A 680 mm beam spacing is still in the safe zone for a 2 m span.
(Note that the carrying capacity of support, plywood and compressive resistance of beam must be checked).

Bending Stress Formula:

$M = Z_e.f$

$\therefore \quad f = \frac{M}{Z_e}$ Mpa

Shear Stress Formula:

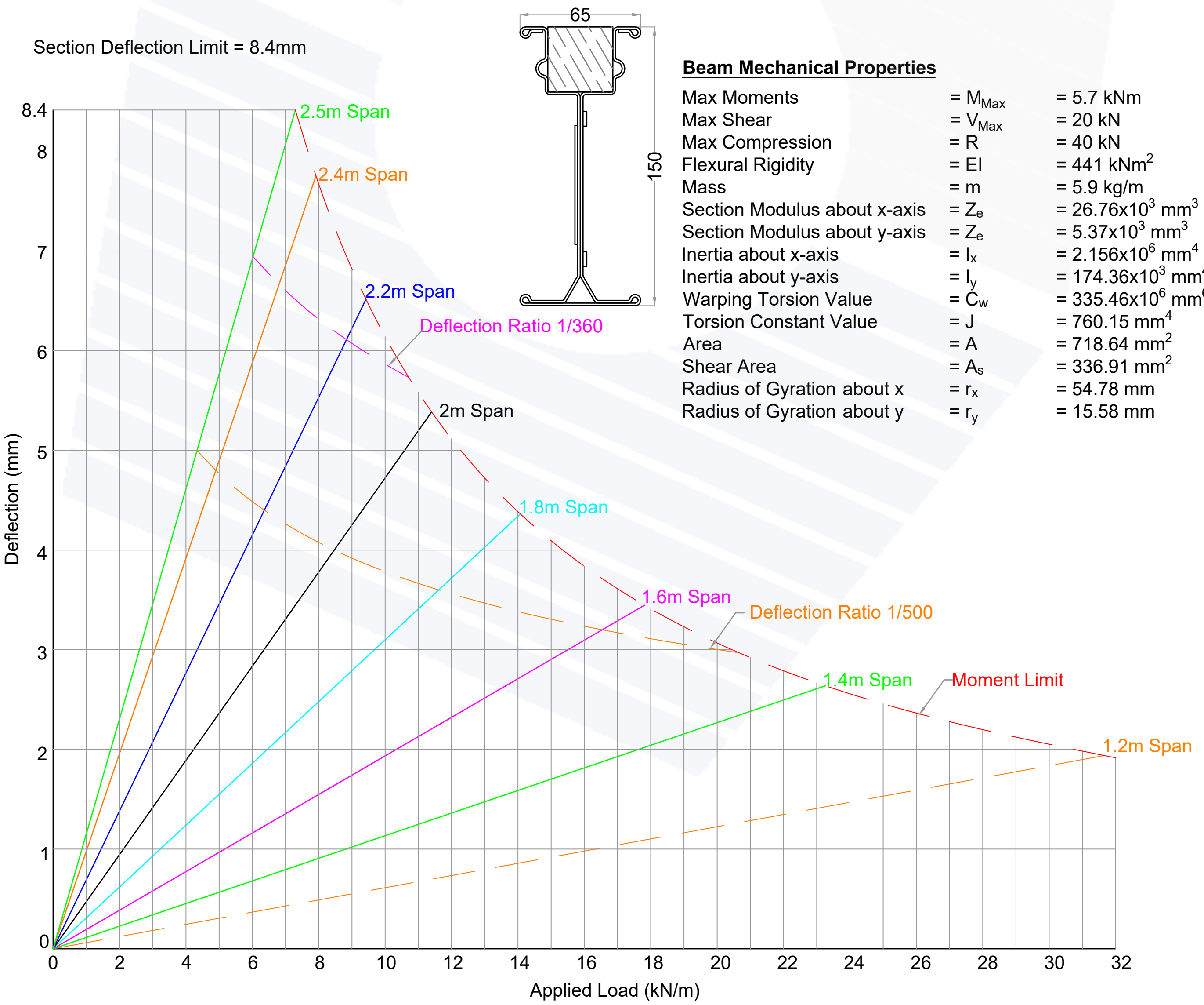
$V = A_s.f$

$\therefore \quad f = \frac{V}{A_s}$ Mpa

Beam Mechanical Properties

Max Moments	$= M_{Max}$	= 5.7 kNm
Max Shear	$= V_{Max}$	= 20 kN
Max Compression	= R	= 40 kN
Flexural Rigidity	= EI	= 441 kNm²
Mass	= m	= 5.9 kg/m
Section Modulus about x-axis	$= Z_e$	$= 26.76\times10^3$ mm³
Section Modulus about y-axis	$= Z_e$	$= 5.37\times10^3$ mm³
Inertia about x-axis	$= I_x$	$= 2.156\times10^6$ mm⁴
Inertia about y-axis	$= I_y$	$= 174.36\times10^3$ mm⁴
Warping Torsion Value	$= C_w$	$= 335.46\times10^6$ mm⁶
Torsion Constant Value	= J	= 760.15 mm⁴
Area	= A	= 718.64 mm²
Shear Area	$= A_s$	= 336.91 mm²
Radius of Gyration about x	$= r_x$	= 54.78 mm
Radius of Gyration about y	$= r_y$	= 15.58 mm

Section Deflection Limit = 8.4mm



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Prop Load Resistance Chart

Permissible Prop Loading (kN) Table.

Prop resistance given in kN	CODE	PR107300	PR107320	PR107450	PR107460	PR107470	PR107621	PR107300
	NAME	BS 0	BS 1	RAS 300	RAS 350	RAS 400	CEP30-350	CEP20-550
	kN-LENGTH	20-300	20-350	30-300	30-350	30-400	30-350	20-550
EXTENDED LENGTH	PROP RANGE	1800-3000	2000-3500	1800-3000	2000-3500	2200-4000	2000-3500	3600-5500
	MASS (kg)	18	20	22	24	26	21.8	35
1800 mm		35		40				
1900 mm		35		40				
2000 mm		35	35	40	40		40	
2100 mm		32.5	35	40	40		40	
2200 mm		30.9	35	40	40	40	40	
2300 mm		29.3	35	37.2	40	40	40	
2400 mm		28	35	36.8	40	40	40	
2500 mm		27.2	35	36.2	40	40	40	
2600 mm		26.4	33.8	35.6	40	40	40	
2700 mm		25.4	32.4	34.8	40	40	40	
2800 mm		24	31.2	33.5	40	40	40	
2900 mm		22.2	30.2	32.2	40	40	40	
3000 mm		20	29.2	30	40	40	40	
3100 mm			27.5		40	40	40	
3200 mm			25.7		37.6	40	37.8	
3300 mm			24.1		35	40	35.5	
3400 mm			22.4		32.3	40	33.2	
3500 mm			20		30	40	30.9	
3600 mm						38.9		34.3
3700 mm						37.4		33.3
3800 mm						34.8		31.2
3900 mm						32.2		29.3
4000 mm						30		27.5
4100 mm								26
4200 mm								24.5
4300 mm								23.1
4400 mm								21.9
4500 mm								20.8
4600 mm								20
4700 mm								20
4800 mm								20
4900 mm								20
5000 mm								20
5100 mm								20
5200 mm								20
5300 mm								20
5400 mm								20
5500 mm								20

BS0, BS1 and CEP20-550 conform with DIN EN 1065 class D.
The permissible load for the entire extension range is minimum 20kN.

RAS300, RAS350, RAS400 and CEP30-350 conform with DIN EN 1065 class E.
The permissible load for the entire extension range is minimum 30kN.

Props can be used with the Inner tube at bottom, in which case the resistance will be slightly more, the given values is for the application when the Inner is at the top.

PRE-FORM (PTY) LTD

Form-Flex Grids on props

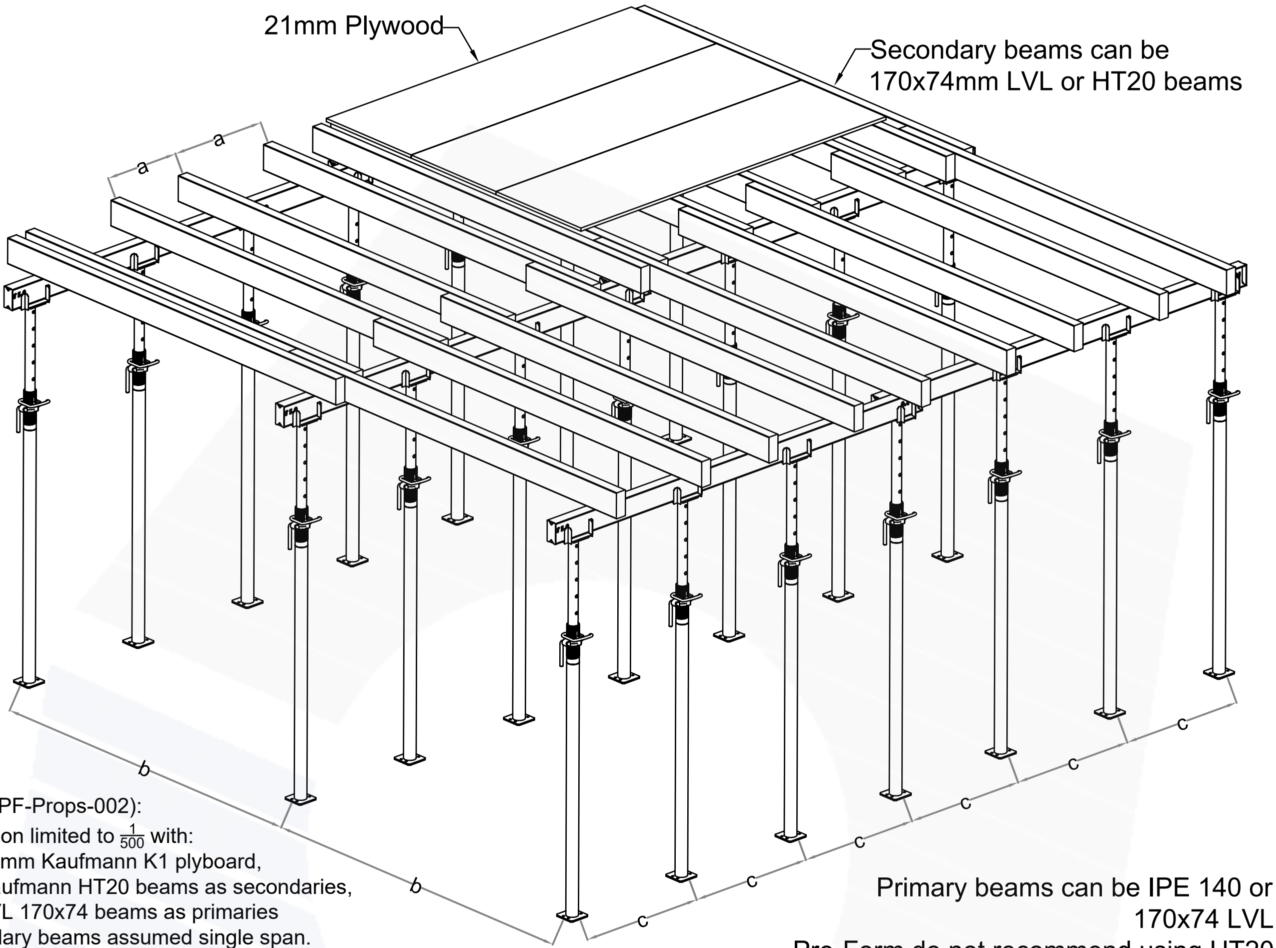

Table Notes (PF-Props-002):

1. Deflection limited to $\frac{1}{500}$ with:
   1.1. 21mm Kaufmann K1 plyboard,
   1.2. Kaufmann HT20 beams as secondaries,
   1.3. LVL 170x74 beams as primaries
2. Secondary beams assumed single span.
3. Use PF-Props-001_Rev0 (Prop Load resistance Chart) for permissable prop loads.

Prop Specific Formulas:

Units:

a = Secondary beam spacing (m)
b = Primary beam spacing (m)
c = Prop spacing (m)
d = Slab Thickness (m)
R = Leg Load (kN)
q = Pressure (kN/m²)
q_L = Construction Live Pressure (kN/m²) ... Typical 2.5 kN/m²
ρ = Density (kN/m³) ... Concrete is 25 kN/m³ for d<1000mm
w_s = Uniformly distributed load acting on secondary (kN/m)
w_p = Uniformly distributed load acting on primary (kN/m)
M = Beam bending moments (kNm)

Uniformly distributed load acting on secondary:

$w_s = (\rho.a.d) + (q_L.a)$ kN ... for d<600mm
$= (25ad) + (2.5a)$ kN

Uniformly distributed load acting on primary:

$w_p = (\rho.b.d) + (q_L.b)$ kN ... for d<600mm
$= (25bd) + (2.5b)$ kN

Leg Load:

$R = (\rho.b.c.d) + (q_L.b.c)$ kN ... for d<600mm
$= (25bcd) + (2.5bc)$ kN

Moments on Secondary:

$M = \frac{wb^2}{8}$ kNm ... use w_s

Moments on Primary:

$M = 0.1071w.c^2$ kNm ... use w_p

Prop grid selection sample:

Assume 350mm slab with RAS30-350 props with extension of 3,3m must be cast. Available secondary beams is HT20 and primary beams 170x74mm LVL. The plywood to be used is Kaufmann K1 21mm.

Method:
Start at top - Plywood → Secondary beams → Primary beams → Prop limit.

1. Getting maximum limits of equipment:
- Kaufmann K1 ply can span maximum 625mm for a 350mm slab (PF-Ply-003)[A].
- 170x74mm LVL as secondary can span 2,4m at 500mm spacing or 2,3m at 625mm spacing. (PF-Beams-003).
- RAS30-350 can resist 35kN at 3,3m extension (PF-Props-001).

2. Selecting a grid:
Referring to PF-Props-003 the best and most economical grid for the site conditions can be selected to satisfy the above values, eg,
- **a** - Secondaries at 625mm spacing,
- **b** - Primaries at 2,2m spacing.
- **c** - Prop spacing at 1,3m spacing.
- **F_L** - Leg load at 32,3kN from table.

3. Check:
- a = 625 ... OK - 625mm allowed for plywood,
- b < 2,3m ... OK - secondary can span 2,3m,
- F_L < 35kN ... OK - allowable leg load is 35kN,

4. Notes:
- Secondary span limits is 2,7m for HT20 and 2,4m for 170x74mm LVL.
- [A] - if other plywood than Kaufmann K1 is used, refer to 21mm Plywood Stress and Spacing Graphs.

PRE-FORM (PTY) LTD

Form-Flex with Props Grid Table

Refer to the Prop Load Resistance Chart for Pre-Form supplied props. For other props refer to supplier for permissible load resistance values. This table make no provision for excessive concrete heaping or point loads caused by reinforce rebar stacking.
Refer to Form-Flex on props for terminology information.
This tables is for Secondary beams as either 170x74mm LVL beams or HT20 beams. Primary beams as either 170x44mm LVL or 140 IPE beams. Plywood calculated as 21mm. Secondary span of 170x74mm beams must be limited to 2.4m.

Slab Thickness (mm)	Pressure (kN/m^2)	Secondary Beam Spacing a (mm)	Permissable Spans for Prop spacing c (m)							
			0.6		0.9		1.2		1.3	
200	7.5	750	2.30	10.4	2.30	15.5	2.30	20.7	2.30	22.4
		650	2.50	11.3	2.50	16.9	2.50	22.5	2.50	24.4
		500	2.70	12.2	2.70	18.2	2.70	24.3	2.70	26.3
250	8.8	625	2.40	12.7	2.40	19.0	2.40	25.3	2.40	27.5
		500	2.55	13.5	2.55	20.2	2.55	26.9	2.55	29.2
		400	2.70	14.3	2.70	21.4	2.70	28.5	2.70	20.9
300	10.0	625	2.30	13.8	2.30	20.7	2.30	27.6	2.30	29.9
		500	2.45	14.7	2.45	22.1	2.45	29.4	2.45	31.9
		400	2.65	15.9	2.65	23.9	2.65	31.8	2.65	34.5
325	10.6	625	2.25	14.3	2.25	21.5	2.25	28.6	2.25	31.0
		500	2.45	15.6	2.45	23.4	2.45	31.2	2.45	33.8
		400	2.60	16.5	2.60	24.8	2.60	33.1	2.60	35.8
350	11.3	625	2.20	14.9	2.20	22.4	2.20	29.8	2.20	32.3
		500	2.35	15.9	2.35	23.9	2.35	31.9	2.35	34.5
		400	2.55	17.3	2.55	25.9	2.55	34.6	2.55	37.5
375	11.9	600	2.20	15.7	2.20	23.6	2.20	31.4	2.20	34.0
		500	2.30	16.4	2.30	24.6	2.30	32.8	2.30	35.6
		400	2.50	17.9	2.50	26.8	2.50	35.7	2.50	38.7
400	12.5	550	2.25	16.9	2.25	25.3	2.25	33.8	2.25	36.6
		500	2.30	17.3	2.30	27.6	2.30	34.5	2.30	37.4
		400	2.45	18.4	2.45	25.3	2.45	36.8	2.45	39.8
425	13.1	550	2.15	16.9	2.15	25.9	2.15	33.8	2.15	36.6
		500	2.25	17.7	2.25	27.6	2.25	35.4	2.25	38.3
		400	2.40	18.9	2.40	25.3	2.40	37.7	2.30	39.2
450	13.8	550	2.10	17.4	2.10	26.5	2.10	34.8	2.10	37.7
		500	2.20	18.2	2.20	28.3	2.20	36.4	2.20	39.5
		400	2.35	19.5	2.35	26.1	2.35	38.9	2.20	39.5
475	14.4	550	2.05	17.7	2.05	27.3	2.05	35.4	2.05	38.4
		500	2.10	18.1	2.10	29.2	2.10	36.3	2.10	39.3
		400	2.30	19.9	2.30	26.6	2.30	39.7	2.10	39.3
500	15.0	500	2.15	19.4	2.15	27.2	2.15	38.7	2.05	40.0
		450	2.20	19.8	2.20	29.8	2.20	39.6	2.05	40.0
		400	2.30	20.7	2.30	29.0	2.20	39.6	2.05	40.0
550	16.3	500	2.05	20.0	2.05	29.7	2.00	39.1	1.85	39.2
		450	2.15	21.0	2.15	31.1	2.00	39.1	1.85	39.2
		400	2.25	22.0	2.25	30.1	2.00	39.1	1.85	39.2
600	17.5	500	2.00	21.0	2.00	31.5	1.90	39.9	1.75	39.8
		450	2.10	22.1	2.10	33.1	1.90	39.9	1.75	39.8
		400	2.20	23.1	2.20	34.7	1.90	39.9	1.75	39.8
			Primary beam Span b (m)	Leg Load (kN)	Primary beam Span b (m)	Leg Load (kN)	Primary beam Span b (m)	Leg Load (kN)	Primary beam Span b (m)	Leg Load (kN)

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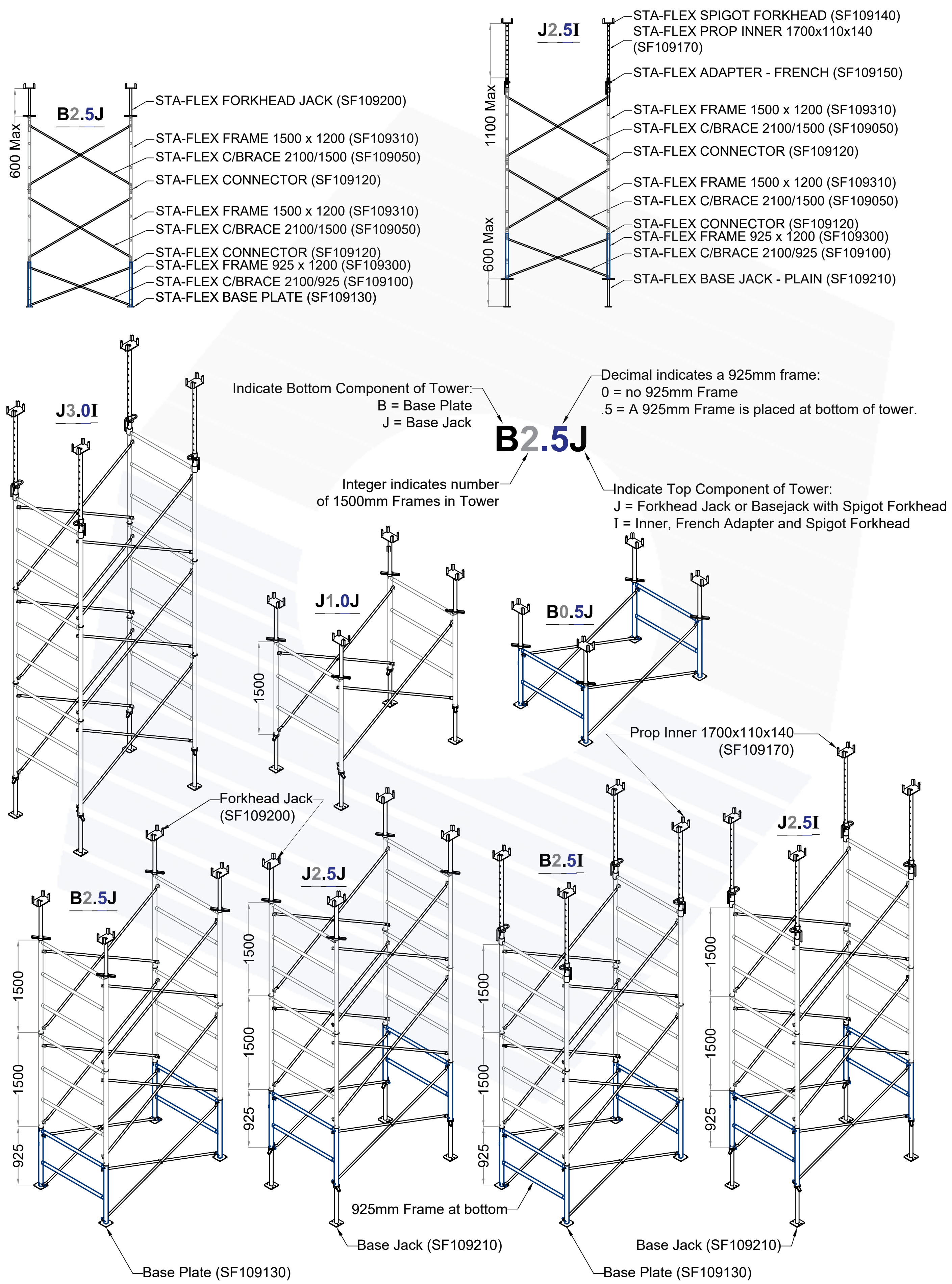
Sta-Flex™ Tower Configurations



PRE-FORM (PTY) LTD

Sta-Flex™ Free Standing Tower Leg Loading Chart

Tower Configurations (Refer to PF-STA-001 for exalanation)	Tower Height in metres between min / max (70 – 100mm for stripping included)	Projected Areas of Wind Influence per tower (m^2) - 90°/0° in plan to Cross-Brace (A_T)	Leg Load V_1 with 15% Horizontal Containment at top[1]	Leg Load V_2 with 15% Horizontal Containment at top[2]	Leg Load V_3 - Free Standing Towers (F_s)	Tower Configuration Self Weight (kN)	Frame 1500 x 1200mm	Frame 925 x 1200mm	Base Plate with Toggle Pin	Base Jack	Cross-Brace for 1500 Frame Series	Cross-Brace for 925 Frame Series	Forkhead Jack	Horizontal Diagonal	Adapter, Inner and Spigot Forkhead	Frame Connectors
			V_1 (kN)	V_2 (kN)	V_3 (kN)											
B0.5J	1.13 - 1.53	0.8/0.9	65	-	60	0.89	-	2	4	-	-	2	4	1	-	-
B1.0J	1.62 - 2.10	0.8/1.0	65	-	60	1.05	2	-	4	-	2	-	4	1	-	-
J1.0J	1.89 - 2.70	0.8/1.0	65	-	60	1.27	2	-	-	4	2	-	4	1	-	-
B1.0I	1.94 - 2.82	0.9/1.2	40	-	40	1.35	2	-	4	-	2	-	-	1	4	-
J1.0I	2.69 - 3.41	1.1/1.4	40	-	40	1.57	2	-	-	4	2	-	-	1	4	-
B1.5J	2.56 - 3.04	1.3/1.6	60	-	55	1.46	2	2	4	-	2	2	4	1	-	4
J1.5J	2.62 - 3.63	1.4/1.8	60	-	55	1.67	2	2	-	4	2	2	4	1	-	4
B1.5I	2.81- 3.75	1.4/1.8	40	-	40	1.77	2	2	4	-	2	2	-	1	4	4
J1.5I	2.87 - 4.34	1.6/1.9	40	-	40	1.97	2	2	-	4	2	2	-	1	4	4
B2.0J	3.14 - 3.61	1.4/1.9	60	-	55	1.62	4	-	4	-	4	-	4	1	-	4
J2.0J	3.18 - 4.21	1.6/2.1	60	-	50	1.84	4	-	-	4	4	-	4	1	-	4
B2.0I	3.38 - 4.33	1.6/2.1	40	-	40	1.92	4	-	4	-	4	-	-	1	4	4
J2.0I	3.43 - 4.92	1.7/2.3	40	-	40	2.15	4	-	-	4	4	-	-	1	4	4
B2.5J	4.07 - 4.54	1.9/2.5	55	50	-	2.03	4	2	4	-	4	2	4	1	-	8
J2.5J	4.12 - 5.14	2.0/2.7	50	45	-	2.24	4	2	-	4	4	2	4	1	-	8
B2.5I	4.32 - 5.25	2.1/2.7	40	40	-	2.33	4	2	4	-	4	2	-	1	4	8
J2.5I	4.37 - 5.85	2.2/2.8	40	40	-	2.54	4	2	-	4	4	2	-	1	4	8
B3.0J	4.07 - 5.12	2.1/2.9	55	50	-	2.19	6	-	4	-	6	-	4	1	-	8
J3.0J	4.68 - 5.69	2.2/3.0	50	45	-	2.40	6	-	-	4	6	-	4	1	-	8
B3.0I	4.82 - 5.83	2.3/3.0	40	40	-	2.49	6	-	4	-	6	-	-	1	4	8
J3.0I	4.93 - 6.43	2.4/3.2	40	40	-	2.71	6	-	-	4	6	-	-	1	4	8
B3.5J	5.58- 6.05	2.6/3.4	55	50	-	2.60	6	2	4	-	6	2	4	1	-	12
J3.5J	5.63 - 6.64	2.7/3.6	50	45	-	2.81	6	2	-	4	6	2	4	1	-	12
B3.5I	5.82 - 6.76	2.7/3.6	40	40	-	2.90	6	2	4	-	6	2	-	1	4	12
J3.5I	5.88 - 7.35	2.9/3.8	40	40	-	3.11	6	2	-	4	6	2	-	1	4	12
B4.0J	6.15 - 6.62	2.7/3.8	55	50	-	2.76	8	-	4	-	8	-	4	1	-	12
J4.0J	6.19 - 7.22	2.9/3.9	50	45	-	2.97	8	-	-	4	8	-	4	1	-	12
B4.0I	6.39 - 7.34	2.9/3.9	35	30	-	3.06	8	-	4	-	8	-	-	1	4	12
J4.0I	6.44 - 7.93	3.0/4.1	35	30	-	3.28	8	-	-	4	8	-	-	1	4	12
B4.5J	7.08 - 7.55	3.2/4.3	50	45	-	3.17	8	2	4	-	8	2	4	1	-	16
J4.5J	7.15 - 8.15	3.3/4.5	45	40	-	3.37	8	2	-	4	8	2	4	1	-	16
B4.5I	7.33 - 8.27	3.4/4.5	35	30	-	3.47	8	2	4	-	8	2	-	1	4	16
J4.5I	7.40 - 8.86	3.5/4.7	30	25	-	3.68	8	2	-	4	8	2	-	1	4	16
B5.0J	7.66 - 8.13	3.4/4.7	50	45	-	3.33	10	-	4	-	10	-	4	1	-	16
J5.0J	7.72 - 8.72	3.5/4.8	45	40	-	3.54	10	-	-	4	10	-	4	1	-	16
B5.0I	7.90 - 8.84	3.5/4.8	30	25	-	3.63	10	-	4	-	10	-	-	1	4	16
J5.0I	7.96 - 9.44	3.7/5.0	25	20	-	3.85	10	-	-	4	10	-	-	1	4	16

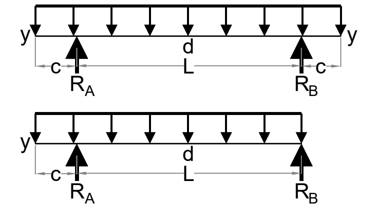
NOTES:

1. Vertical leg load V_1 applies only if a horizontal containment force H, equal to 15% of vertical loads, is applied in both directions. The containment force H is defined per meter in the direction of the cross-braces or per 10m length in the frame plane. Loads are for vertical towers only. H is established by two possible means, i.e. reaction forces as a result of the existing structure (columns and walls), or, the group effect of at least 6 towers braced together in at least two rows.
2. Vertical leg load V_2 for wind loads not exceeding 6 kN/m. No allowance for wind load is made for towers lower than 4,2m. Simple diagonal bracing between outer towers by means of scaffold tube and fittings must be introduced for heights between 4,2m and 9,44m. Refer to PF-STA-006_Rev0 for wind brace design information Please consult our technical department for advice on wind loads for towers exceeding 6,05m high.
3. All safe working loads with a safety factor of 2,0.
4. Designs and bracing done to EN 12813-2004 - Shoring towers made of prefabricated components.

Sta-Flex™ Slab Layout with 2100mm Cross-Braces

PRE-FORM (PTY) LTD

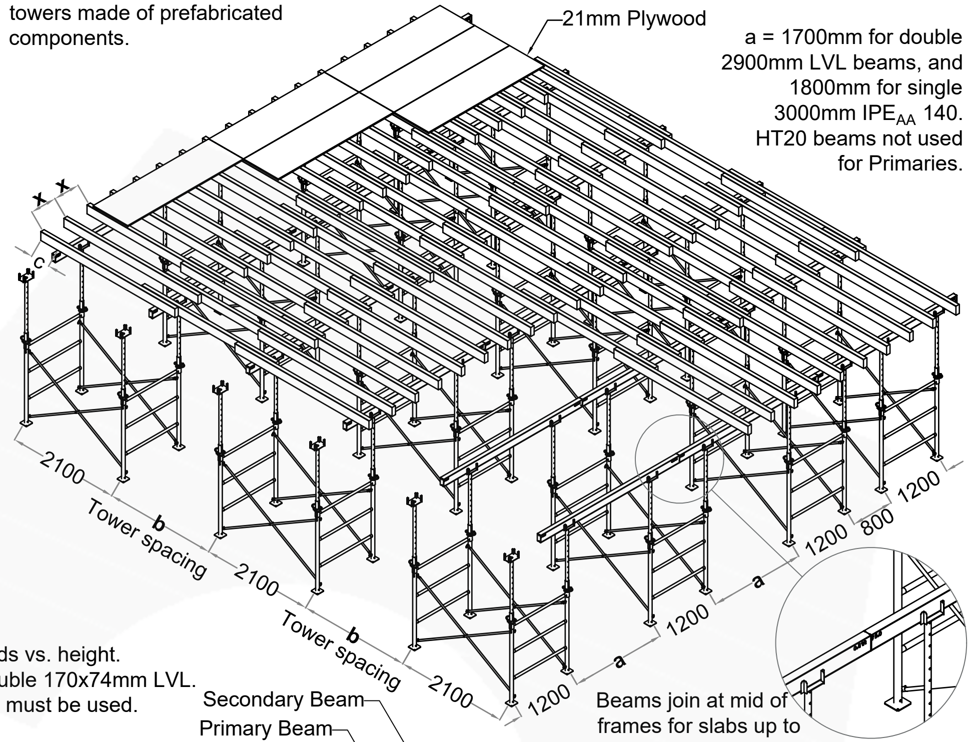
Secondary Beam Cantilever Allowance at end/edge of slab.



Secondary beam max cantilever **c** (mm)
Deflection limit set 6mm.

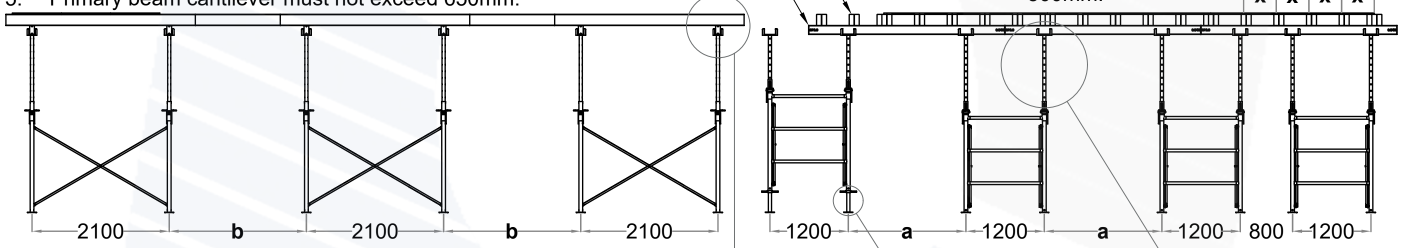
Slab Thk (mm)	HT20 Spacing (mm)			LVL Spacing (mm)			
	500	625	675	400	500	625	675
<280	800	800	800	800	800	750	750
300	800	800	800	800	800	750	700
350	800	800	800	800	750	700	700
400	800	800	800	750	700	650	650
450	800	800	-	750	700	650	650
500	800	-	-	700	650	650	600
550	800	-	-	-	-	-	-
600	800	-	-	-	-	-	-

According to EN 12813-2004 - Shoring towers made of prefabricated components.



Notes:

1. Refer to Load Chart for allowable leg loads vs. height.
2. Primary beams must be 140_{AA} IPE or double 170x74mm LVL.
3. 21mm thick construction quality Plywood must be used.
4. Primary beam join in center of towers.
5. Primary beam cantilever must not exceed 650mm.



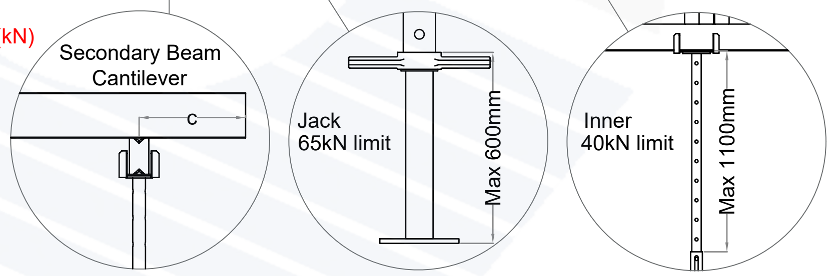
Leg load formula:

Area of Leg Load (m) x Total Load (kN/m) = Leg Load (kN)

$(\frac{(b+2.1)}{2} \times \frac{L}{2}) \times F = R_L$

Example:

Leg Load for a 300mm slab, 2100mm cross-brace and 2400mm tower spacing with 2900mm Primary beams:
From Table 300mm slab = 9.4kN/m² Total Load
$(\frac{(2.4+2.1)}{2} \times \frac{2.9}{2}) \times 9.3 =$ 30.4kN

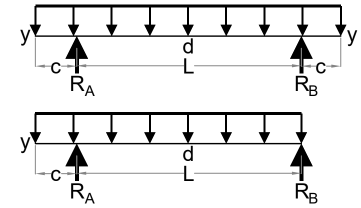


¹⁄₃₆₀ deflection limit		HT20 Secondary Beam Spacing **x** (m)			170x74mm LVL Secondary Beam Spacing **x** (m)				Tower Spacing **b** (m)						
Slab Thickness (mm)	Total Load (kN/m²)	0.5	0.625	0.675	0.4	0.5	0.625	0.675	2.1	2.2	2.3	2.4	2.5	2.6	2.7
		Tower Spacing **b** (m)			Tower Spacing **b** (m)				Leg Loads with 2100mm Cross Braces R_L (kN)						
100	4.1	2.7	2.7	2.7	2.7	2.7	2.7	2.7	12.9	13.2	13.5	13.8	14.1	14.5	14.8
120	4.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6	14.6	14.9	15.2	15.6	15.9	16.3	16.6
140	5.2	2.7	2.7	2.7	2.7	2.7	2.6	2.5	16.2	16.6	17.0	17.3	17.7	18.1	18.5
160	5.7	2.7	2.7	2.7	2.7	2.7	2.5	2.4	17.8	18.3	18.7	19.1	19.5	20.0	20.4
180	6.2	2.7	2.7	2.7	2.7	2.6	2.4	2.4	19.5	19.9	20.4	20.9	21.3	21.8	22.2
200	6.7	2.7	2.7	2.7	2.7	2.5	2.4	2.3	21.1	21.6	22.1	22.6	23.1	23.6	24.1
220	7.3	2.7	2.7	2.7	2.7	2.5	2.3	2.2	22.7	23.3	23.8	24.4	24.9	25.5	26.0
240	7.8	2.7	2.7	2.7	2.6	2.4	2.2	2.2	24.4	25.0	25.5	26.1	26.7	27.3	27.9
260	8.1	2.7	2.7	2.7	2.6	2.4	2.2	2.2	25.4	26.0	26.6	27.2	27.8	28.4	29.0
280	8.7	2.7	2.7	2.6	2.5	2.3	2.2	2.1	27.3	28.0	28.6	29.3	29.9	30.6	31.2
300	9.3	2.7	2.6	2.5	2.4	2.3	2.1	-	29.3	30.0	30.7	31.4	32.1	32.8	33.5
350	10.9	2.7	2.4	2.3	2.3	2.2	-	-	34.2	35.0	35.8	36.6	37.4	38.2	39.1
400	12.4	2.5	2.3	2.2	2.2	-	-	-	39.1	40.0	40.9	41.9	42.8	-	-
420	13.1	2.5	2.2	2.1	2.2	-	-	-	41.0	42.0	43.0	43.9	44.9	-	-
450	14.0	2.4	2.1	-	2.1	-	-	-	43.9	45.0	46.0	47.1	-	-	-
480	14.9	2.3	-	-	-	-	-	-	46.9	48.0	49.1	-	-	-	-
500	15.5	2.3	-	-	-	-	-	-	48.8	50.0	51.2	-	-	-	-

PRE-FORM (PTY) LTD

Sta-Flex™ Slab Layout with 1600mm Cross-Braces

Secondary Beam Cantilever Allowance at end/edge of slab.

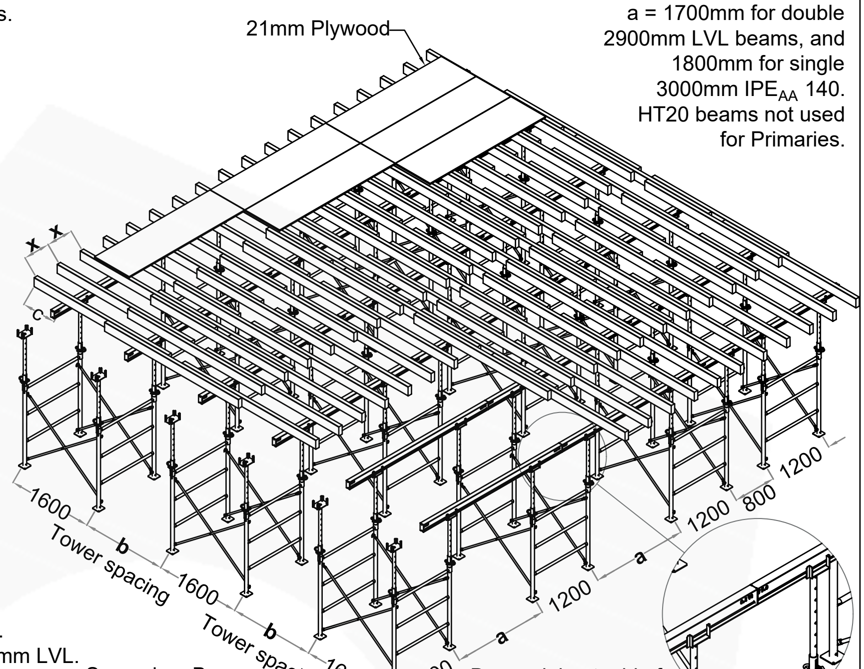


Secondary beam max cantilever **c** (mm)
Deflection limit set 6mm.

Slab Thk (mm)	HT20 Spacing (mm)			LVL Spacing (mm)			
	500	625	675	400	500	625	675
<280	800	800	800	800	800	750	750
300	800	800	800	800	800	750	700
350	800	800	800	800	750	700	700
400	800	800	800	750	700	650	650
450	800	800	-	750	700	650	650
500	800	-	-	700	650	650	600
550	800	-	-	-	-	-	-
600	800	-	-	-	-	-	-

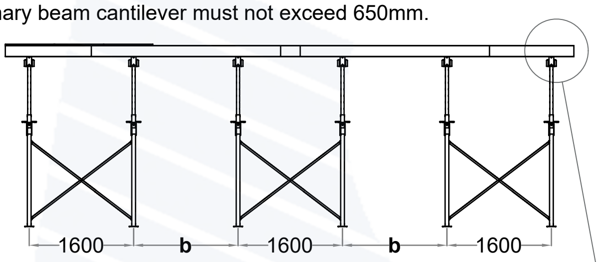
According to EN 12813-2004 - Shoring towers made of prefabricated components.

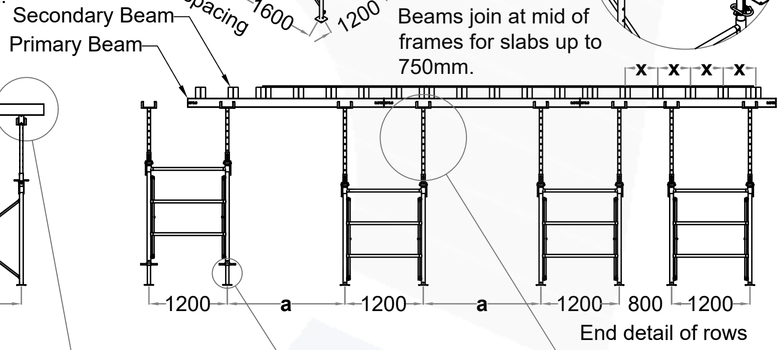
a = 1700mm for double 2900mm LVL beams, and 1800mm for single 3000mm IPE_{AA} 140. HT20 beams not used for Primaries.



Notes:

1. Refer to Load Chart for allowable leg loads vs. height.
2. Primary beams must be 140_{AA} IPE or double 170x74mm LVL.
3. 21mm thick construction quality Plywood must be used.
4. Primary beam join in center of towers.
5. Primary beam cantilever must not exceed 650mm.





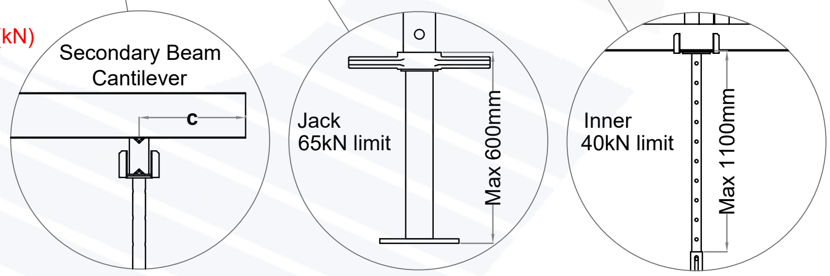
Leg load formula:

Area of Leg Load (m) x Total Load (kN/m) = Leg Load (kN)

$\left(\frac{b+[\text{cross-brace size}]}{2} \times \frac{L}{2}\right) \times F = R_L$

Example:

Leg Load for a 450mm slab, 1600mm cross-brace and 2.4mm tower spacing with 3000mm Primary beams:
From Table 450mm slab = 14.0kN/m² Total Load
$\left(\frac{2.4m+1.6m}{2} \times \frac{3.0m}{2}\right) \times 14kN/m^2 = 42.0kN$



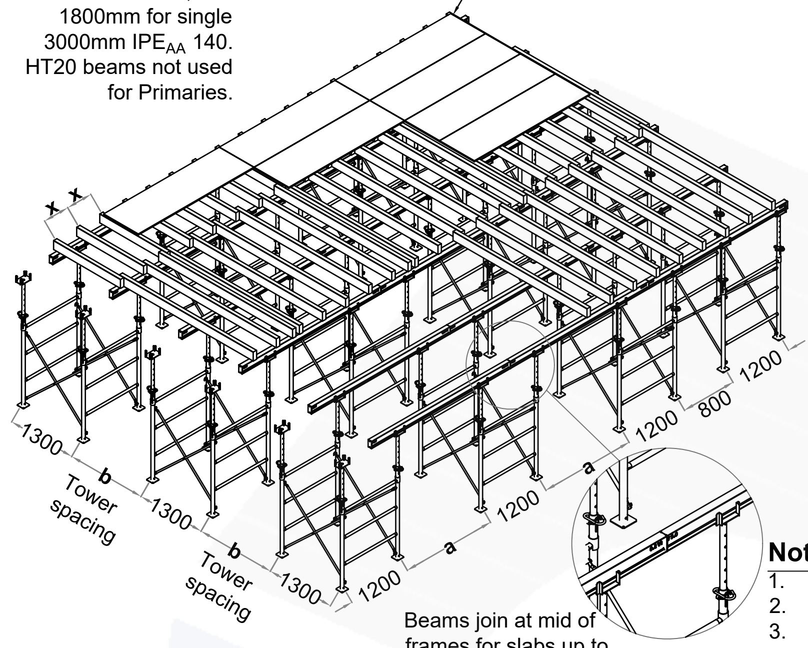
$\frac{1}{360}$ deflection limit		HT20 Secondary Beam Spacing **x** (m)			170x74mm LVL Secondary Beam Spacing **x** (m)				Tower Spacing **b** (m)									
Slab Thickness (mm)	Total Load (kN/m²)	0.5	0.625	0.675	0.4	0.5	0.625	0.675	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.5	2.7
		Tower Spacing **b** (m)			Tower Spacing **b** (m)				Leg Loads with 2100mm Cross Braces R_L (kN)									
150	5.4	2.7	2.7	2.7	2.7	2.7	2.5	2.5	11.7	12.2	12.6	13.0	13.4	13.8	14.2	14.6	15.4	16.2
200	6.7	2.7	2.7	2.7	2.7	2.5	2.4	2.3	14.6	15.1	15.6	16.1	16.6	17.1	17.6	18.1	19.1	20.1
250	7.8	2.7	2.7	2.7	2.6	2.4	2.2	2.2	16.9	17.4	18.0	18.6	19.2	19.8	20.3	20.9	22.1	23.3
300	9.3	2.7	2.6	2.5	2.4	2.3	2.1	2.1	20.2	20.9	21.6	22.3	23.0	23.7	24.4	25.1	26.5	27.9
350	10.9	2.7	2.4	2.3	2.3	2.2	2.0	2.0	23.6	24.4	25.2	26.0	26.9	27.7	28.5	29.3	30.9	32.6
400	12.4	2.5	2.3	2.2	2.2	2.1	1.9	1.9	27.0	27.9	28.8	29.8	30.7	31.6	32.6	33.5	35.3	-
450	14.0	2.4	2.1	2.1	2.1	2.0	1.8	1.8	30.3	31.4	32.4	33.5	34.5	35.6	36.6	37.7	-	-
500	15.5	2.3	2.0	2.0	2.1	1.9	1.8	1.7	33.7	34.9	36.0	37.2	38.4	39.5	40.7	41.9	-	-
550	17.1	2.2	1.9	1.9	2.0	1.9	1.7	1.7	37.1	38.4	39.6	40.9	42.2	43.5	44.8	-	-	-
600	18.6	2.1	1.9	1.8	1.9	1.8	1.7	1.6	40.5	41.9	43.2	44.6	46.0	47.4	-	-	-	-
650	20.2	2.0	1.7	1.6	1.9	1.8	1.6	1.6	43.8	45.3	46.8	48.4	49.9	-	-	-	-	-
700	21.7	1.9	1.6	-	1.8	1.7	1.6	1.6	47.2	48.8	50.5	52.1	-	-	-	-	-	-
750	23.3	1.7	-	-	1.7	1.7	1.6	-	50.6	52.3	-	-	-	-	-	-	-	-

PRE-FORM (PTY) LTD

Sta-Flex™ Slab Layout with 1300mm Cross-Braces

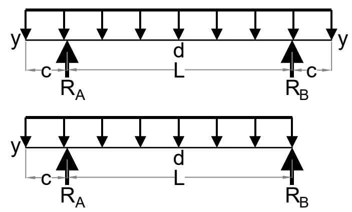
According to EN 12813-2004 - Shoring towers made of prefabricated components.

a = 1700mm for double 2900mm LVL beams, and 1800mm for single 3000mm IPE_{AA} 140. HT20 beams not used for Primaries.



Beams join at mid of frames for slabs up to 850mm.

Secondary Beam Cantilever Allowance at end/edge of slab.



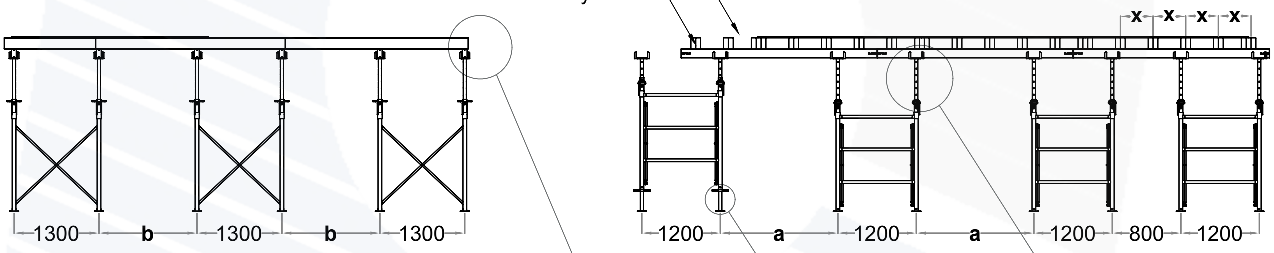
Secondary beam max cantilever **c** (mm)

Deflection limit set 6mm.

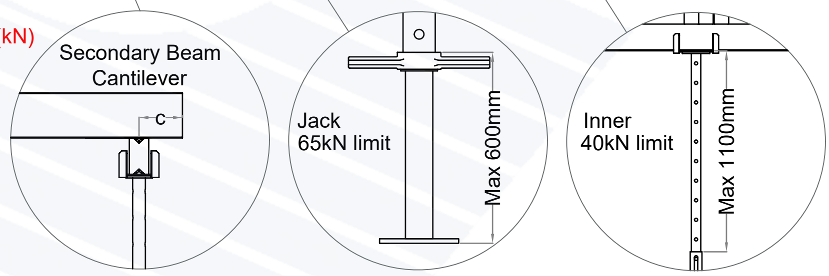
Slab Thk (mm)	HT20 Spacing (mm)			LVL Spacing (mm)			
	500	625	675	400	500	625	675
<280	800	800	800	800	800	750	750
300	800	800	800	800	800	750	700
350	800	800	800	800	750	700	700
400	800	800	800	750	700	650	650
450	800	800	-	750	700	650	650
500	800	-	-	700	650	650	600
550	800	-	-	-	-	-	-
600	800	-	-	-	-	-	-

Notes:

1. Refer to Load Chart for allowable leg loads vs. height.
2. Primary beams must be 140_{AA} IPE or double 170x74mm LVL.
3. 21mm thick construction quality Plywood must be used.
4. Primary beam join in center of towers.
5. Primary beam cantilever must not exceed 650mm.



End detail of rows



Leg load formula:

Area of Leg Load (m) x Total Load (kN/m) = Leg Load (kN)

$(\frac{b+1.3}{2}) \times \frac{\text{Cross Brace} + b}{2}) \times F = R_L$

Example:

Leg Load for a 400mm slab, 1300mm cross-brace and 1500mm tower spacing with 2900mm Primary beams:
From Table 400mm slab = 12.4kN/m² Total Load

$(\frac{1.5+1.3}{2} \times \frac{2.9}{3}) \times 12.4 = \underline{16.8\text{kN}}$

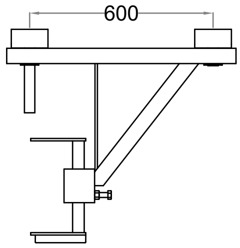
⅟360 deflection limit		HT20 Secondary Beam Spacing **x** (m)			170x74mm LVL Secondary Beam Spacing **x** (m)				Tower Spacing **b** (m)									
Slab Thickness (mm)	Total Load (kN/m²)	0.5	0.625	0.675	0.4	0.5	0.625	0.675	1.3	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.3	2.7
		Tower Spacing **b** (m)			Tower Spacing **b** (m)				Leg Loads with 2100mm Cross Braces R_L (kN)									
350	10.9	2.7	$2.3_{2.4}$	2.3	2.3	2.2	2.0	2.0	21.2	22.8	23.6	24.4	25.2	26.0	26.9	27.7	29.3	32.6
400	12.4	$2.3_{2.5}$	2.3	$2.1_{2.2}$	$2.1_{2.2}$	2.1	1.9	1.9	24.2	26.0	27.0	27.9	28.8	29.8	30.7	31.6	33.5	-
450	14	$2.3_{2.4}$	2.1	2.1	2.1	2.0	1.8	1.8	27.2	29.3	30.3	31.4	32.4	33.5	34.5	35.6	37.7	-
500	15.5	2.3	2.0	2.0	2.1	1.9	1.8	1.7	30.2	32.6	33.7	34.9	36.0	37.2	38.4	39.5	41.9	-
550	17.1	$2.1_{2.2}$	1.9	1.9	2.0	1.9	1.7	1.7	33.2	35.8	37.1	38.4	39.6	40.9	42.2	43.5	-	-
600	18.6	2.1	1.9	1.8	1.9	1.8	1.7	1.6	36.3	39.1	40.5	41.9	43.2	44.6	46.0	47.4	-	-
650	20.2	2.0	1.7	1.6	1.9	1.8	1.6	1.6	39.3	42.3	43.8	45.3	46.8	48.4	49.9	-	-	-
700	21.7	1.9	1.6	1.5	1.8	1.7	1.6	1.6	42.3	45.6	47.2	48.8	50.5	52.1	-	-	-	-
750	23.3	1.7	1.5	$1.3_{1.4}$	1.7	1.7	1.6	1.5	45.3	48.8	50.6	52.3	-	-	-	-	-	-
800	24.8	1.5	$1.3_{1.4}$	1.3	1.5	1.5	1.5	1.5	48.4	52.1	-	-	-	-	-	-	-	-
850	26.4	1.3	1.3	-	1.3	1.3	1.3	1.3	51.4	-	-	-	-	-	-	-	-	-

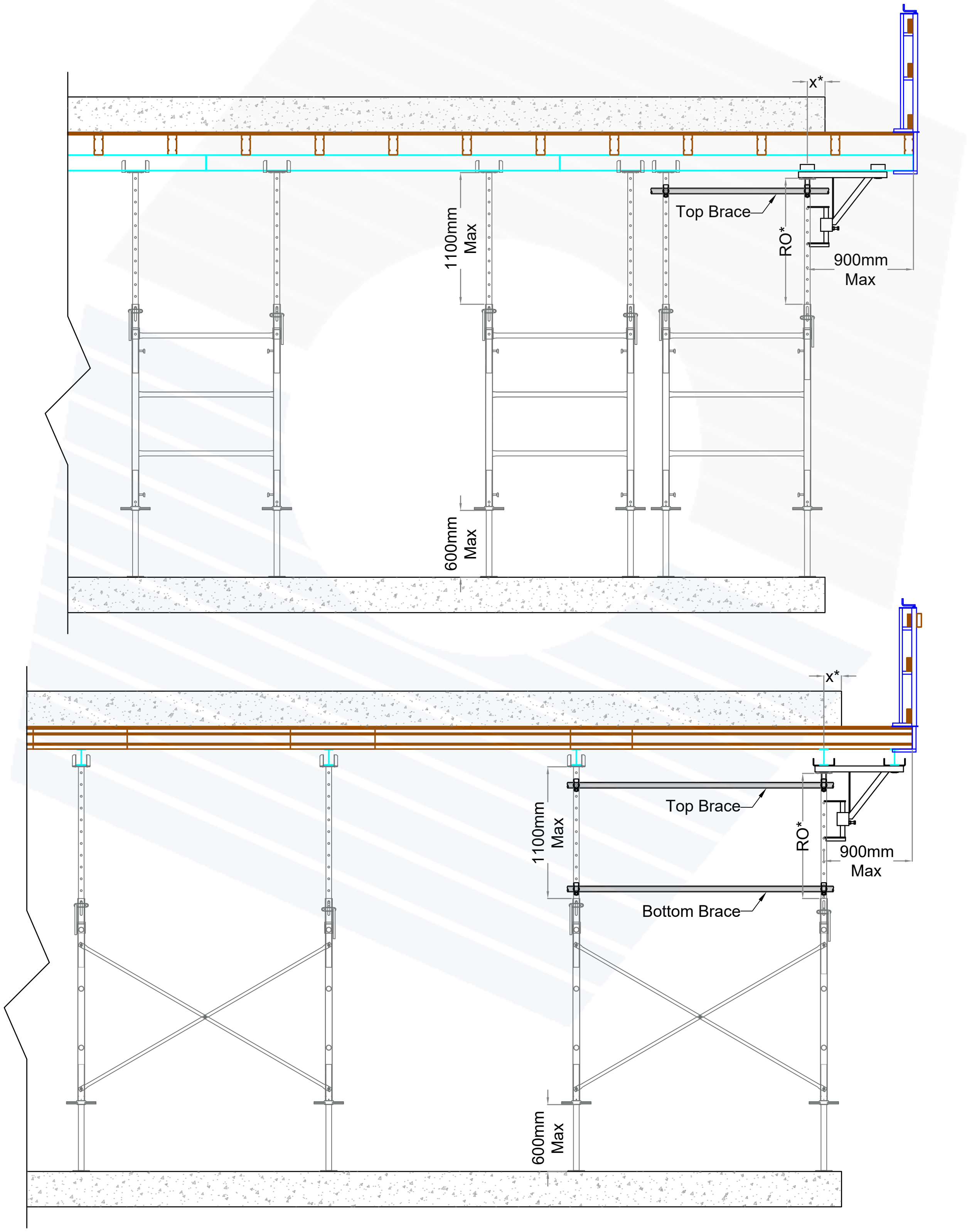
Sta-Flex™ Cantilever Brackets (600mm)

PRE-FORM (PTY) LTD

Notes:

1. x*=150mm maximum concrete distance. Consult with Pre-Form Technical Department if more load is required.
2. For RO*>300, Top bracing must be installed as shown.
3. Bottom Bracing must always be installed in the Sta-Flex™ Cross-Brace direction as indicated.
4. Cantilever can be installed with Inner of Base Jack.
5. Bracing can be done with Swivel Couplers and Scaffold Tube, or Multi-diameter Connectors.
6. Allowable Live Load on work area = 1.6kN/m^2.
7. If the beam spans on the brackets are more than shown (900mm), consult with Pre-Form Technical Department.



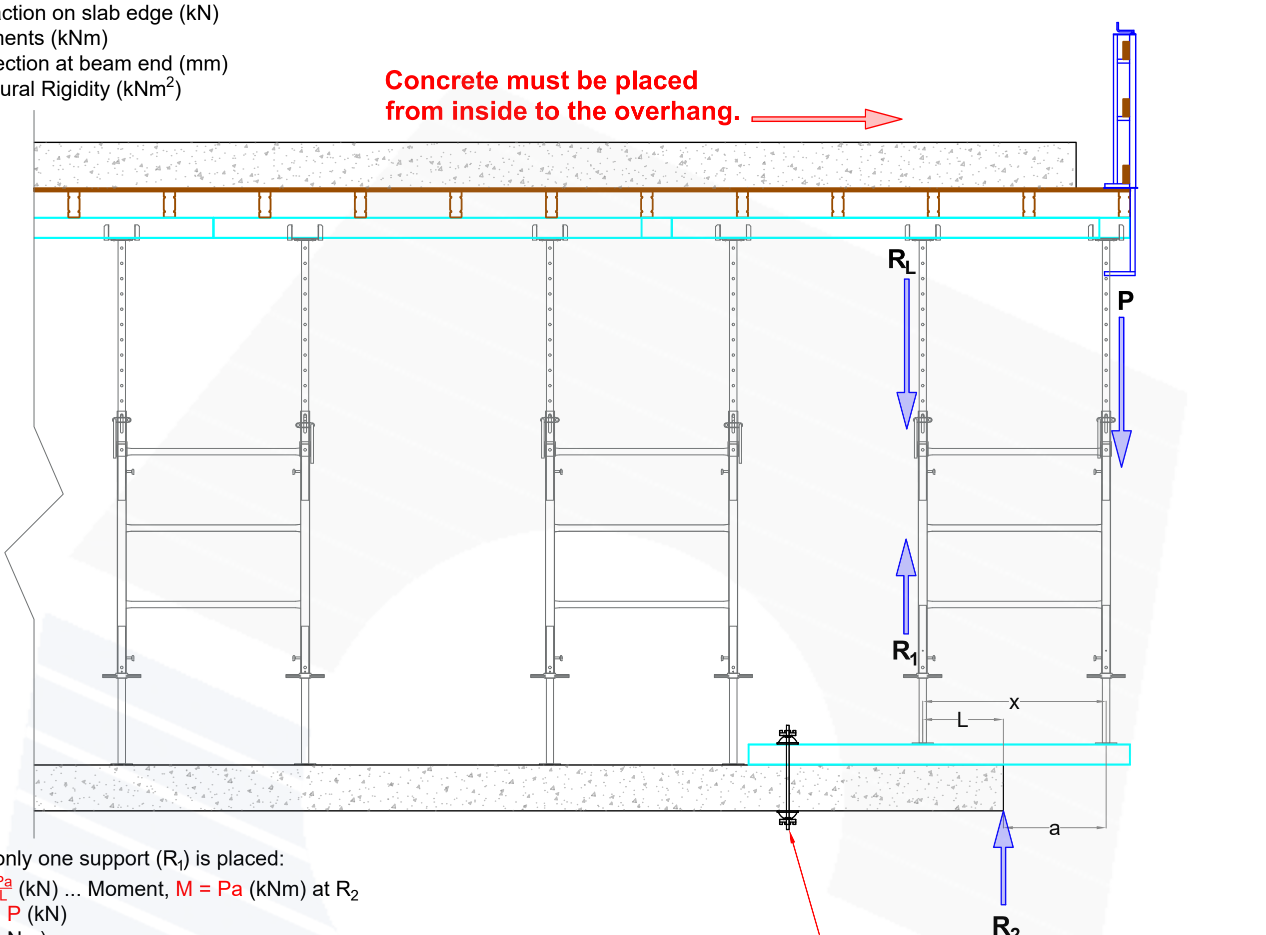


PRE-FORM (PTY) LTD

Sta-Flex™ Single Overhang Beam Deflections

Units:

1. P = Leg Load (kN)
2. R_L = Leg Load (kN)
3. R_2 = Reaction on slab edge (kN)
4. M = Moments (kNm)
5. Δ = Deflection at beam end (mm)
6. EI = Flexural Rigidity (kNm^2)



Formulas:

If no Tie and only one support (R_1) is placed:

1. $R_1 = R_L - \frac{Pa}{L}$ (kN) ... Moment, M = Pa (kNm) at R_2
2. $R_2 = R_1 + P$ (kN)
3. M = Pa (kNm)
4. V = P (kN) ... Shear
5. Deflections:

5.1. $\Delta = 1000 \frac{Pa^2}{3EI}(L+a)$ ... For other Beams

5.2. $\Delta = \frac{250Pa^2x}{363}$ mm ... Double LVL

5.3. $\Delta = \frac{500Pa^2x}{1221}$ mm ... Single IPE_{AA} 140

5.4. $\Delta = \frac{125Pa^2x}{609}$ mm ... Double IPE_{AA} 140

5.5. $\Delta = \frac{100Pa^2x}{1737}$ mm ... Single IPE_{AA} 140

Table must be used as Reference to Formulas.
- is out of limit.

Deflections (mm) and Limits for Overhang Beams up to 1000mm and L=1.2m

a* (m)	Double 170x74mm LVL					Single IPE_{AA} 140					Double IPE_{AA} 140					300mm Form Soldier*				
	P=10 (kN)	P=17.5 (kN)	P=25 (kN)	P=32.5 (kN)	P=40 (kN)	P=10 (kN)	P=17.5 (kN)	P=25 (kN)	P=32.5 (kN)	P=40 (kN)	P=10 (kN)	P=17.5 (kN)	P=25 (kN)	P=32.5 (kN)	P=40 (kN)	P=10 (kN)	P=17.5 (kN)	P=25 (kN)	P=32.5 (kN)	P=40 (kN)
0.15	0.12	0.22	0.31	0.4	0.5	0.13	0.22	0.31	0.4	0.5	0.06	0.11	0.16	0.2	0.25	0.02	0.03	0.04	0.06	0.07
0.2	0.23	0.4	0.57	0.75	0.92	0.3	0.4	0.57	0.75	0.92	0.12	0.2	0.29	0.37	0.46	0.03	0.06	0.08	0.11	0.13
0.25	0.37	0.65	0.93	1.21	1.48	0.37	0.65	0.93	1.21	-	0.86	0.33	0.47	0.6	0.74	0.05	0.09	0.13	0.17	0.21
0.3	0.55	0.97	1.38	1.8	-	0.55	0.97	1.38	-	-	0.28	0.49	0.7	0.9	1.11	0.08	0.14	0.19	0.25	0.3
0.35	0.78	1.36	1.94	2.53	-	0.78	1.36	-	-	-	0.39	0.68	0.98	1.27	1.56	0.11	0.2	0.27	0.36	0.44
0.4	1.05	1.83	2.62	-	-	1.05	1.84	-	-	-	0.53	0.92	1.31	1.71	-	0.15	0.26	0.37	0.48	0.59
0.45	1.37	2.39	3.4	-	-	1.37	2.4	-	-	-	0.69	1.2	1.71	2.23	-	0.19	0.34	0.48	0.63	0.77
0.5	1.74	3.05	-	-	-	1.74	-	-	-	-	0.87	1.53	2.18	-	-	0.25	0.43	0.61	0.8	0.98
0.55	2.17	3.79	-	-	-	2.17	-	-	-	-	1.09	1.9	2.72	-	-	0.31	0.53	0.76	1.0	1.22
0.6	2.65	4.64	-	-	-	2.65	-	-	-	-	1.33	2.33	3.33	-	-	0.37	0.65	0.93	1.21	-
0.65	3.2	-	-	-	-	-	-	-	-	-	1.6	2.81	-	-	-	0.45	0.79	1.13	1.46	-
0.7	3.81	-	-	-	-	-	-	-	-	-	1.91	3.34	-	-	-	0.54	0.94	1.34	1.75	-
0.75	4.49	-	-	-	-	-	-	-	-	-	2.25	-	-	-	-	0.63	1.11	1.58	-	-
0.8	-	-	-	-	-	-	-	-	-	-	2.63	-	-	-	-	0.73	1.29	1.84	-	-
0.85	-	-	-	-	-	-	-	-	-	-	3.04	-	-	-	-	0.85	1.5	2.13	-	-
0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.98	1.71	2.8	-	-
0.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.12	1.95	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.27	2.22	-	-	-

Table based on L = 1200 mm.
* If overhang (a) needs to be more than 1000mm, consult Pre-Form Technical Department for a design.
Limits of beams calculated with ULS of 1.6 for Dead and Live Load. For Steel members SANS 1062: Part 1, used as design code.

Back Propping as per SANS 0100-2

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General:

1. Slab Formwork will remain in place until the concrete has at least reached the design strength (which should be specified in the contract documents) to support its own weight (9.5.1.1; SANS 0100-2).
2. If the strength of concrete to support its own weight is not specified, a strength at 75% of the 28 day strength will be assumed sufficient to strip.
3. Post-tension slabs and beams will be stripped after cables have been tensioned.
4. Formwork shall be removed one bay at a time, from the center outwards, and re-propped to prevent shock on the slab. (9.5.1.3; SANS 0100-2).
5. Cantilever slabs shall be stripped from the outside towards the structure to prevent shock.
6. Once a structural element or slab has transferred its weight to the structure (columns, beams, load bearing walls, etc.),Re-Propping (re-shoring), will be done on the stripped bay, if Back-Propping is required.

Formwork Removal Time for Cast-in Situ concrete:

1. Refer to Table below. (9.5.2.1 Table 7; SANS 0100-2).
2. It may be possible to remove Formwork within shorter periods of time than normal if strength is assessed. It may be assessed by test cubes of equal maturity, and cured, as far as possible, at the same time as the concrete in the element to be stripped. (9.5.2.2; SANS 0100-2).
3. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete, may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations. The main contractor is responsible for wrapping or aplication of curing compound to retain moisture

Removal of Formwork in days									
Type of structural member or Formwork	Portland Cement			Rapid-hardening Portland Cement(1)			Cements with > 15% GGBS or FA		
	Weather(3)								
	Normal	Cool	Cold	Normal	Cool	Cold	Normal	Cool	Cold
Beam sides, walls and columns	0.75	(2)	1.5	0.5	(2)	1	2	(2)	4
Slabs with props left in place	4	(2)	7	2	(2)	4	6	(2)	10
Beam Soffits with props left in place	7	(2)	12	3	(2)	5	10	(2)	17
Slab Props (including Cantilever)	10	(2)	17	5	(2)	9	10	(2)	17
Beam Props (including Cantilever)	14	(2)	21	7	(2)	12	14	(2)	21

(1) Shorter periods may be used for sections having a thickness of 300 or more.
(2) In cool weather, stripping times are to be determined by interpolation between the periods specified for normal and cold weather.
(3) Weather conditions:
(3)1) Cold weather in which the ambient temperature is 5°C or less,
(3)2) Cool weather in which the ambient temperature exceeds 5°C but does not exceed 15°C,
(3)3) Normal weather in which the ambient temperature exceeds 15°C but does not exceed 32C, and
(3)4) Hot weather in which the ambient temperature exceeds 32°C.

Back Propping Design with Percentages

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1. Given percentages:

1.1. The percentages Back Propping given in the contract documents will indicate amount of levels and equipment requirements.

1.1.1. For example (also refer to illustration below):

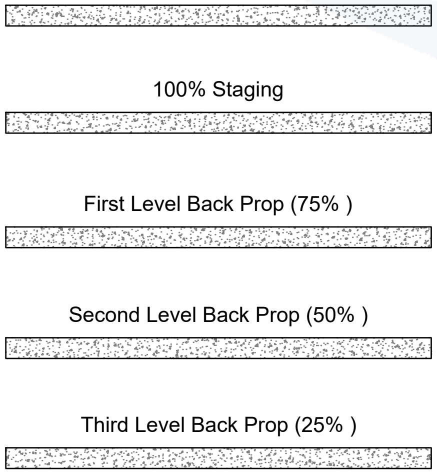
1.1.1.1. If stated a Back Prop requirement of 75%; 50% and 25%, three levels back prop and the 100% staging is required.

1.1.1.2. The First Level staging will be 100% (Slab Support Formwork) of the Fresh Concrete Dead Load and Construction Live Loads.

1.1.1.3. The Second Level staging will be the first level back prop, in this case 75% of the Fresh Concrete Dead Load and Live Loads.

1.1.1.4. The Third Level staging will be the first level back prop, in this case 50% of the Fresh Concrete Dead Load and Live Loads.

1.1.1.5. The Fourth Level staging will be the first level back prop, in this case 25% of the Fresh Concrete Dead Load and Live Loads.



Back Prop Design Example:

- Given Parameters:
  - Assume a 300mm thick Slab to be poured and Back Prop requirements to be 66% and 33%.
  - Assume 30kN Props to be used.
- Design:
  - The Total Load of the Fresh Concrete is 9,4kN/m^2 (7.8 Dead Load and 1.6 Live Load).
  - For First Back Prop Level:The 30kN props must support 9.4 x 66% = 6.2kN/m^2
    - To determine the prop grid, take Prop Allowable Axial Resistance divide by the Load, $\frac{30}{6.2}$ = 3.2m^2. A prop can support 3.2m^2 area. For an equal spacing take the square root. In this case a grid of 1.8 x 1.8m will be sufficient.
  - For Second Back Prop Level:The 30kN props must support 9,4 x 33% = 3.1kN/m^2
    - To determine the prop grid, take Prop Allowable Axial Resistance divide by the Load, $\frac{30}{3.1}$ = 9.7m^2. A prop can support 9.7m^2 area. For an equal spacing take the square root. In this case a grid of 3.1 x 3.1m will be sufficient.
- Result:
  - 100% Staging: Refer to system Tables;
  - 66% Back Prop: 1.8 x 1.8m Prop Grid;
  - 33% Back Prop: 3.1 x 3.1m Prop Grid.

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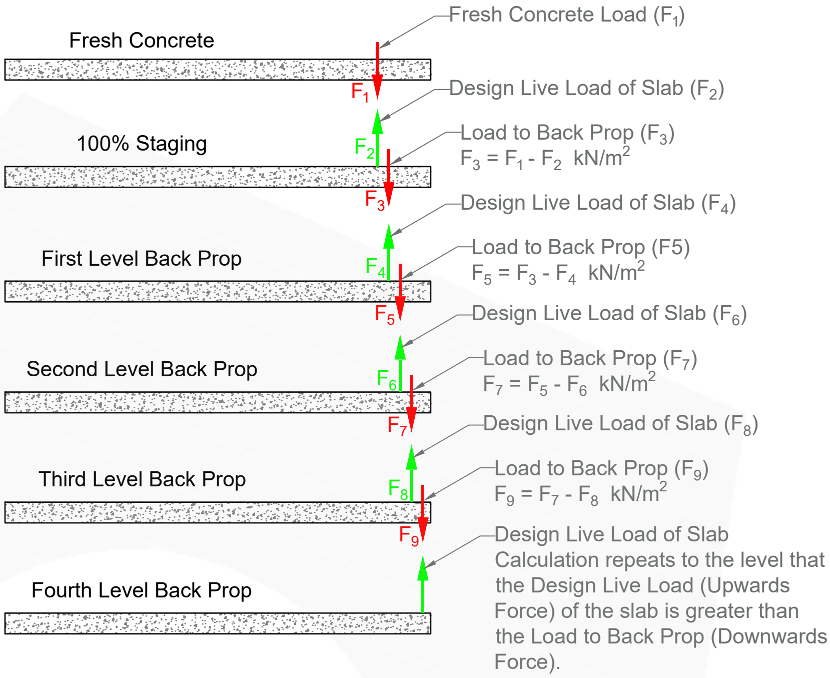
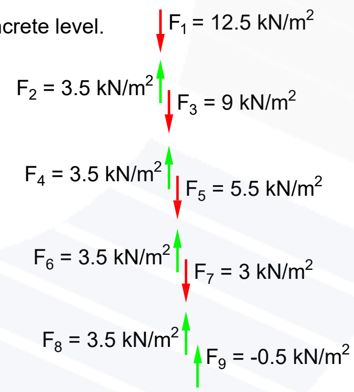
Back Propping Design with Slab Design Live Loads

Vertical Fresh Concrete Loads (kN/m²)			
Slab Thickness (m)	Dead Load (kN/m²)	Live Load (kN/m²)	Total Load (kN/m²)
0.17	4.4	1.5	5.9
0.2	5.2	1.5	6.7
0.25	6.5	1.5	8
0.3	7.8	1.6	9.4
0.35	9.1	1.8	10.9
0.4	10.4	2.1	12.5
0.45	11.7	2.3	14
0.5	13	2.6	15.6
0.55	14.3	2.9	17.2
0.6	15.6	3.1	18.7
0.65	16.9	3.4	20.3
0.7	18.2	3.6	21.8
0.75	19.5	3.9	23.4
0.8	20.8	4.2	25
0.85	22.1	4.4	26.5
0.9	23.4	4.7	28.1
0.95	24.7	4.9	29.6
1	26	5	31



Back Prop Design Example:

1. Given Parameters:
   1.1. Assume a slab of 400mm thick must be cast.
   1.2. Assume the slabs have a Design Live Load of 3.5 kN/m^2 (including services and brickwork that is not present during construction). Resistance of the slabs will be; F_2 = 3.5 kN/m^2; F_4 = 3.5 kN/m^2; F_6 = 3.5 kN/m^2; and F_8 = 3.5 kN/m^2.
   1.3. Assume 30 kN props will be used to Back Prop.



2. Loads to Back Prop:
   2.1. 100% Staging Level must support all Loads imposed from the Fresh Concrete level.
      2.1.1. Refer to the Support System Tables.
      2.1.2. F_1 = 12.5 kN/m^2 from Table.

   2.2. First Level Back Prop:
      2.2.1. $F_3 = F_1 - F_2 = 12.5 - 3.5 = 9$ kN/m^2

   2.3. Second Level Back Prop:
      2.3.1. $F_5 = F_3 - F_4 = 9 - 3.5 = 5.5$ kN/m^2

   2.4. Third Level Back Prop:
      2.4.1. $F_7 = F_5 - F_6 = 5.5 - 3.5 = 3$ kN/m^2

   2.5. Fourth Level Back Prop:
      2.5.1. $F_9 = F_7 - F_8 = 3 - 3.5 = -0.5$ kN/m^2
      2.5.2. There is no need for Back Prop in the Fourth Back Prop Level. The Design Live Load of the slab surpassed the Load to Back Prop.

3. Back Prop Design:
   3.1. To calculate the props per bay, use the Load to Back Prop multiplied by the Grid Area to determine the Total Load in kN to Support. Divide Prop capacity with the load. Assume a Prop Resistance of 30 kN for the example.
      3.1.1. Assume a Grid between Columns of 8.4 x 8.4m. Area will be 70.6m^2.
      3.1.2. For First Level Back Prop the Load to Back Prop is 9 kN/m^2.
      3.1.3. The Total Load to Prop per bay will be; 70.6 x 9 = 635.4 kN
      3.1.4. Number of Props per bay is $\frac{635.4}{30}$ = 22 Props. The columns and shear walls can be included as props if the Props are close to columns or shear walls.
      3.1.5. 22 Props can then be equally spaced over the Grid area.

   3.2. Alternatively. To calculate the area each prop can support, take the Prop Resistance and divide it with the Load to Prop;
      3.2.1. $\frac{30}{9}$ = 3.3m^2/prop
      3.2.2. To support 9 kN/m^2 the Prop grid will be $\sqrt{3.3}$ = 1.8 x 1.8m; or a grid that will not exceed 3.3m^2 area per prop.

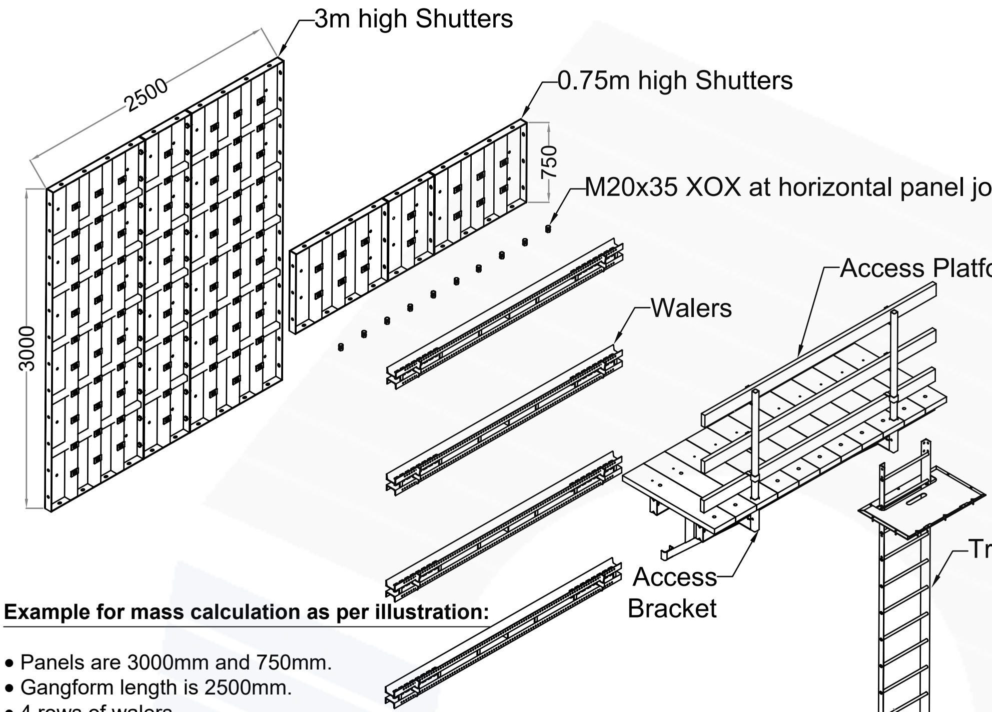
Back Propping Standards and assumptions:

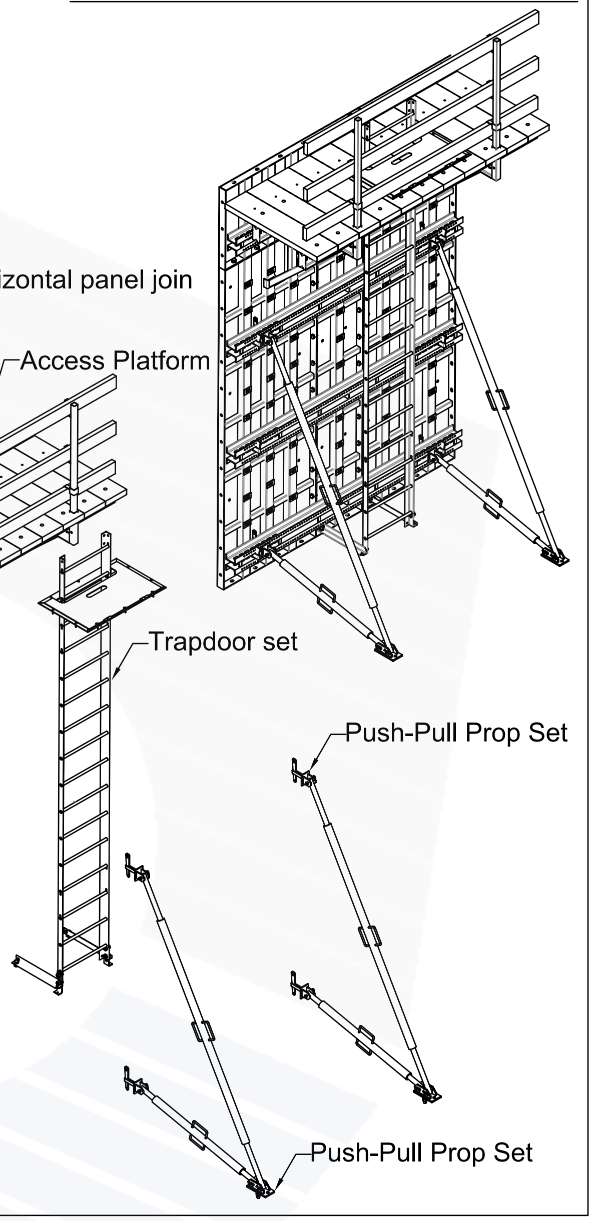
1. Back Propping operation according to SANS 0100-2
2. Concrete Dead Loads in Table according to DIN 1055
3. Construction Live Loads in Table according to DIN 4421
4. Support condition can be assumed Clamped-Clamped in Prop Tables, to have an effective length of L_e = 0.5L

HD Panels configured as Wall Gangform - Masses

2.5m x 3.75m High Gangform setup

2.5m x 3.75m High Gangform setup - Exploded





Example for mass calculation as per illustration:

- Panels are 3000mm and 750mm.
- Gangform length is 2500mm.
- 4 rows of walers.
- Access Platform is also 2500mm.
- There is 2 sets of Push-Pull Prop sets.
- 1 Panel Join between the 3000mm high and 750mm high panels.

From Table:

750mm high panels at 2500mm length:	= 129 kg
3000mm high panels at 2500mm length:	= 510 kg
4 levels walers at 2500mm length:	= 240 kg
Access Platform at 2500mm length:	= 194 kg
A Trapdoor set is included:	= 60 kg
No side safety is included on Platform:	= 0 kg
2 Push-Pull Prop Sets at 3rd waler:	= 90 kg (45 x 2)
1 Panel Join at 2500mm length:	= 2 kg
Total mass	= 1225 kg

Note:
4-5% of Mass on Panels can be reduced if large panels are being used in Gangform.

Estimated mass calculator per HD Gangform in kg (5% factored)		Length of Gangform (mm)											
		500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
Panel height series (includes fasteners)	500mm high	18	36	55	73	92	110	128	147	165	184	202	220
	750mm high	25	51	77	103	129	155	181	207	233	259	285	311
	1000mm high	34	70	105	140	175	211	246	281	317	352	387	422
	3000mm high	100	202	305	408	510	613	716	818	921	1024	1126	1229
Walers (includes Waler to Panel Clamps)	1 level	12	24	36	48	60	72	84	96	108	120	132	144
	2 levels	24	48	72	96	120	144	168	192	216	240	264	288
	3 levels	36	72	108	144	180	216	252	288	324	360	396	432
	4 levels	48	96	144	192	240	288	336	384	432	480	528	576
	5 levels	60	120	180	240	300	360	420	480	540	600	660	720
	6 levels	72	144	216	288	360	432	504	576	648	720	792	864
Access Platform (3 brackets from 3,5m wide)	Access Platform	-	104	134	164	194	224	276	328	380	432	484	536
	Trapdoor set	-	60	60	60	60	60	60	60	60	60	60	60
	One end safety	-	44	44	44	44	44	44	44	44	44	44	44
	Both ends safety	-	88	88	88	88	88	88	88	88	88	88	88
Push-Pull Props (Per Set)	3rd waler (Type A)	45	45	45	45	45	45	45	45	45	45	45	45
	4th waler (Type B)	50	50	50	50	50	50	50	50	50	50	50	50
Horizontal Panel Joints (no Soldiers)	1 Panel Join	0	1	1	2	2	3	3	4	4	5	5	6
	2 Panel Joins	1	2	3	4	5	6	7	8	8	9	10	11
	3 Panel Joins	1	3	4	6	7	8	10	11	13	14	16	17
Add for Total added mass (kg)													

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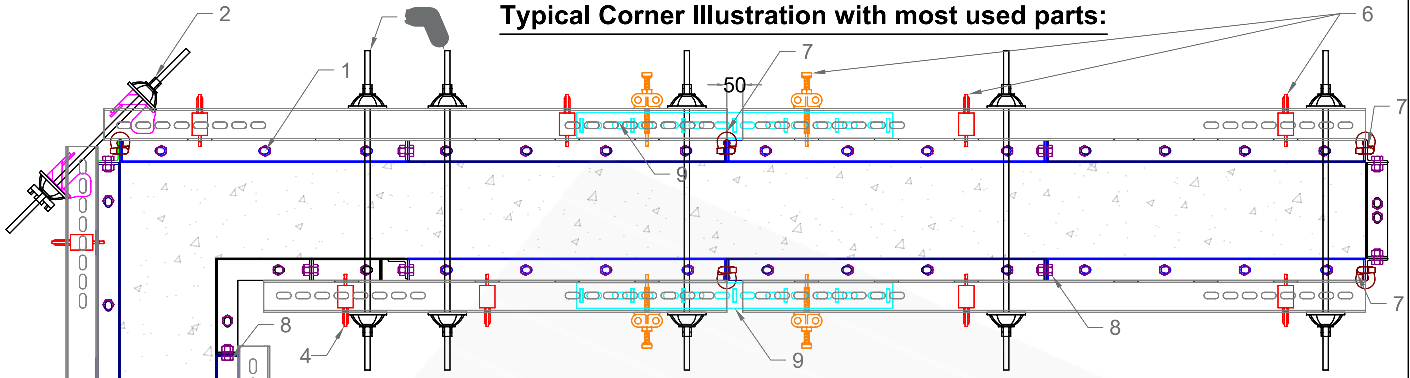
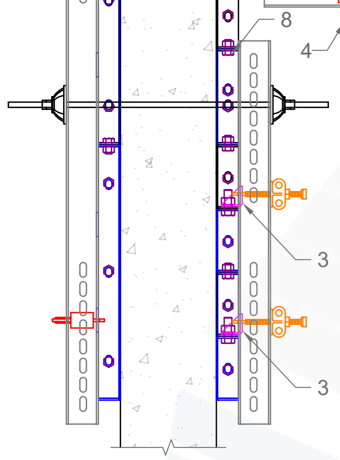
HD Wall Recommended Design Parameters

Typical Corner Illustration with most used parts:





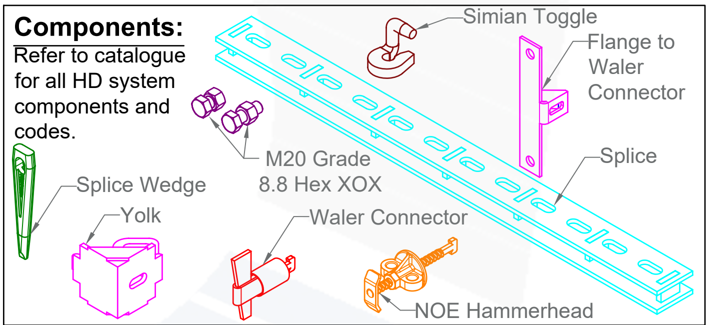
1. Use M20x35 Grade 8.8 Hex XOX to fasten Panels together on horizontal joins.
2. Place 'Yolks', 'Splice Wedges' and 'T'ies at outside corners for 3m and higher panels on each 'Waler'.
3. Fit 'Flange to Waler Connectors' if no tophats are available for 'Waler Connectors'. Use M20x50 Grade 8.8 Hex XOX to fasten the 'Flange to Waler Connector' to the side of the periphery of the Panels. Use a NOE 'Hammerhead bolt' or 'Waler Connector'.
4. Use a 'Waler Connector' or 'NOE Hammerhead Bolt' on a 'FEP' (Floating Extension Panel) and 'Waler'.
5. Place 'Ties' on both sides of a 'FEP'. 'FEP' are used to create a floating internal corner to allow stripping of gangforms.
6. Each 'Waler' must at least have 2 'Waler Connectors' or 'Flange to Waler Connectors'. If it is not possible fit a 'Hammerhead Bolt' through the 'Splice' at gangform joins.
7. Use 'Simian Toggles' at gangform joins to allow fast erecting and striking of gangforms. Only a hammer is needed for fitment and removal of 'Simian Toggle'.
8. Use M20x35 Grade 8.8 Hex XOX to fasten Panels to create gangform.
9. Use 'Splice' and 4 'Wedges' on each 'Waler' at gangform joins.
10. Use 18mm Plastic Button to plug tie holes not used.

HD (Heavy Duty) System:

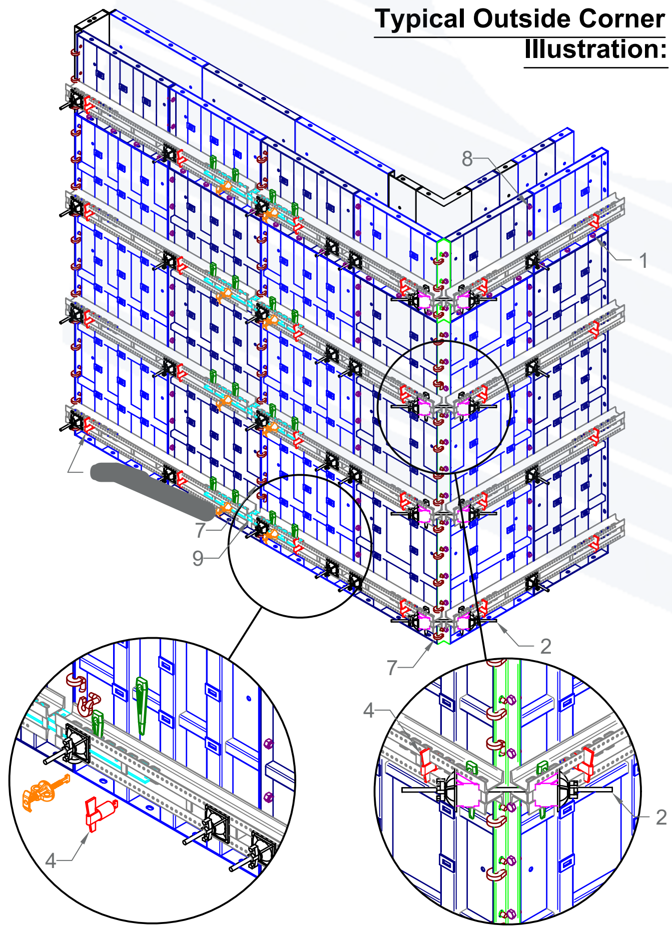
A crane handled, all steel system with 4mm faceplate, enforced with tophats in both the vertical and horizontal direction.
Ideal for off-shutter finish and repetitive elements, eg. cores and retaining walls.
The system is designed for 100 kN/m^2.

Components:

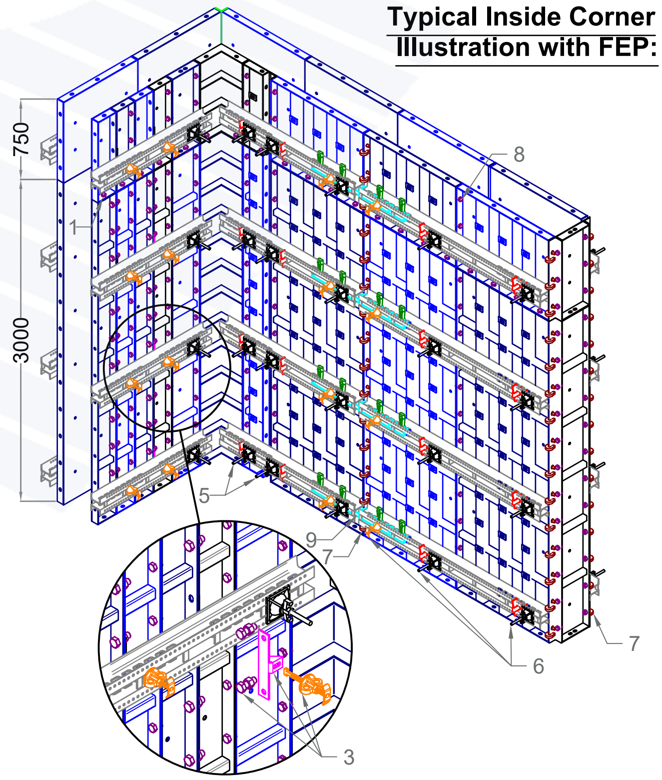
Refer to catalogue for all HD system components and codes.



Typical Outside Corner Illustration:



Typical Inside Corner Illustration with FEP:



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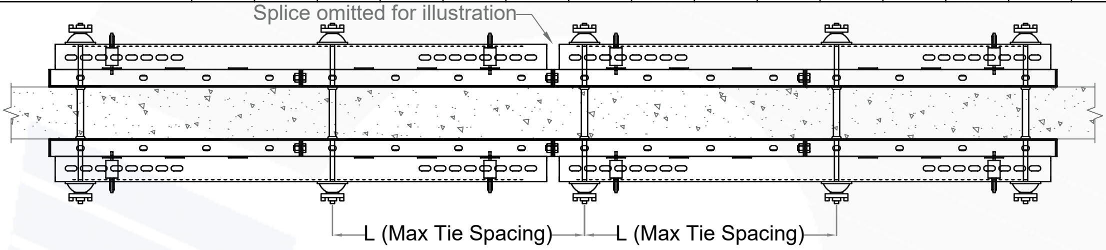
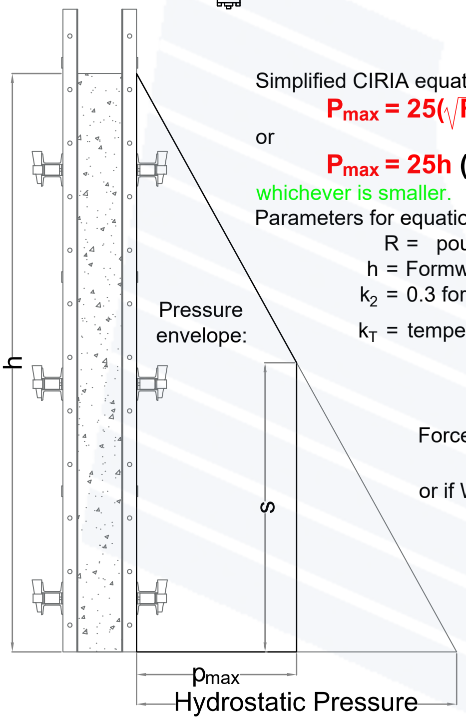
HD Wall Gangform Tie and Waler Spacing

Temp T		Pour Height h (mm)																
		750	1000	1500	1750	2000	2500	2750	3000	3500	3750	4000	4500	4750	5000	5500	5750	6000
5°C	Pour Rate R (m/h)	0.5	0.5	0.5	0.5	1	2.5	3.5	4.5	7	7	6	5	4.5	4	3.5	3	3
	Max Pressure P_{max} (kPa)	19	25	37	40	47	61	67	74	87	89	89	89	89	88	89	87	89
	Tie Force F (kN)	9	15	33	48	56	73	80	89	87	89	89	89	89	88	89	87	89
	Max Tie Spacing L (m)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1	1	1	1	1	1	1	1	1
10°C	Pour Rate R (m/h)	0.5	0.5	1	1.5	2.5	4.5	5.5	7	10	9.5	9	8	7.5	7	6.5	6.5	6
	Max Pressure P_{max} (kPa)	19	25	35	41	49	62	68	75	87	89	89	89	89	88	88	89	88
	Tie Force F (kN)	9	11	32	49	59	74	82	90	87	89	89	89	89	88	88	89	88
	Max Tie Spacing L (m)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1	1	1	1	1	1	1	1	1
15°C	Pour Rate R (m/h)	0.5	0.5	1.5	2	3	5	6.5	7.5	11	11	10	9.5	9	9	8.5	8	8
	Max Pressure P_{max} (kPa)	19	23	36	41	49	61	68	74	87	90	88	89	88	89	89	88	89
	Tie Force F (kN)	9	14	32	49	59	73	82	89	87	90	88	89	88	89	89	88	89
	Max Tie Spacing L (m)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1	1	1	1	1	1	1	1	1
20°C	Pour Rate R (m/h)	0.5	0.5	1.5	2.5	3.5	5.5	6.5	8	11.5	11.5	11	10.5	10	10	9.5	9.5	9.5
	Max Pressure P_{max} (kPa)	19	22	35	43	49	62	67	74	87	89	89	89	89	89	89	89	90
	Tie Force F (kN)	9	13	32	52	59	74	80	89	87	89	89	89	89	89	89	89	90
	Max Tie Spacing L (m)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1	1	1	1	1	1	1	1	1
25°C	Pour Rate R (m/h)	0.5	0.5	2	2.5	3.5	5.5	7	8.5	11.5	12	11.5	11	11	10.5	10.5	10	10
	Max Pressure P_{max} (kPa)	19	21	37	42	49	61	68	75	87	90	89	89	90	89	90	88	89
	Tie Force F (kN)	9	13	33	50	59	73	82	90	87	90	89	89	90	89	90	88	89
	Max Tie Spacing L (m)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1	1	1	1	1	1	1	1	1





Simplified CIRIA equation for walls (or use Ciria Tables):

$$P_{max} = 25(\sqrt{R} + k_2 . k_T \sqrt{h - k_1 \sqrt{R}})$$

or

$$P_{max} = 25h \text{ (hydrostatic pressure)}$$

whichever is smaller.

Parameters for equation:

R = pour rate (m/h);

h = Formwork Height (m);

k_2 = 0.3 for normal concrete, and 0.45 for concrete with setting retarders;

k_T = temperature coefficient where: $k_T = (\frac{36}{T+16})^2$ °C.

UDL on waler:

$$f = P_{max} a \text{ (kN/m)}$$

or if Waler spacing is 1m:

$$f = P_{max} \text{ (kN/m)}$$

Force in Tie:

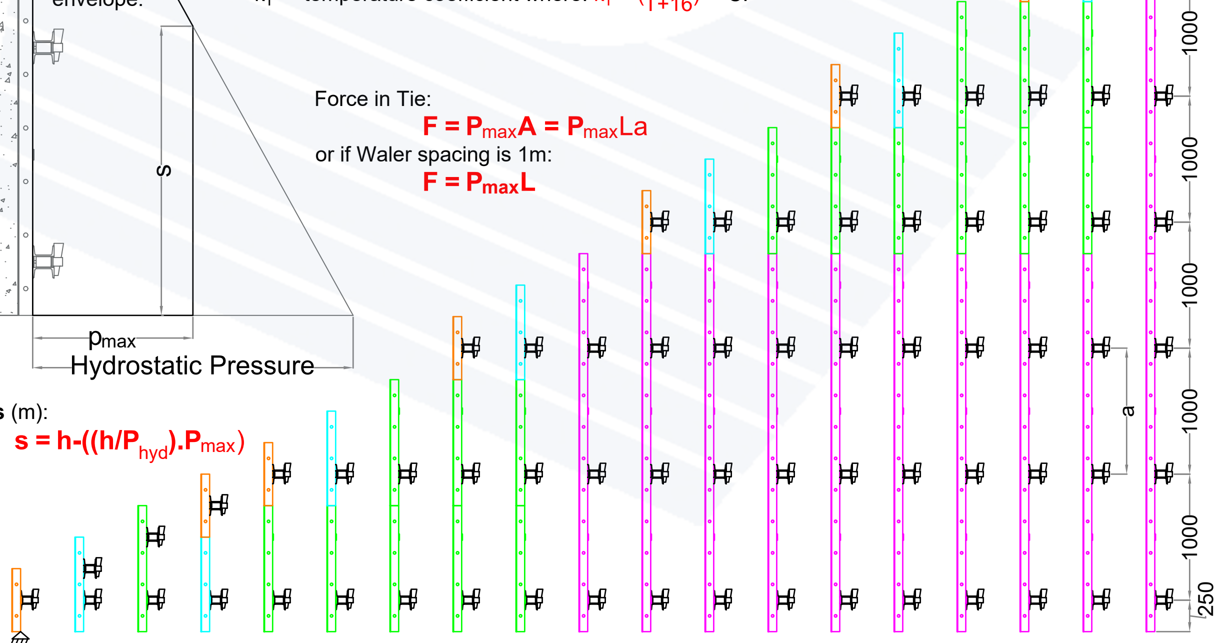
$$F = P_{max} A = P_{max} L a$$

or if Waler spacing is 1m:

$$F = P_{max} L$$

Distance **s** (m):

$$s = h - ((h/P_{hyd}) . P_{max})$$



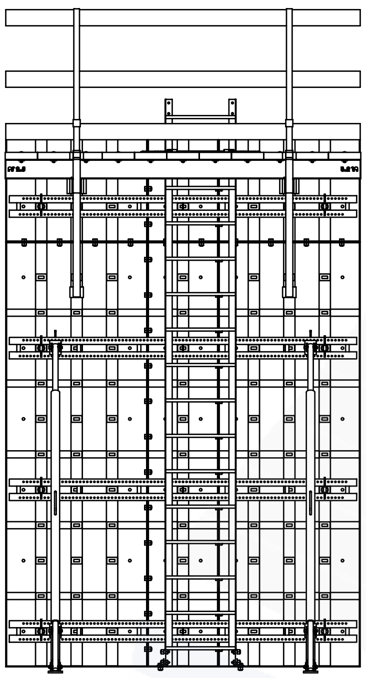
																500	750	
							500	750					500	750	1000	1000	1000	
			500	500	750	1000	1000	1000		500	750	1000	1000	1000	1000	1000	1000	3000
500	750	1000	750	1000	1000	1000	1000	1000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000

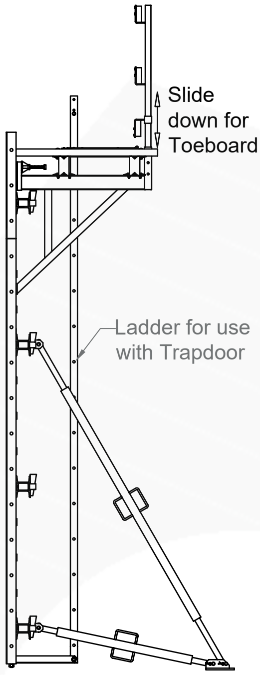
Panel Height Configurations

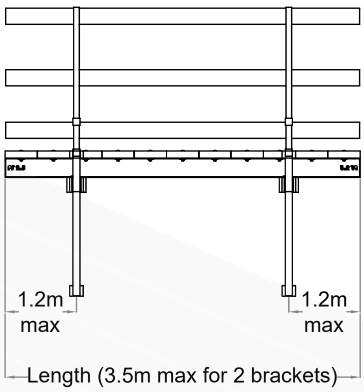
PRE-FORM (PTY) LTD

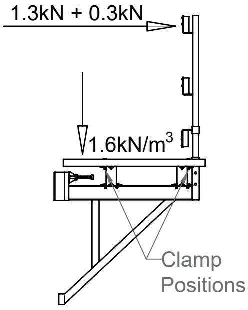
HD Access Platforms

114 x 38mm S5 Structural Grade SA Timber shown for handrail.

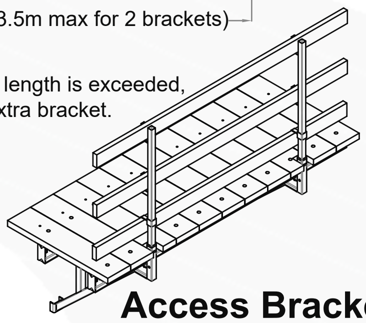








Note:
If the 3.5m length is exceeded, place an extra bracket.

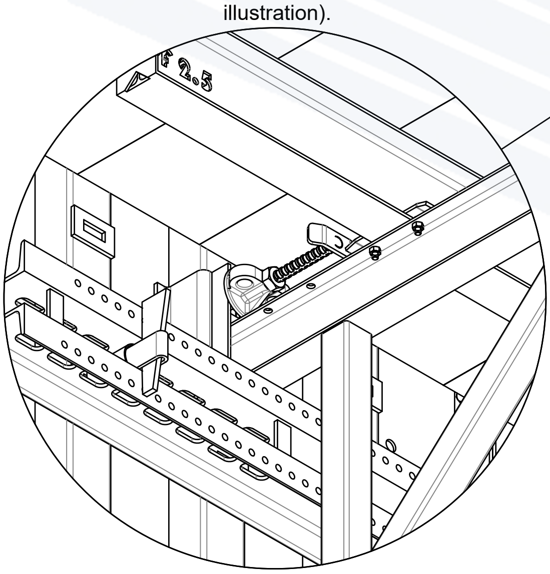


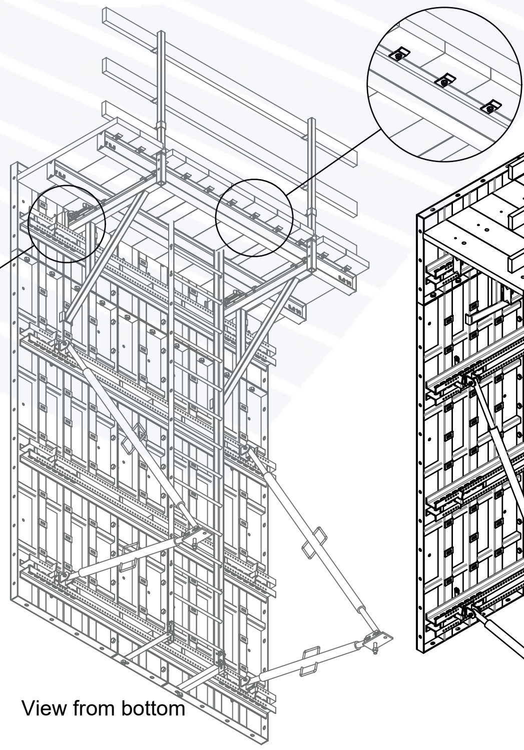
Access Bracket Design

1. Timber railing design as per SABS 0136-2001.
2. Minimum timber quality of S5 (SA Pine Gr5) must be used.
3. Ø48.3mm Scaffold tube and bracket design as per SANS 10162-2005.
4. C_p of 1.3 will be used in wind pressure.
5. Wind pressure, P_w, will be assumed 1.7kN/m².
6. A horizontal load of F = 0.3kN will be used in calculations.

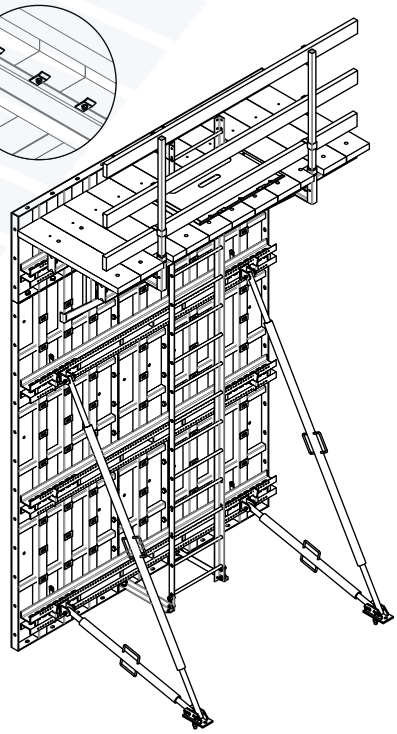
Estimated mass calculator per Access platform (5% factored) kg		Length of Access Platform (mm)											
		500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
Access Platform (3 brackets from 3,5m wide)	Access Platform	-	104	134	164	194	224	276	328	380	432	484	536
	Trapdoor set	-	60	60	60	60	60	60	60	60	60	60	60
	One end safety	-	44	44	44	44	44	44	44	44	44	44	44
	Both ends safety	-	88	88	88	88	88	88	88	88	88	88	88

View on the connections of the brackets and secondary platform beams. HT20 can be screwed and not clamped like IPE (as per illustration).





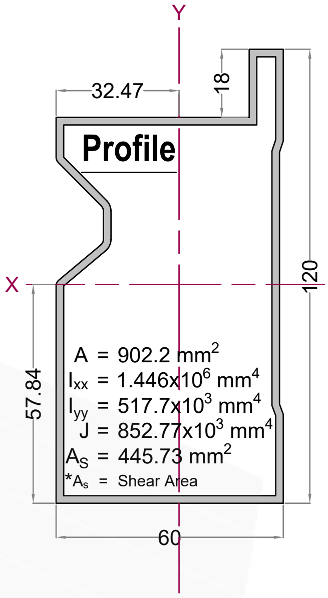
View from bottom



PRE-FORM (PTY) LTD

Comax System Summary

Comax is a crane-handled, versatile, robust and adaptable vertical formwork system, suitable for any construction site. Comax combine quick and easy assembly to ensure a product that will last in time.



Panels:

Seven panel widths of; 230mm, 300mm, 600mm, 720mm, 900mm, 1200mm, 2400mm make the system very easy to assemble. A 720mm Universal Panel with tie holes at 50mm increments is also available.

Panels have a height of 3300mm. Any panel height with increments of 300mm can be assembled.

Panels are constructed with a steel perimeter profile, as shown, with horizontal purlins. An 18mm Finnish multi-layered Birch plywood panel is mounted with self drilling screws to the steel panel. The steel frame is powder coated.

Versatile:

Comax can be used on climbing systems, single sided frames, stand alone for walls, retaining and shear walls, or for upstand and downstand beams. Any vertical element can be cast with Comax.

Panels can be erected vertically or horizontally. The panels have high twisting resistance and are easy to maintain. A 3300mm high and a 2700mm high panel can be used opposite each other, due to the alignment of the tie holes.

3300mm high panels:

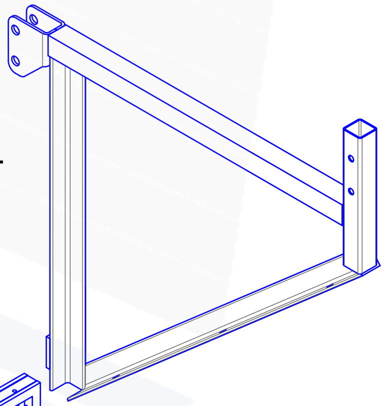
$80kN/m^2$ constant pressure

$60kN/m^2$ hydrostatic pressure

$50kN/m^2$ single sides pressure

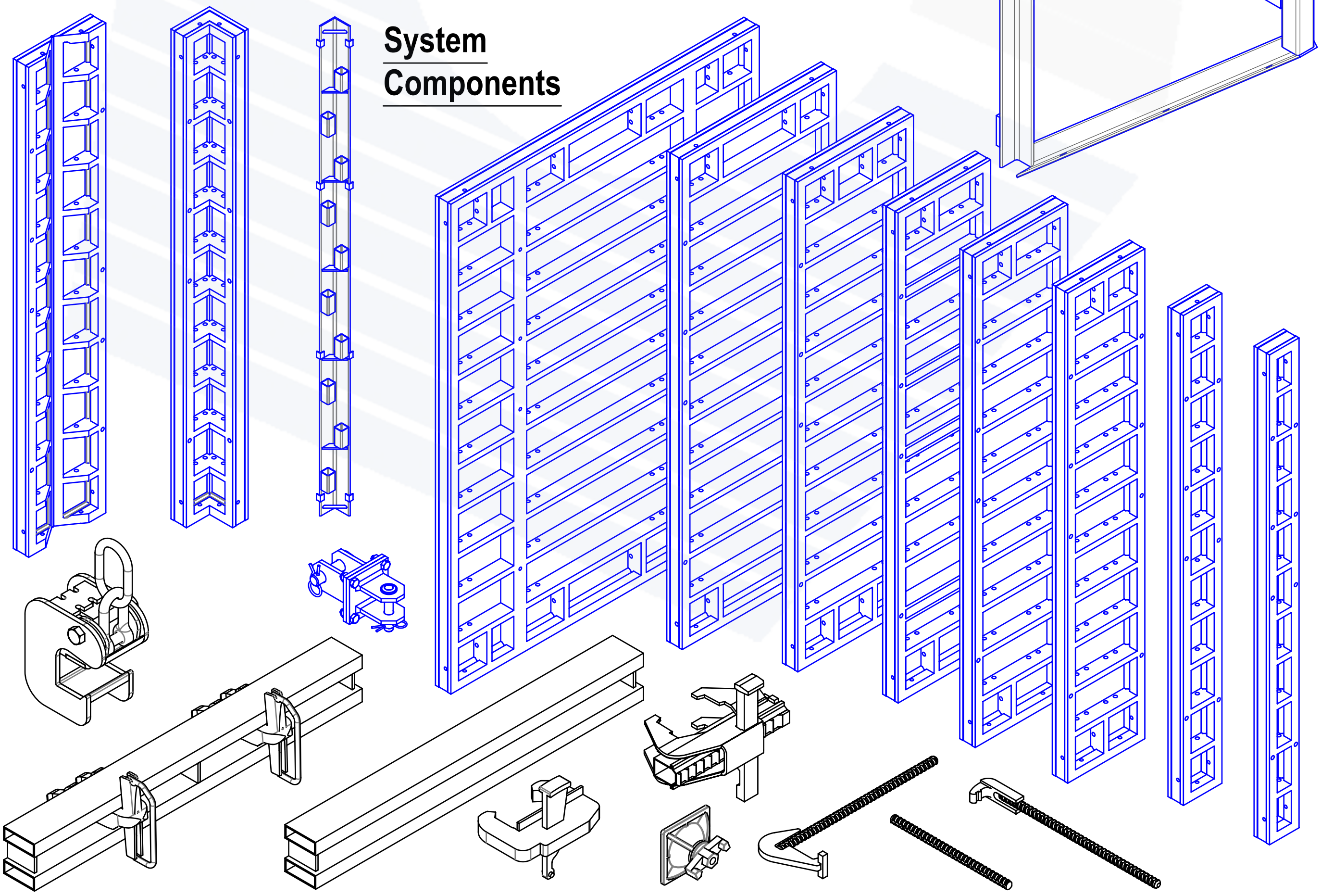
Ties:

The tie holes allow for a DW15 or DW20 tie to be used. Tie rods can have an inclination of 6° in any direction. Only two ties are needed for 3300mm high panels in height.



Access Brackets:

Access Brackets can be hooked on the vertical and horizontal members of the panels. Maximum spacing for the brackets are 1.4m with a working live load of $1,6m^2$.



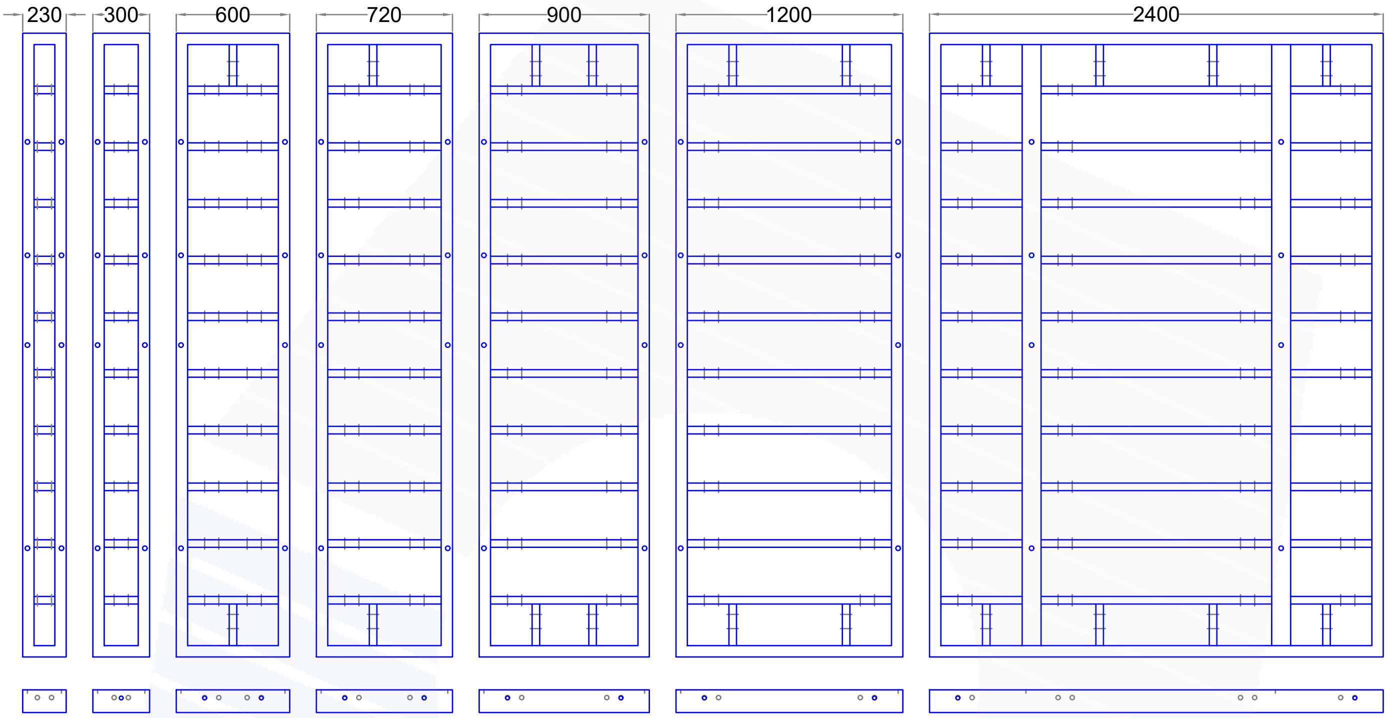
PRE-FORM (PTY) LTD

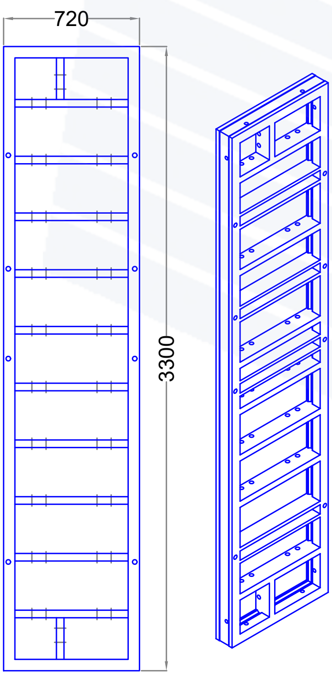
Comax 3300mm High Panels

COMAX PANEL 3300 x 230	TR114010	50kg	0.76m^2
COMAX PANEL 3300 x 300	TR114020	65kg	0.99m^2
COMAX PANEL 3300 x 600	TR114030	98kg	1.98m^2
COMAX PANEL 3300 x 720	TR114040	108kg	2.38m^2
COMAX PANEL 3300 x 900	TR114050	135kg	2.97m^2
COMAX PANEL 3300 x 1200	TR114070	192kg	3.96m^2
COMAX PANEL 3300 x 2400	TR114080	398kg	7.92m^2

3300mm high panels:

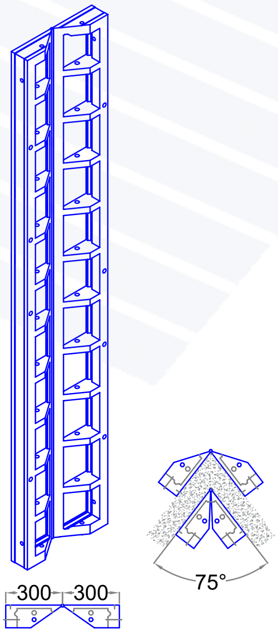
80kN/m^2 constant pressure
60kN/m^2 hydrostatic pressure
50kN/m^2 single sides pressure

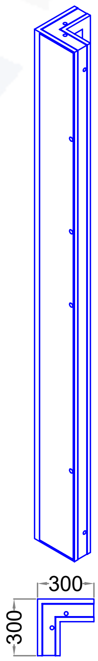




COMAX PANEL 3300 x 720 UNIVERSAL
TR114047
122kg
2.38m^2
Used with external corners, T-junctions, oblique angles, wall extensions, etc.

COMAX ACP 3300 x 300 x 300
TR114111
90kg
1.98m^2
For Internal and outside corners with oblique angles from 75°.



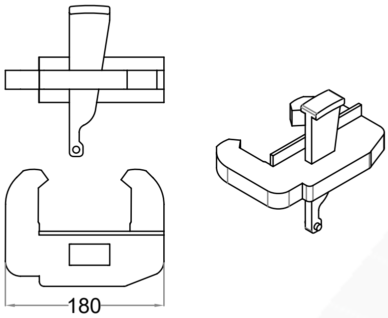


COMAX ICP 3300 x 300 x 300
TR114100
86kg
1.98m^2
For 90° Internal Corners

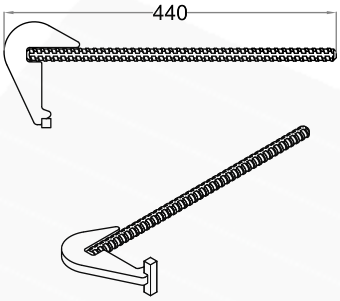
PRE-FORM (PTY) LTD

Comax Components

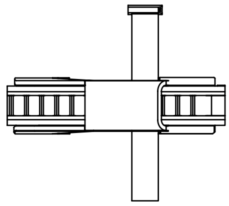
COMAX FIXED CLAMP
TR114251
3.8kg
Used for connecting panels without timber infills.

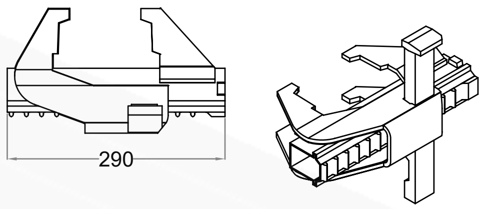


COMAX STOP END TIE
TR114260
1.5kg
DW15
Used mostly on Stop-Ends

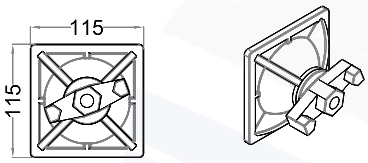


COMAX MFC CLAMP
TR114250
3.3kg
Used for connecting panels with timber infills, 70mm maximum.
Also used on corners, panel height extensions, etc.

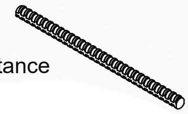




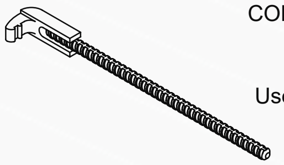
COMBI WING NUT 115 x 115
CO126130
1.23kg
90kN Tensile Resistance

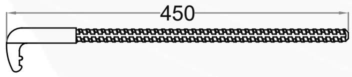


DYNABAR 15DIA / METRE
CO126170
1.44kg/m
90kN Tensile Resistance

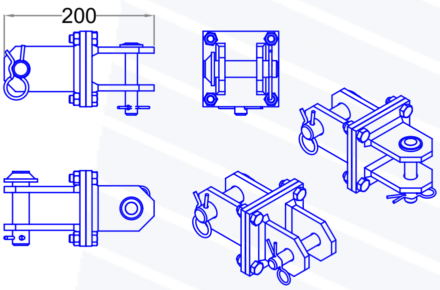


COMAX HOOK TIE 15DW
TR114261
1.0kg
Used at corners with thick walls and wall offsets

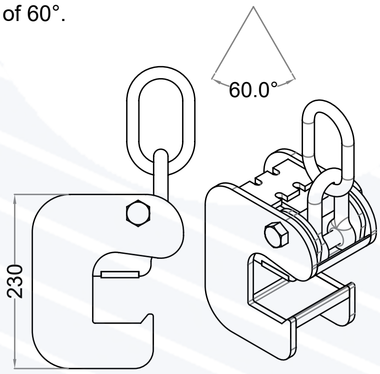




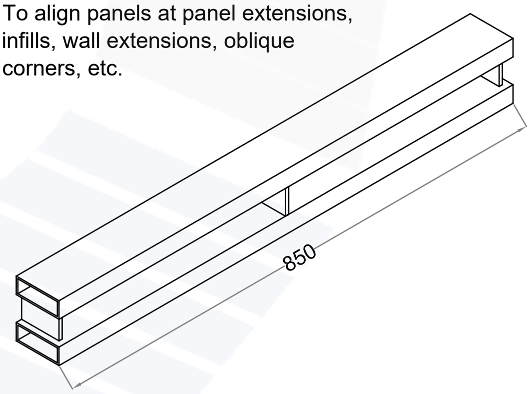
COMAX PROP COUPLER
TR114280
3.1kg
To connect Push-Pull Props to COMAX Panels. Coupler can turn 90°.



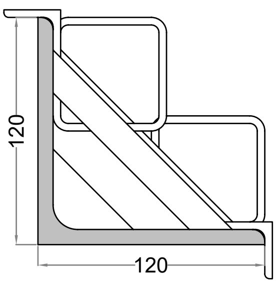
COMAX LIFTING HOOK
TR114241
9.0kg
1500kg SWL and maximum sling angle of 60°.

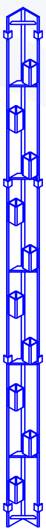


COMAX WALER 850mm
TR114275
9.0kg
To align panels at panel extensions, infills, wall extensions, oblique corners, etc.

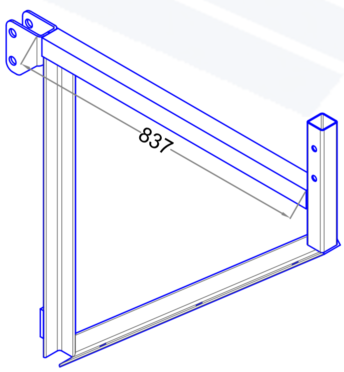


COMAX ECA 3300 X 120 x 120
TR114280
62kg
Used on External corners.

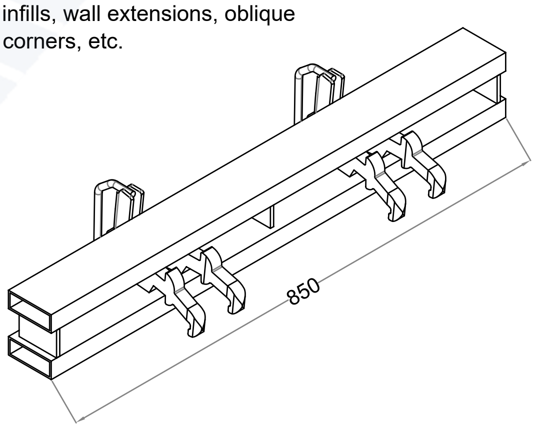




COMAX SUPPORT BRACKET
TR114230
13.5kg
To create a access concreting platform.
Maximum spacing of 1.4m and 1.6kN/m^2 Live Load.



TVR ALIGNMENT BAR
TR114270
13.5kg
To align panels at panel extensions, infills, wall extensions, oblique corners, etc.



Comax Panel Height Extensions (3.3 - 3.6m)

PRE-FORM (PTY) LTD

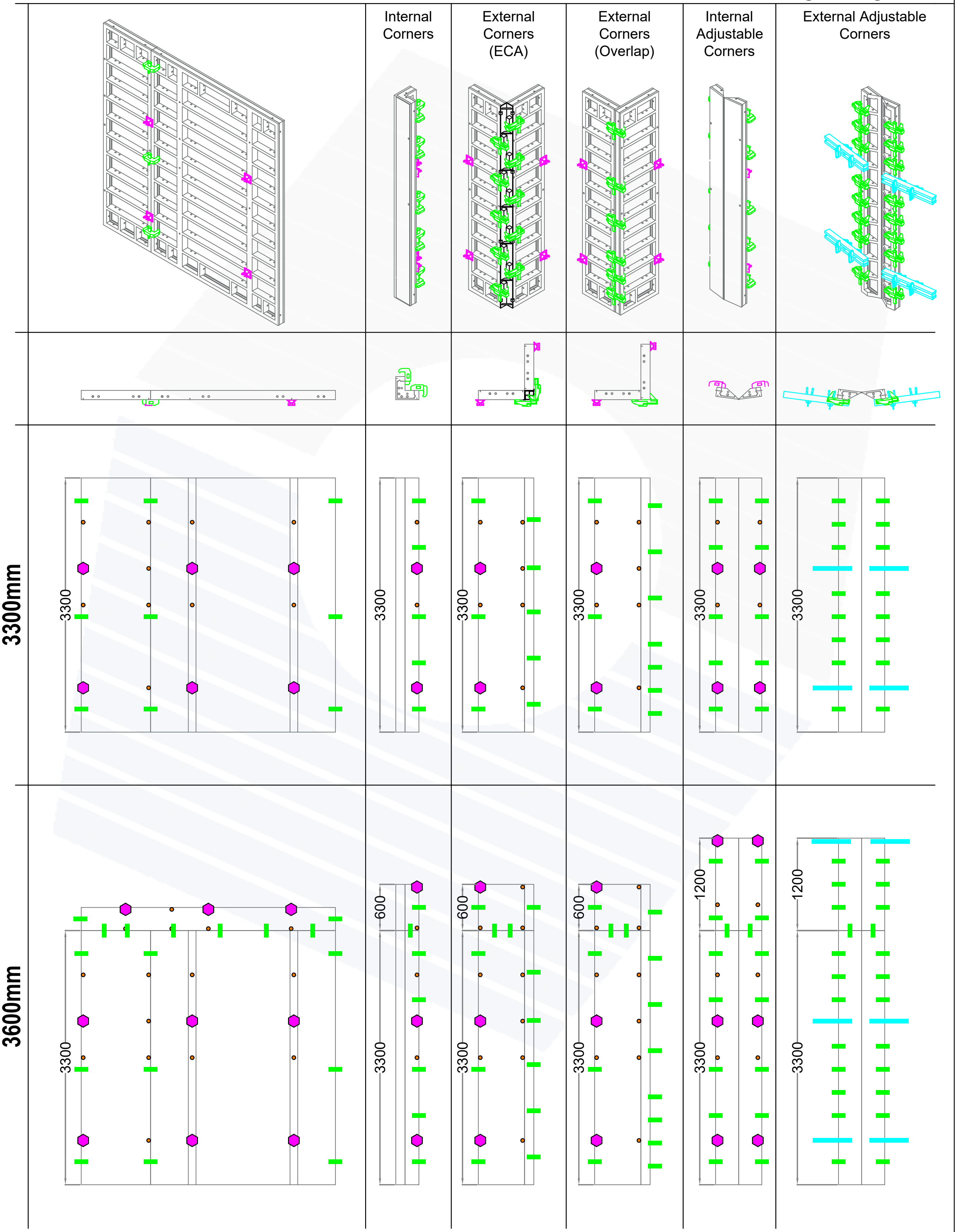
Tie Positions

Unused Tie Holes

Clamp Positions

Waler Positions

Formwork Extensions must be assembled to Full Height on ground.



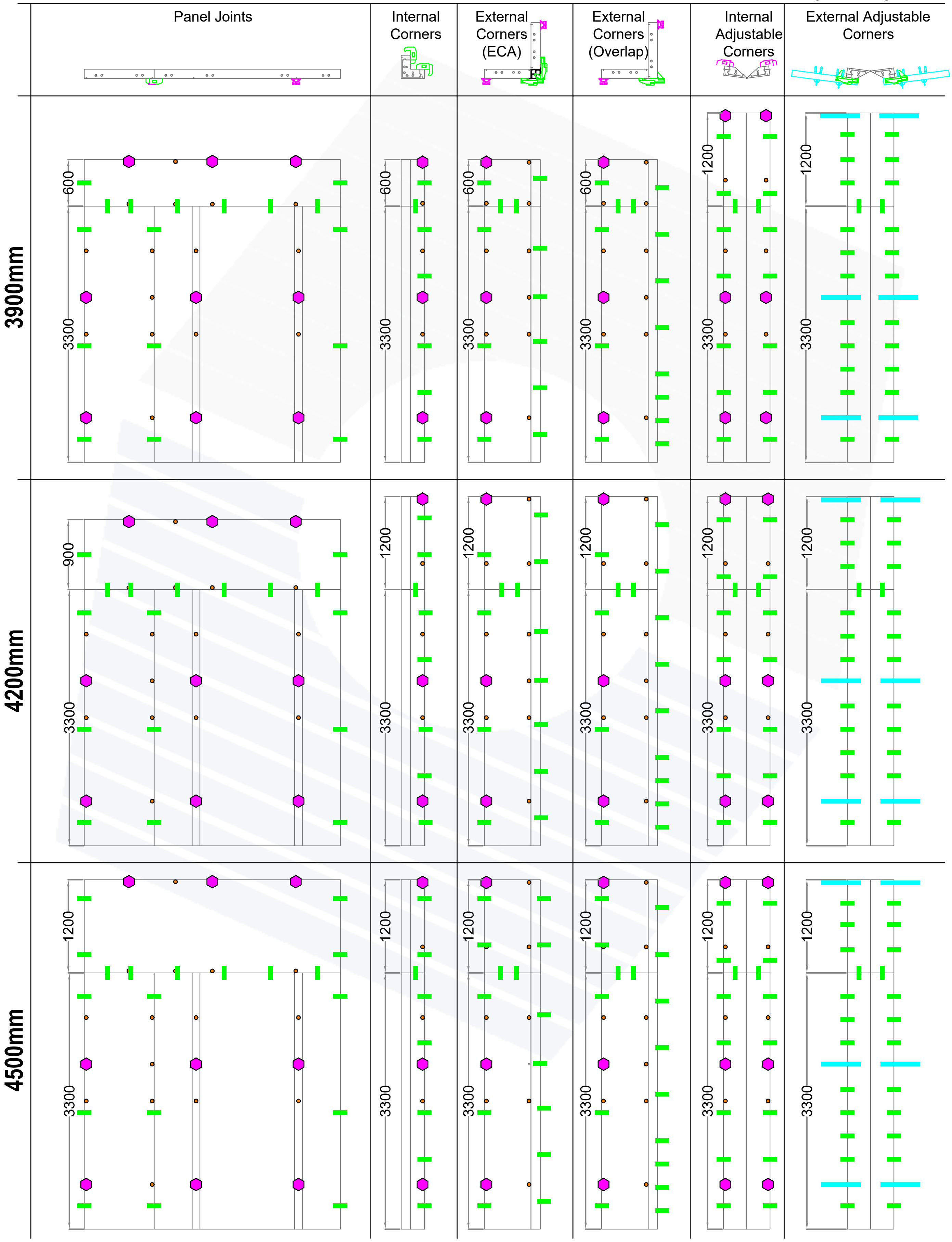
PRE-FORM (PTY) LTD

Comax Panel Height Extensions (3.9 - 4.5m)

Tie Positions · Clamp Positions

Unused Tie Holes · Waler Positions

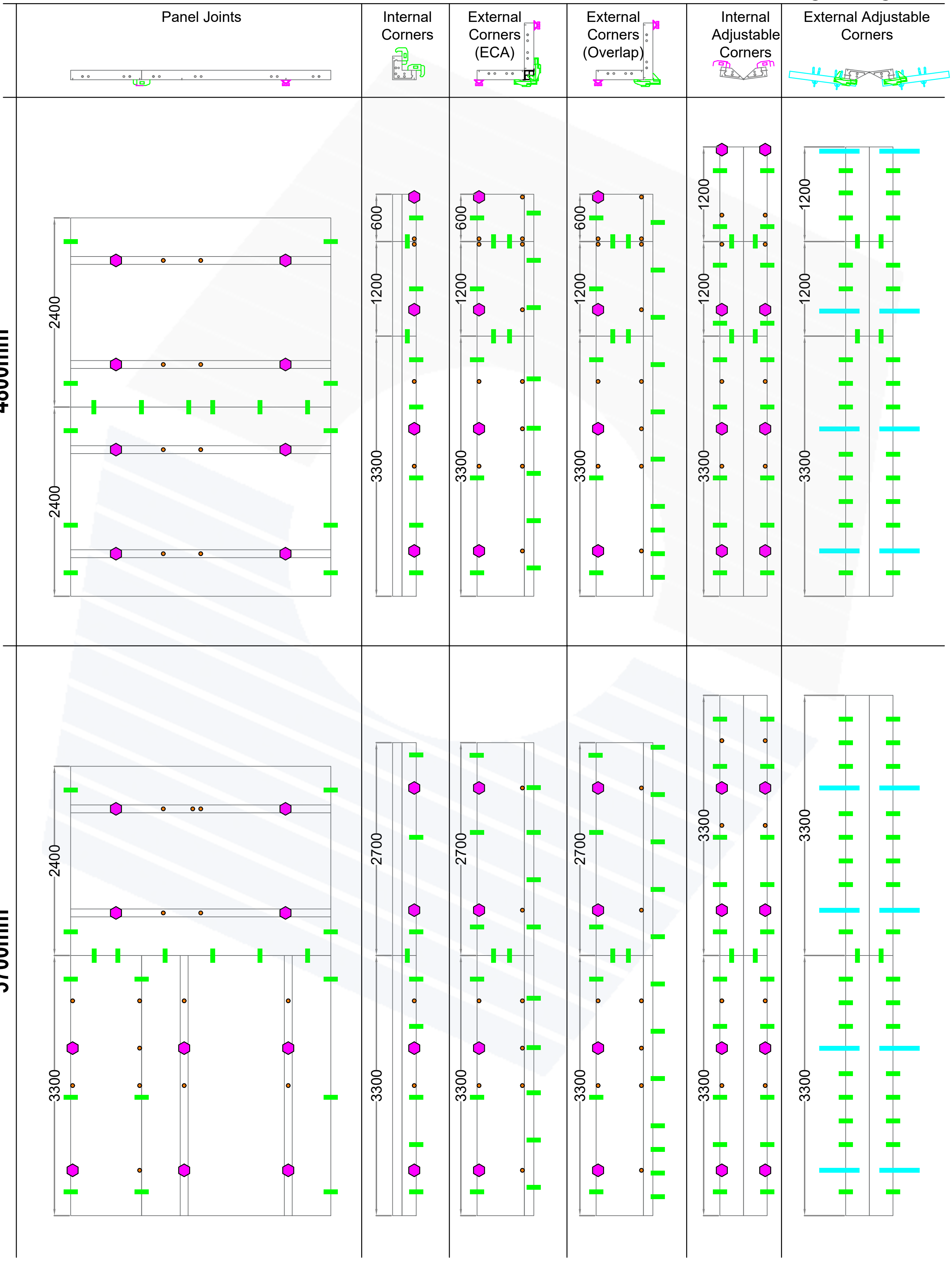
Formwork Extensions must be assembled to Full Height on ground.



Comax Panel Height Extensions (4.8 - 5.7m)

Tie Positions ⬢ Clamp Positions
Unused Tie Holes • Waler Positions

Formwork Extensions must be assembled to Full Height on ground.



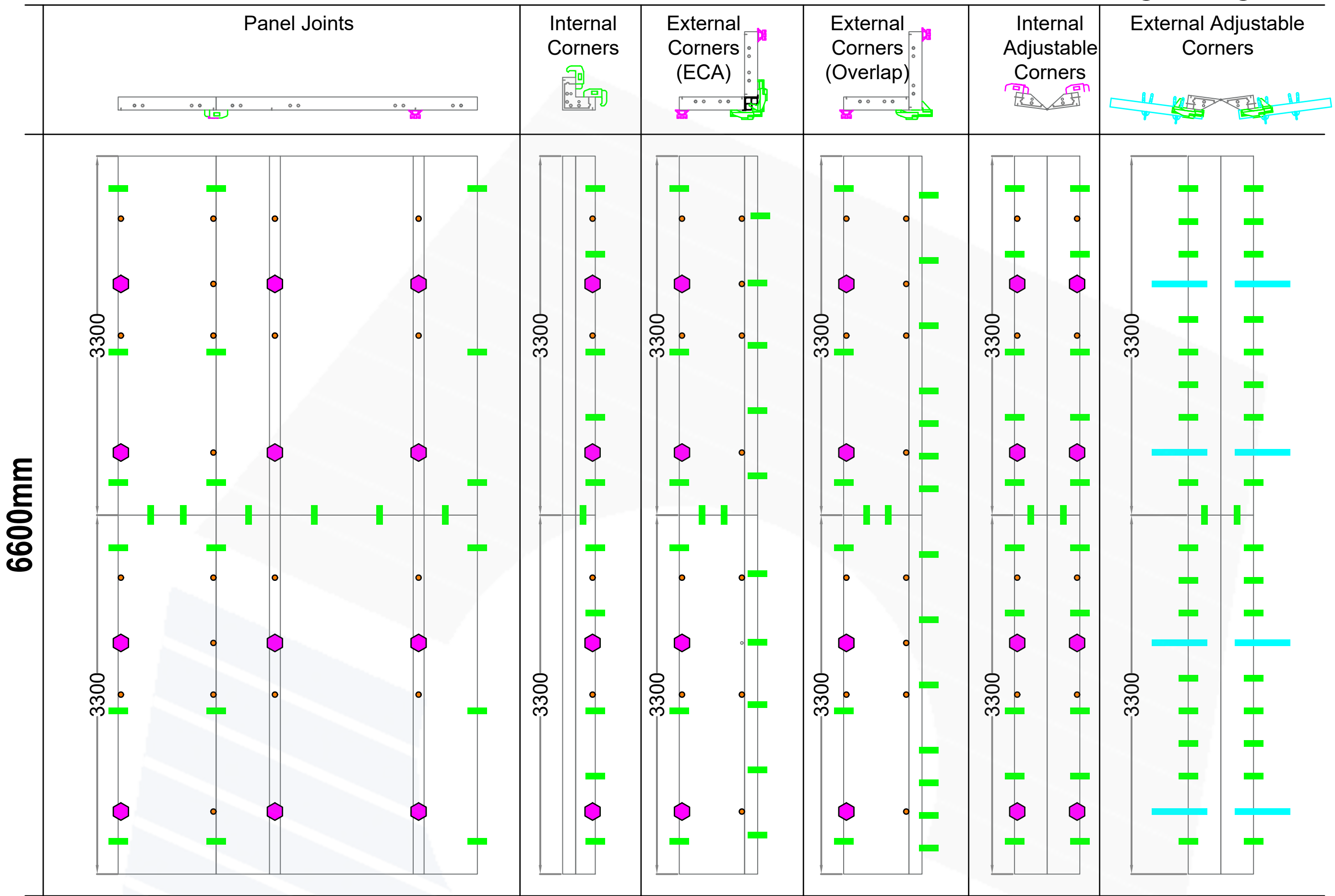
Second Edition

ComaxPanel Height Extensions (6.6 - 9.9m)

PRE-FORM (PTY) LTD

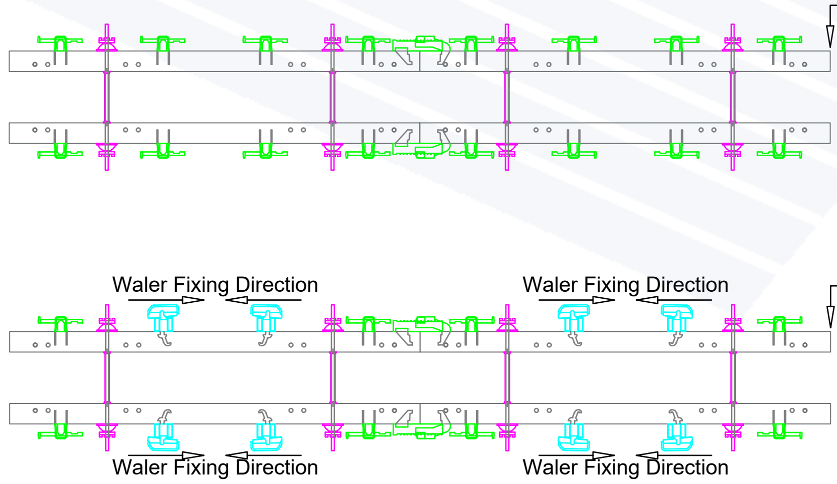
Tie Positions
Clamp Positions
Unused Tie Holes
Waler Positions

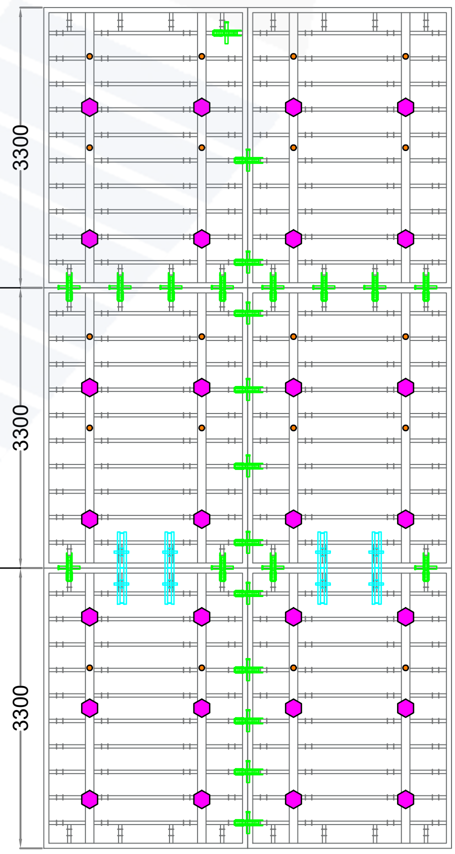
Formwork Extensions must be assembled to Full Height on ground.



9900mm

For Formwork Heights greater than 6600mm, consult Pre-Form Drawing Office for a Design.

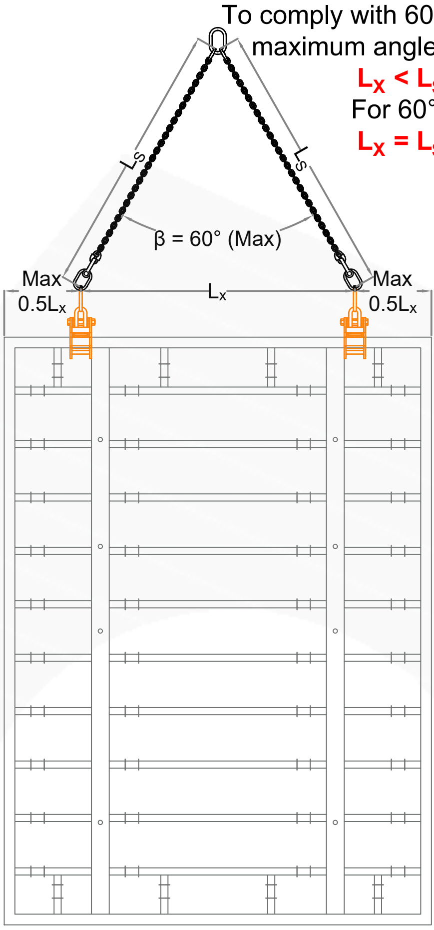




PRE-FORM (PTY) LTD

Comax Lifting Hook and Sling Information

Sling Information



Lifting Hook Notes:

1. Maximum **1.5 Ton** Load Capacity.
2. Always use in pairs.
3. In the scenario of panel extensions being used, the panels must be assembled to its full height on the ground.

1. Chain Length Formulas

1.1. $\phi = \frac{180-\beta}{2}$

1.2. $L_S = \frac{L_X}{\sin\beta}.\sin\phi$

or

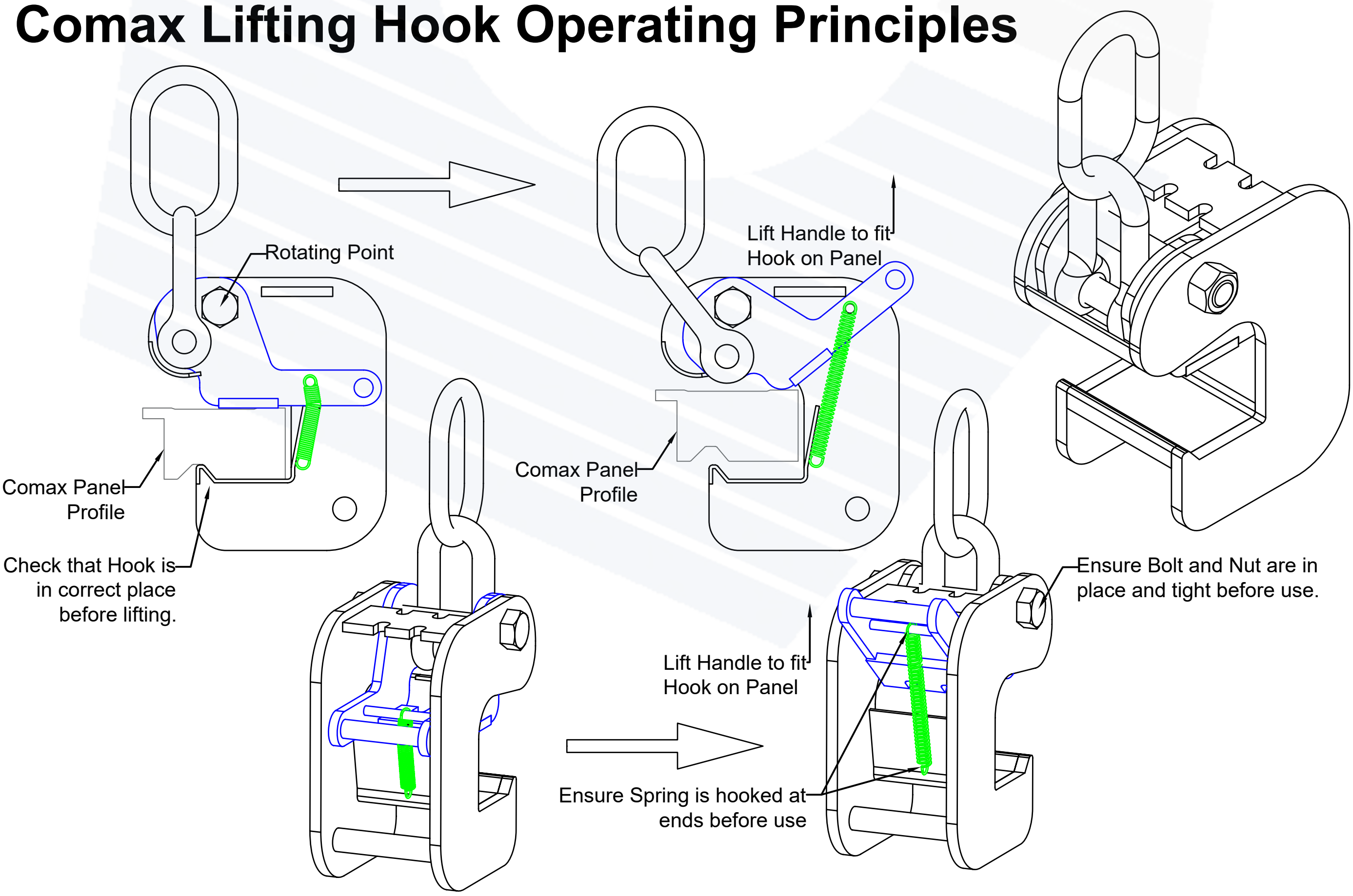
1.3. $\beta = 15°$
  1.3.1. $L_S = 0.261\ L_X$
1.4. $\beta = 30°$
  1.4.1. $L_S = 0.518\ L_X$
1.5. $\beta = 45°$
  1.5.1. $L_S = 0.765\ L_X$
1.6. $\beta = 60°$
  1.6.1. $L_S = L_X$
1.7. $\beta = 75°$
  1.7.1. $L_S = 1.218\ L_X$
1.8. $\beta = 90°$
  1.8.1. $L_S = 1.414\ L_X$

2. Chain Load Factors

2.1. $\beta = 60°$
  2.1.1. $2F_S = 1.7m$ ....(kg)
  2.1.2. $\therefore\ F_S = 0.85m$ ....(kg)
2.1. $\beta = 90°$
  2.1.1. $2F_S = 1.4m$ ....(kg)
  $\therefore\ F_S = 0.85m$ ....(kg)

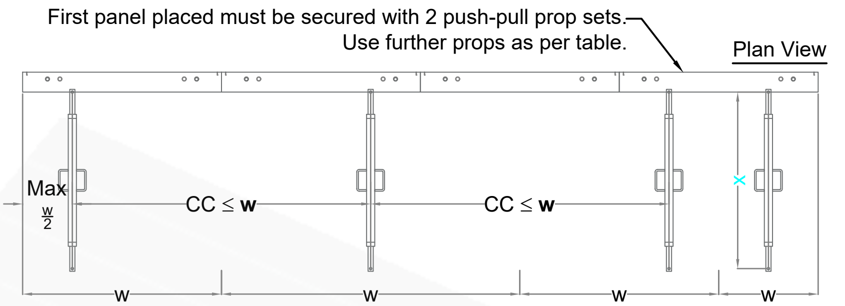
Comax Component Masses (Add items on gangform for total mass)	
Description	Mass (kg)
COMAX PANEL 3300 x 230	70
COMAX PANEL 3300 x 300	75
COMAX PANEL 3300 x 600	107
COMAX PANEL 3300 x 720	119
COMAX PANEL 3300 x 720 UNIVERSAL	133
COMAX PANEL 3300 x 900	140
COMAX PANEL 3300 x 1200	195
COMAX PANEL 3300 x 2400	398
COMAX ECA 3300 x 120 x 120	45
COMAX ICP 3300 x 300 x 300	86
COMAX ACP 3300 x 300 x 300	119
COMAX LIFTING HOOK	8
COMAX MFC CLAMP	5
COMAX FIXED CLAMP	7
COMAX STOP END TIE	1
COMAX HOOK TIE 15DW	1
TVR ALIGNMENT BAR	13
COMAX WALER 850mm	9
COMAX PROP COUPLER	4

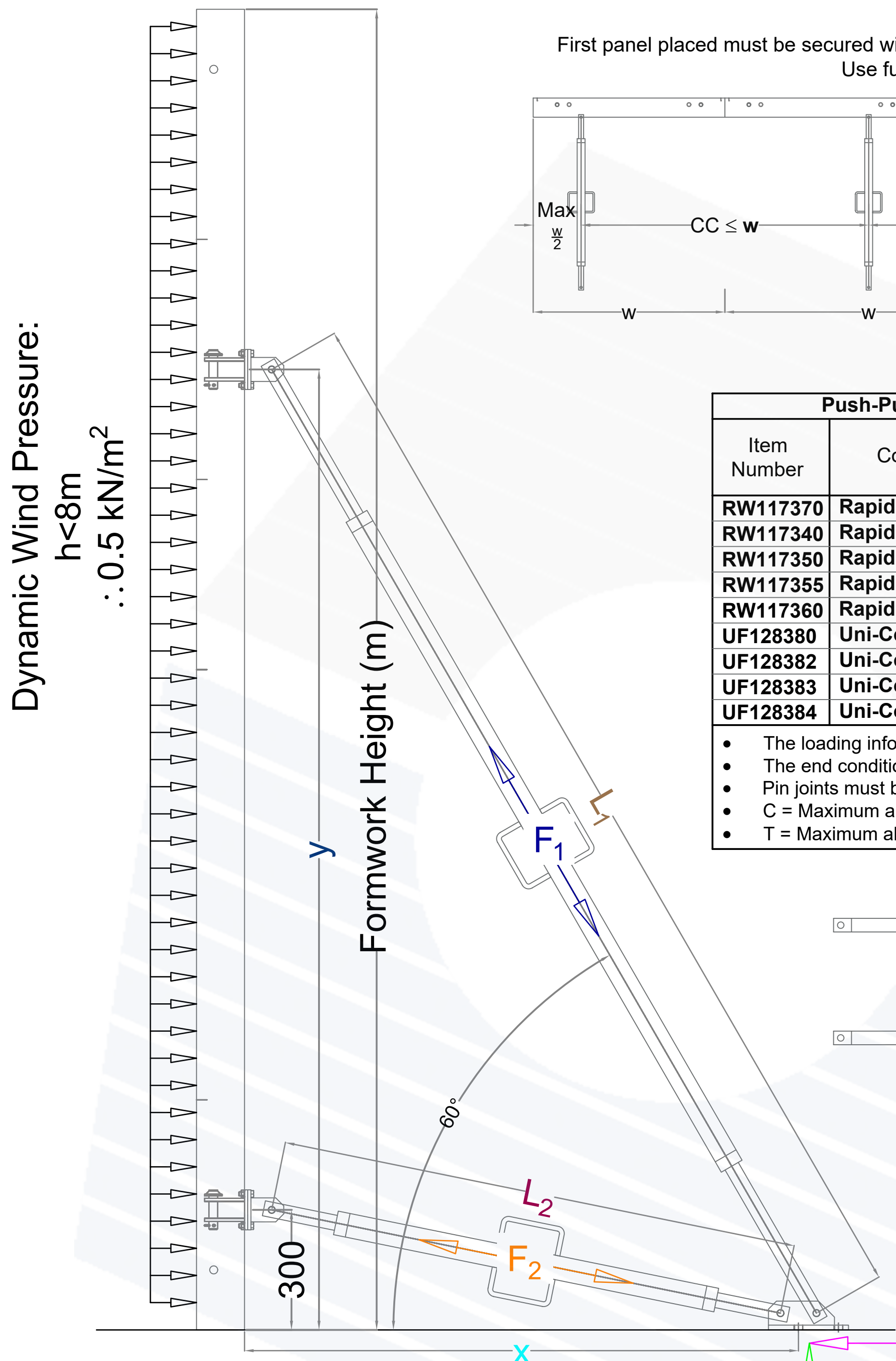
Comax Lifting Hook Operating Principles



PRE-FORM (PTY) LTD

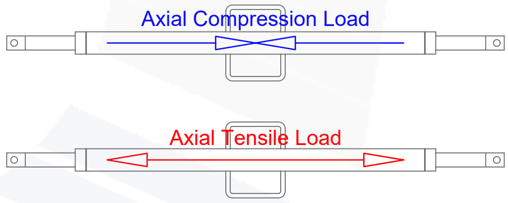
Comax Push-Pull Prop and Kicker Brace Infomation





Push-Pull Prop and Kicker Selection Table			
Item Number	Component Description and Range	Max Load (kN)	
		C	T
RW117370	**Rapid Kicker Type A & B (1150-2000mm)**	31	20
RW117340	**Rapid P-P Prop Type B (2000-2900mm)**	20	20
RW117350	**Rapid P-P Prop Type B (2900-3800mm)**	13	20
RW117355	**Rapid P-P Prop Type BB (3700-4600mm)**	14	20
RW117360	**Rapid P-P Prop Type C (4600-6000mm)**	10	20
UF128380	**Uni-Compression Prop 2000-2900mm**	66	31
UF128382	**Uni-Compression Prop 2900-3800mm**	45	31
UF128383	**Uni-Compression Prop 3800-4700mm**	31	31
UF128384	**Uni-Compression Prop 4700-5600mm**	42	31

- The loading information assume symmetrical thread rod extensions.
- The end conditions must be pin joints.
- Pin joints must be designed and calculated to withstand the loads.
- C = Maximum allowable axial compression load at full extension.
- T = Maximum allowable axial tensile load at full extension.



Anchor and Rapid Push-Pull Base Plate T2:

Pin shear restriction is 21kN per pin.

F_{perm} = 23 kN for one 16/100 Excalibur on 20Mpa concrete, irrespective of load direction and angle.

F_{perm} = 36 kN for two 16/100 Excaliburs on 20Mpa concrete, irrespective of load direction and angle.

Or alternatively refer to Push-Pull Prop Anchor System with Excaliber section for anchor design.

Refering to the tabel below:

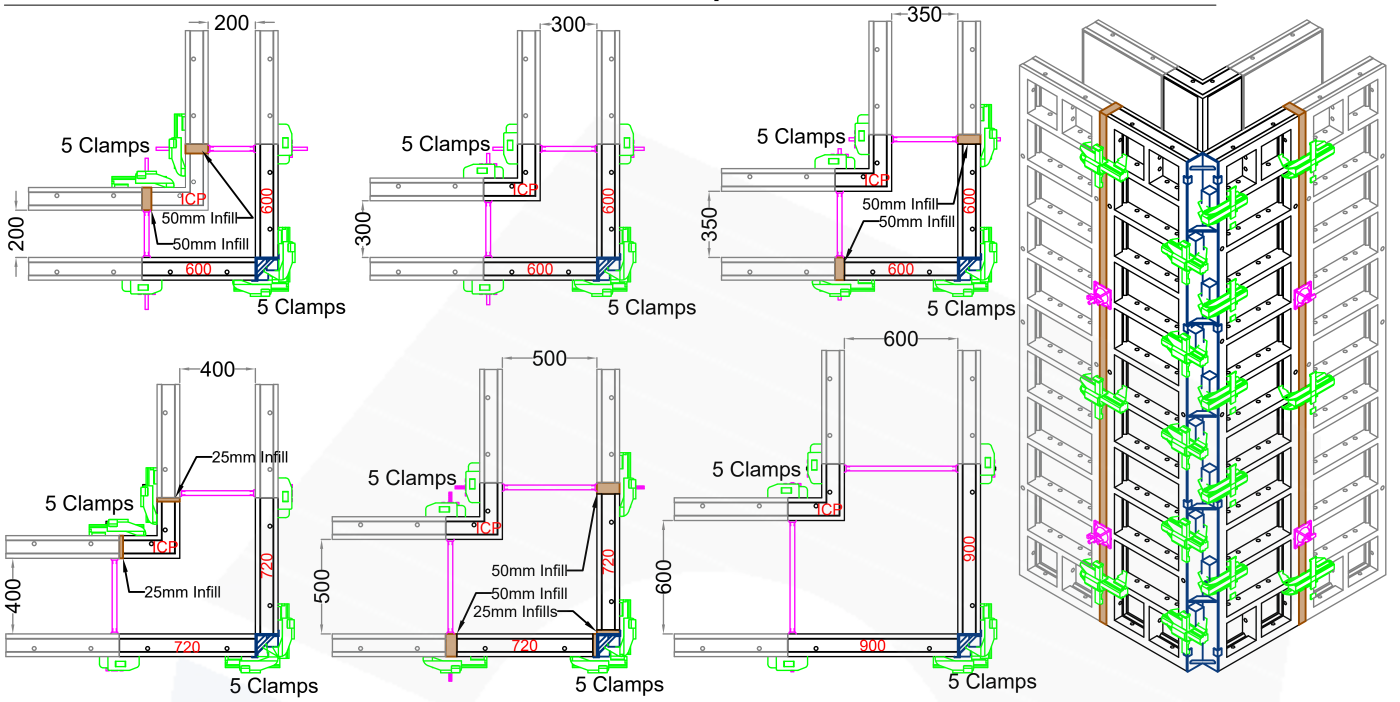
The stated widths of influence transfer a maximum force of 7.5kN in all directions into the building at the bottom anchor point of the push-pull prop.

Push-Pull Prop and Kicker Brace Table for Standard Extension Configuarations										
Symbol	Description	Unit	Height of Formwork (m)							
			3.3	3.6	3.9	4.2	4.5	4.8	5.7	6.6
w	Maximum Length of Influence	m	3.5	3.2	2.8	2.7	2.4	2.2	1.8	1.6
x	Anchor distance from fromwork	m	1.4	1.6	1.7	2.1	2.1	1.9	2.4	2.8
y	Prop connector height from ground	m	2.4	2.7	3.0	3.6	3.6	3.3	4.2	4.8
L_1	Extension Length of Prop	m	2.7	3.0	3.4	4.1	4.1	3.8	4.8	5.5
L_2	Extension Length of Kicker Prop	m	1.3	1.5	1.6	2.0	2.0	1.8	2.3	2.7
F_1	Actual Axial Load in Prop	kN	6.0	7.0	6.8	6.2	6.3	6.7	6.7	7.0
F_2	Actual Axial Load in Kicker	kN	2.3	2.2	2.2	2.6	2.2	1.5	1.8	1.8
F_s	Shear Reaction at Anchor	kN	5.3	5.8	5.5	5.7	5.4	4.8	5.2	5.3
F_c	Vertical Reaction at Anchor	kN	5.6	6.5	6.3	5.7	5.8	6.1	6.1	6.2

PRE-FORM (PTY) LTD

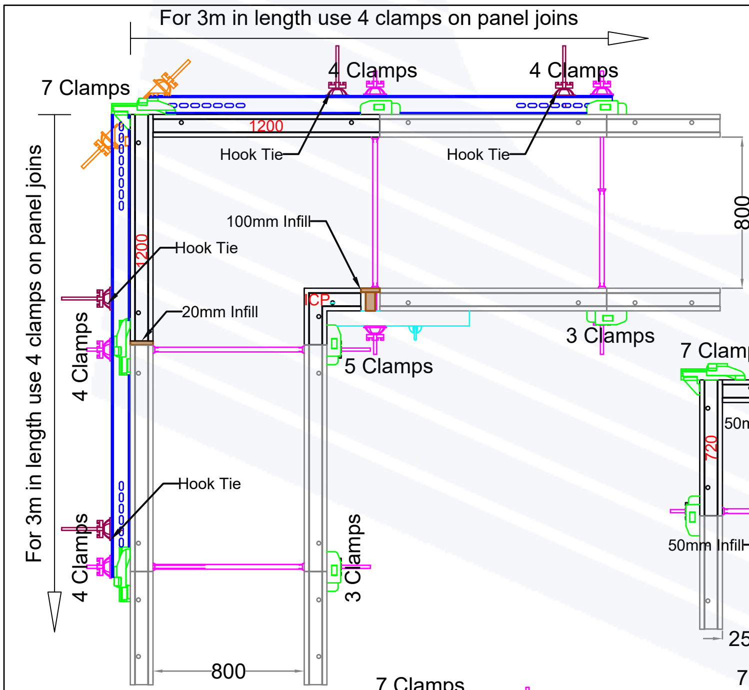
Comax Corners with ECA's 3300mm Height

Corners with ECA's must be secured with 5 Clamps at External and Internal Corners

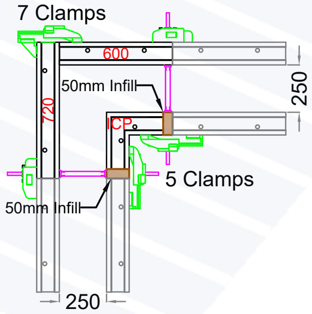


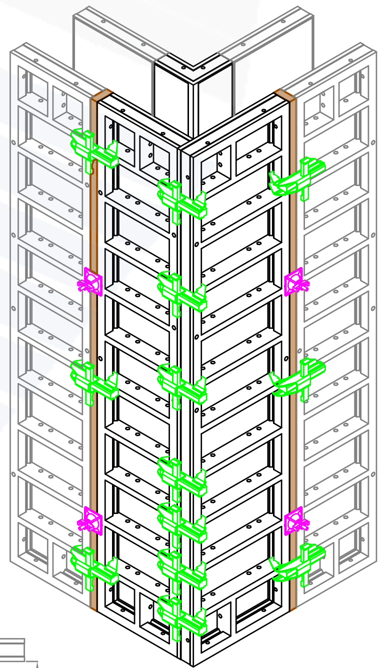
PRE-FORM (PTY) LTD

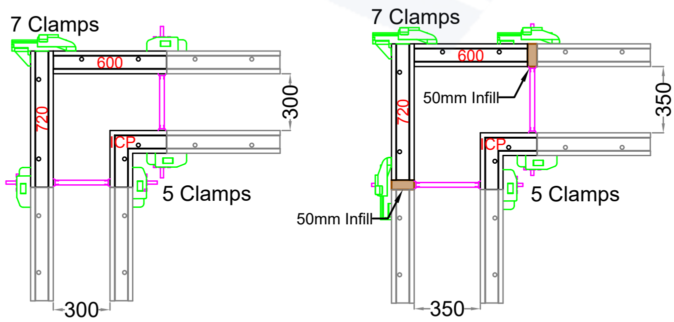
Comax Overlap Corners 3300mm Height



Corner method if first panel has no tie.



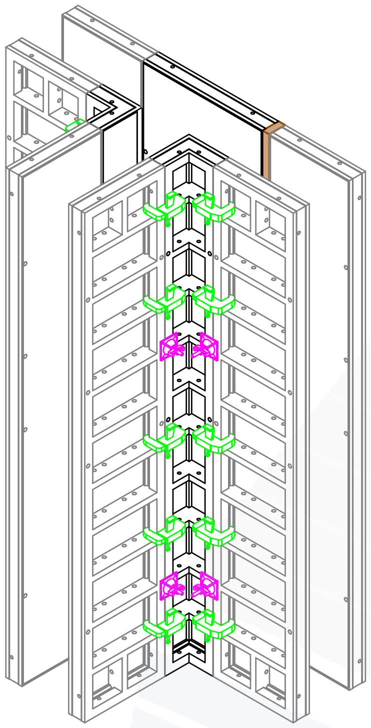


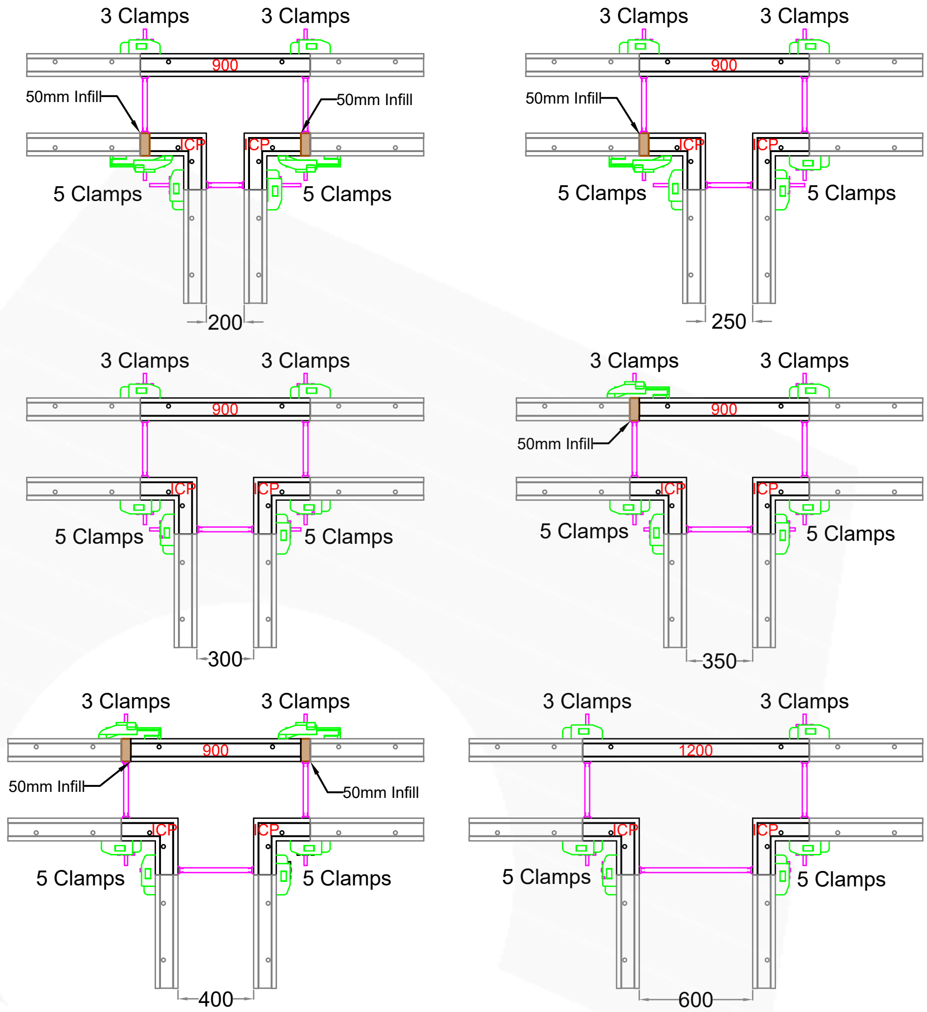


Overlap Corners must be secured with 7 Clamps at External and 5 Clamps at Internal Corners

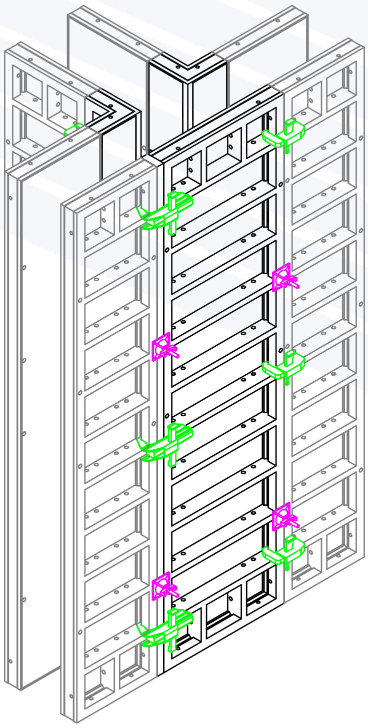
PRE-FORM
(PTY) LTD

Comax T-junctions 3300mm Height



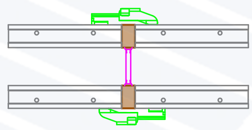


Internal Corners with T-junction must be secured with 5 Clamps and Outside Panel with 3 Clamps.

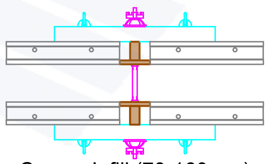


Comax Timber Infills 3300mm Height

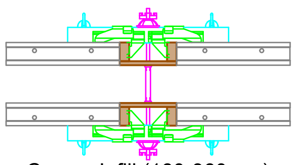
Timber Infills up to a Maximum of 360mm.



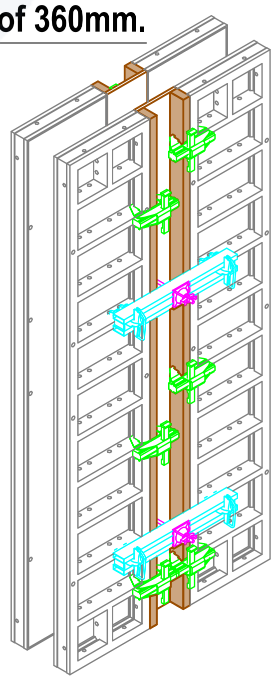
Comax Infill (0-70mm)
Maximum 70mm



Comax Infill (70-160mm)

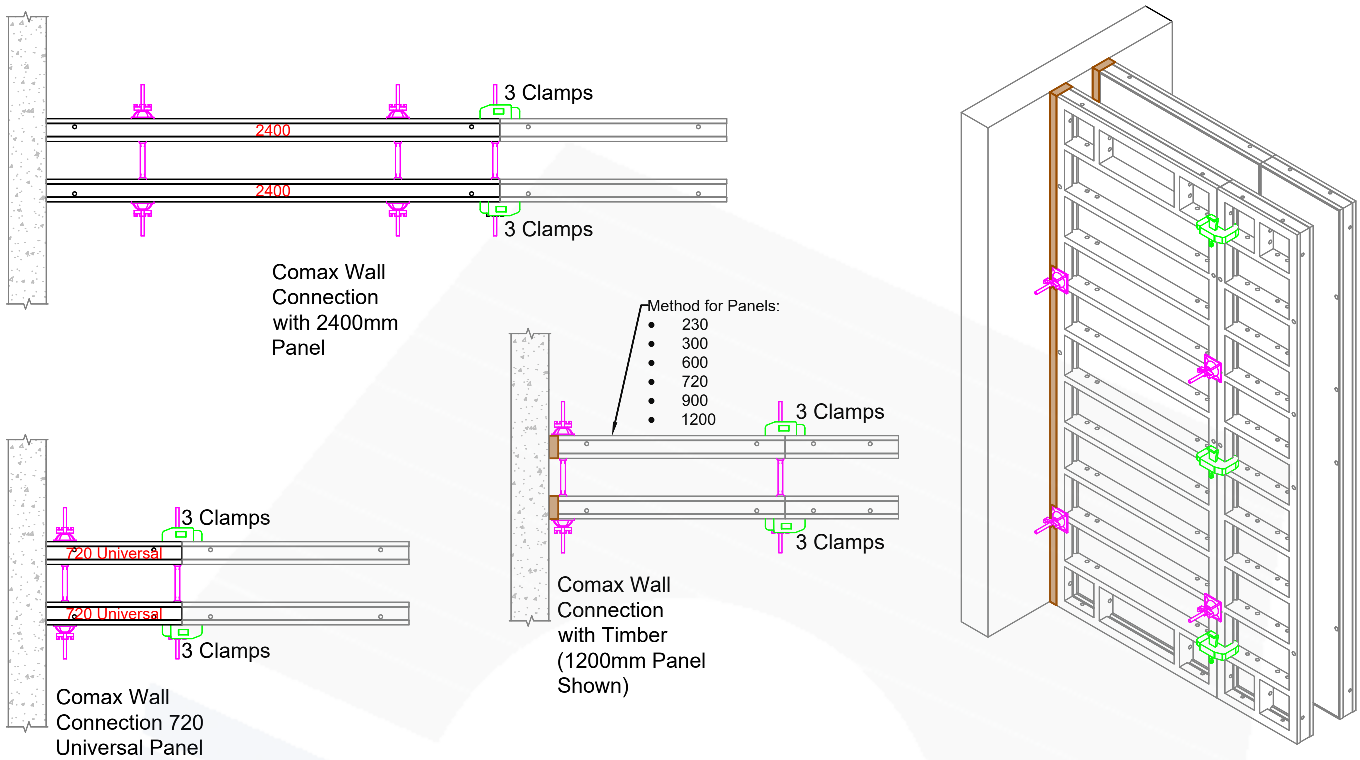


Comax Infill (160-360mm)



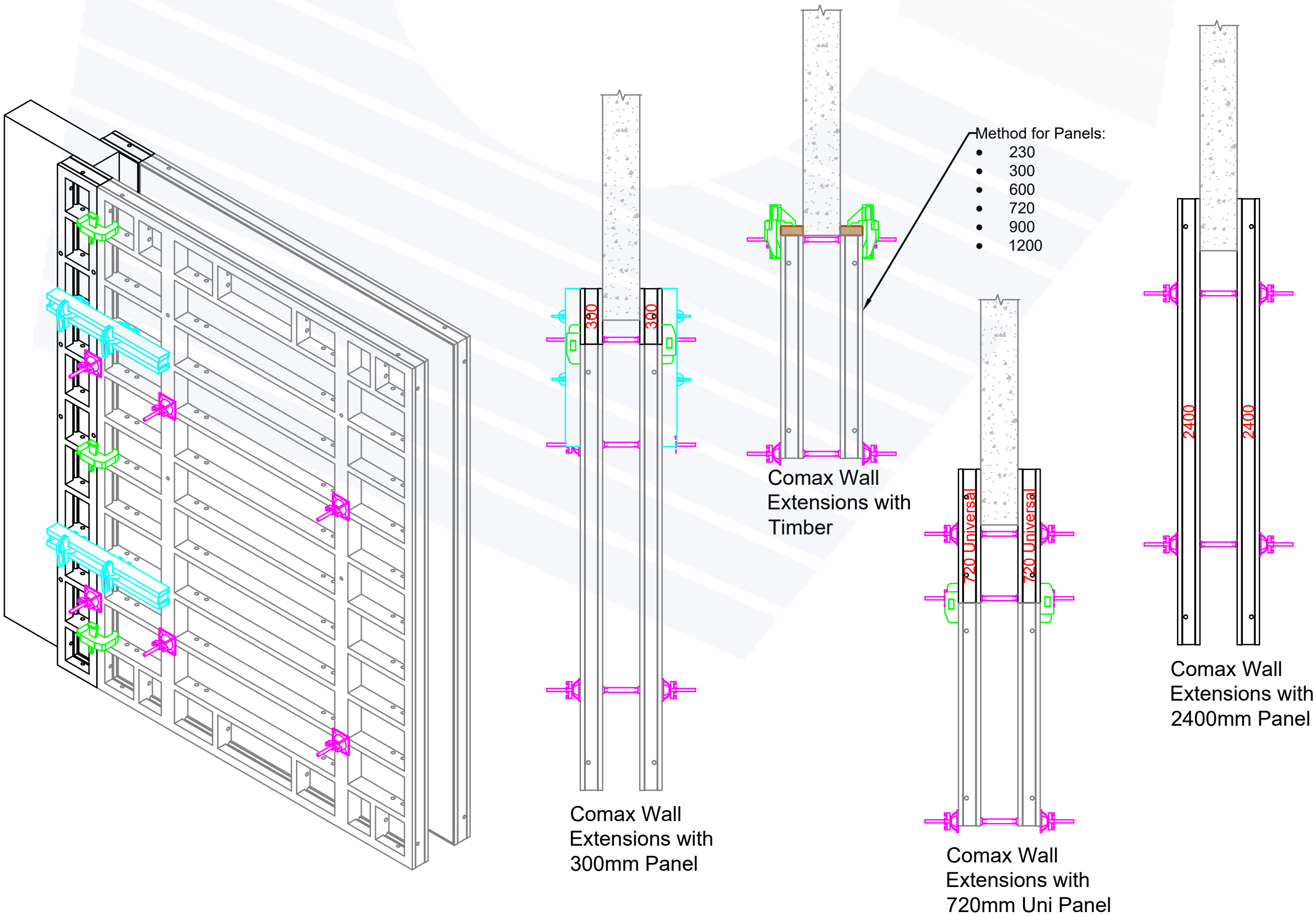
PRE-FORM (PTY) LTD

Comax Connections to Existing Walls



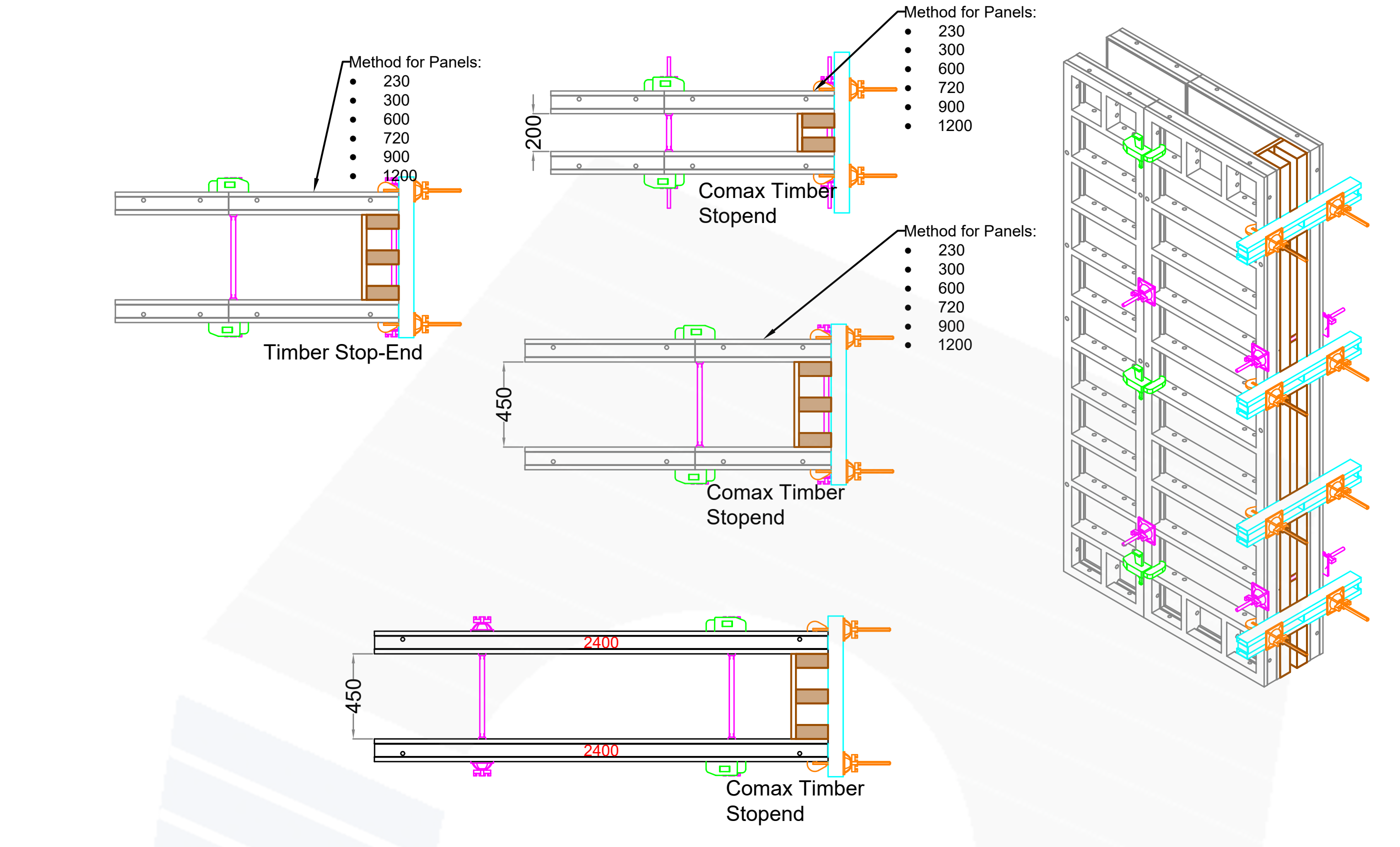
PRE-FORM (PTY) LTD

Comax Wall Extensions for Existing Walls



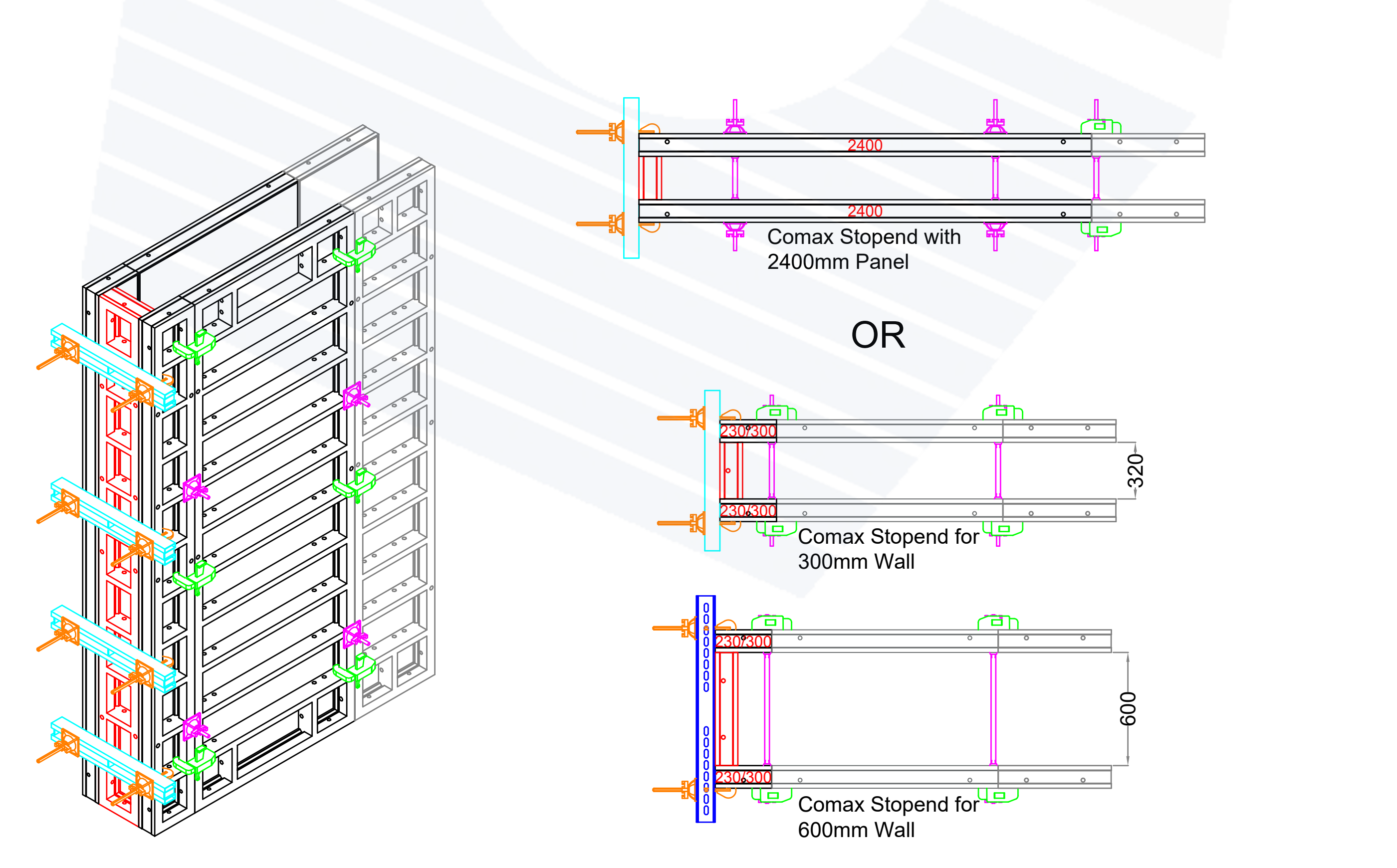
PRE-FORM (PTY) LTD

Comax Stop-Ends with Timber

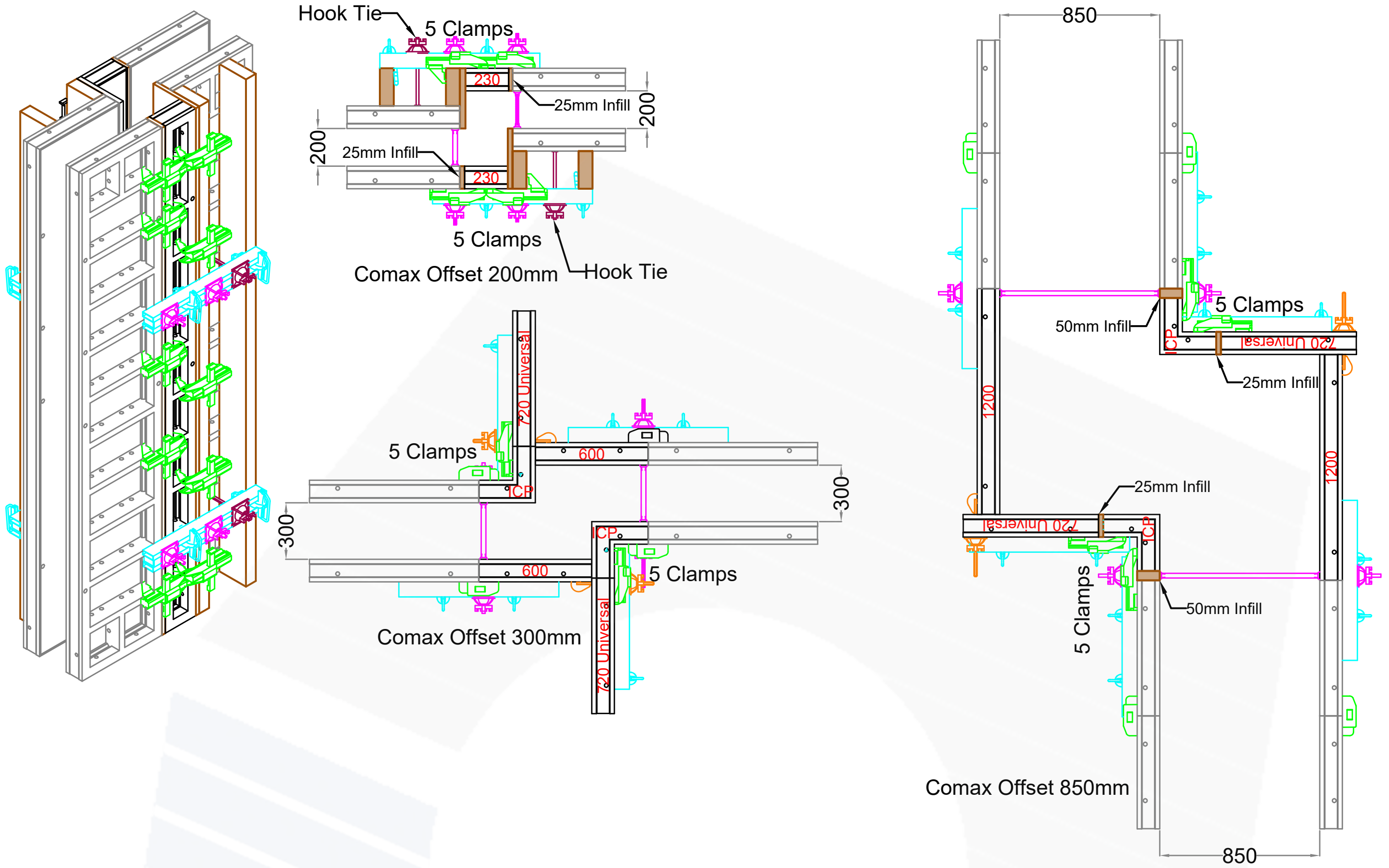


PRE-FORM (PTY) LTD

Comax Alternative Stop-Ends with Panels



Comax Wall Offsets

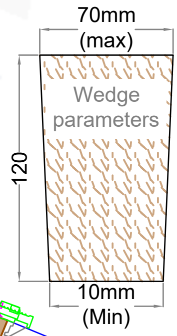


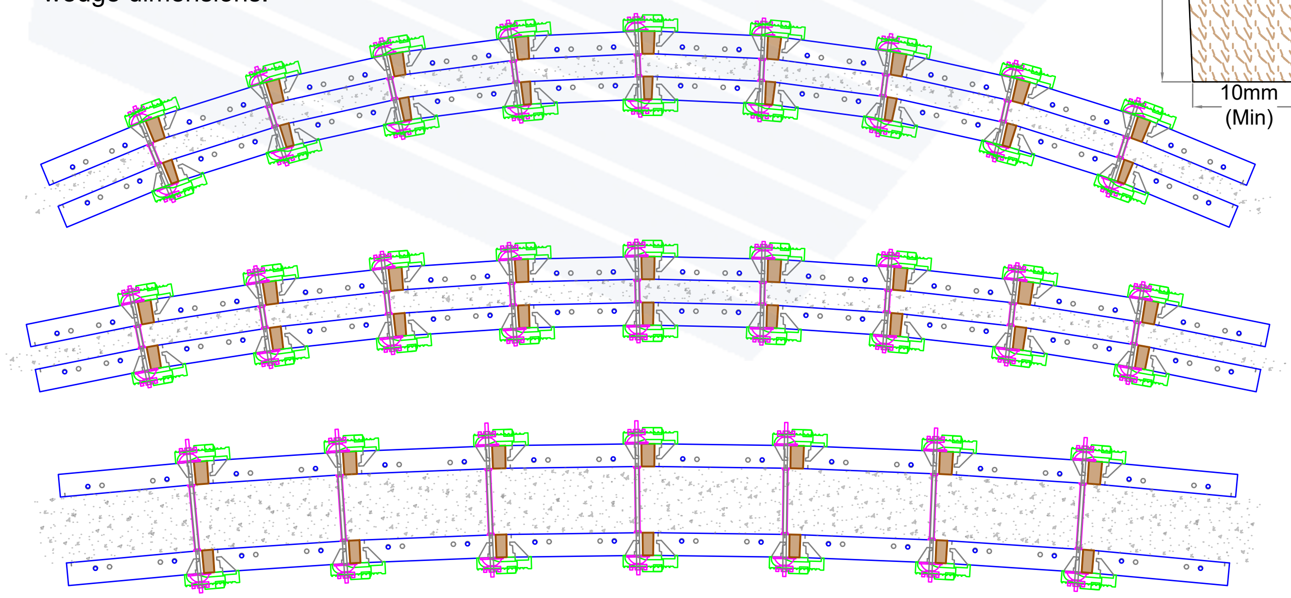
Comax Curved Walls

To form curved profiles, timber wedges must be cut to create the profile.

Notes:

- 5 clamps must be used per panel join,
- every panel join must get 2 tie rods in height,
- if needed, contact Pre-Form's Technical Department to assist with wedge dimensions.

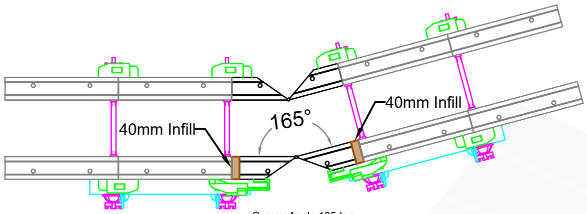




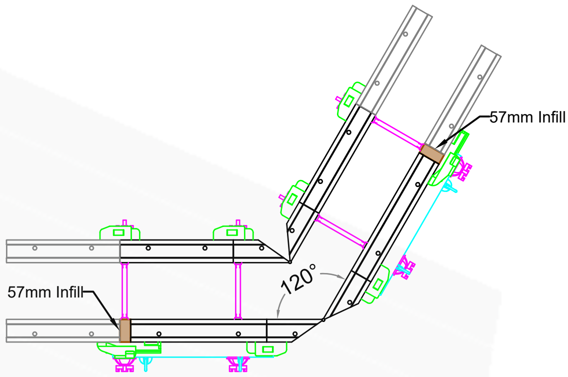
PRE-FORM (PTY) LTD

Comax Angles with Adjustable Panels

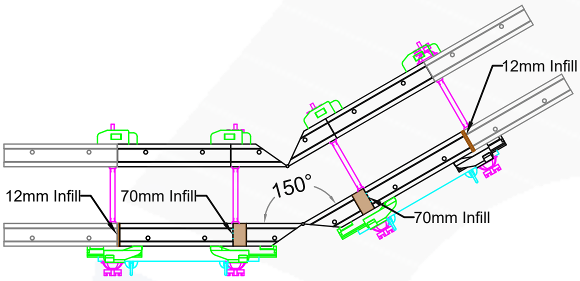
300mm Wall Thickness



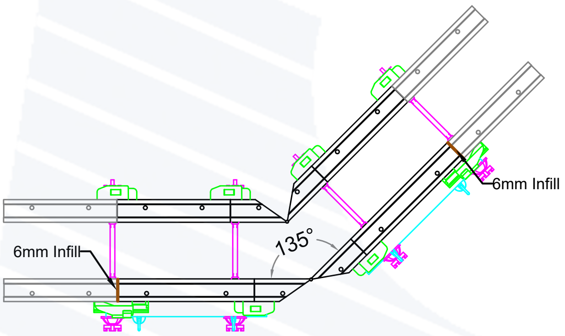
Comax Angle 165deg



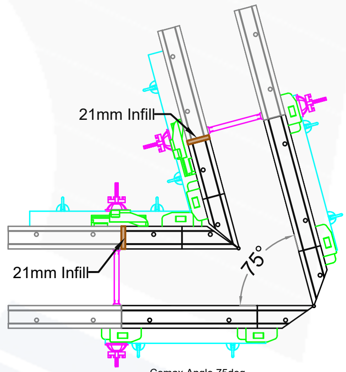
Comax Angle 120deg



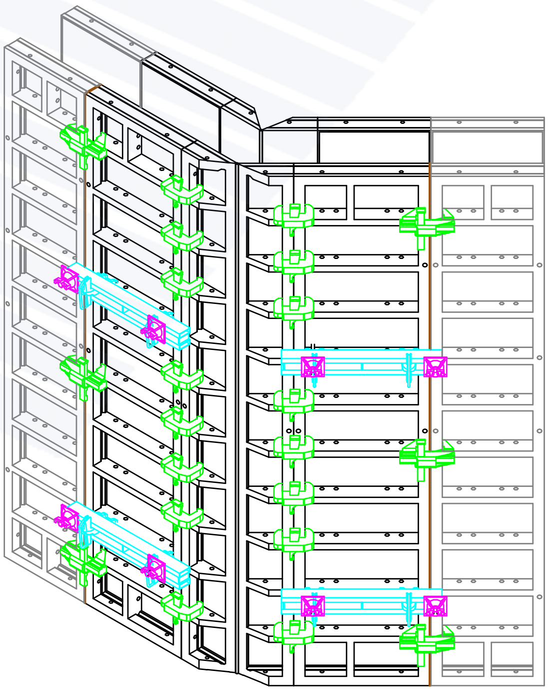
Comax Angle 65deg



Comax Angle 135deg



Comax Angle 75deg

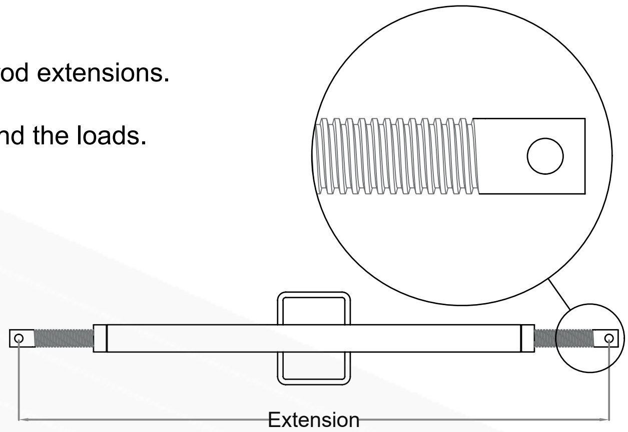


PRE-FORM (PTY) LTD

Push-Pull Prop allowable axial loads

Overview:

- The loading information assume symmetrical thread rod extensions.
- The end conditions must be pin joints.
- Pin joints must be designed and calculated to withstand the loads.



RW117370 - Rapid Kicker Brace Type A & B (1150-2000)							
Extension Length (m)	1.15	1.25	1.4	1.55	1.7	1.85	2
Permissible Compression Force (kN)	53	53	53	53	51	39	31
Permissable Tensile Force (kN)	20						

RW117340 - Rapid P-P Prop Type A (2000-2900)							
Extension Length (m)	2	2.15	2.3	2.45	2.6	2.75	2.9
Permissible Compression Force (kN)	53	46	39	33	28	24	20
Permissable Tensile Force (kN)	20						

UF128280 - Uni-Compression Prop 2000 - 2900mm							
Extension Length (m)	2	2.15	2.3	2.45	2.6	2.75	2.9
Permissible Compression Force (kN)	81	81	81	81	81	79	66
Permissable Tensile Force (kN)	31						

RW117350 - Rapid P-P Prop Type B (2900-3800)							
Extension Length (m)	2.9	3.05	3.2	3.35	3.5	3.65	3.8
Permissible Compression Force (kN)	25	23	20	18	16	15	13
Permissable Tensile Force (kN)	20						

UF128382 - Uni-Compression Prop 2900 - 3800mm							
Extension Length (m)	2.9	3.05	3.2	3.35	3.5	3.65	3.8
Permissible Compression Force (kN)	81	79	71	64	57	50	45
Permissable Tensile Force (kN)	31						

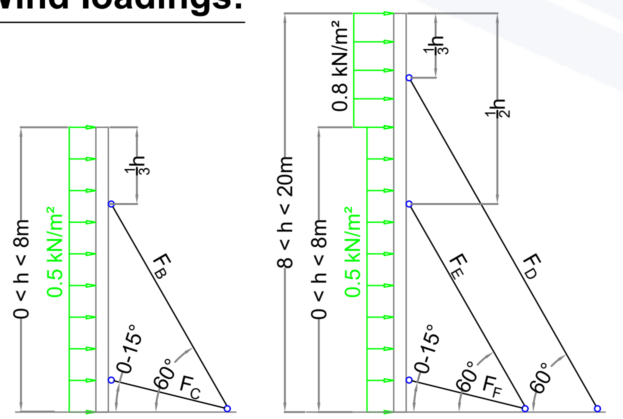
RW117355 - Rapid P-P Prop Type BB (3700-4600)							
Extension Length (m)	3.7	3.85	4	4.15	4.3	4.45	4.6
Permissible Compression Force (kN)	33	25	23	20	18	16	14
Permissable Tensile Force (kN)	20						

UF128383 - Uni-Compression Prop 3800 - 4700mm							
Extension Length (m)	3.8	3.95	4.1	4.25	4.4	4.55	4.7
Permissible Compression Force (kN)	51	47	44	40	37	34	31
Permissable Tensile Force (kN)	31						

RW117360 - Rapid P-P Prop Type C (4600-6000)							
Extension Length (m)	4.6	4.84	5.07	5.3	5.53	5.66	5.8
Permissible Compression Force (kN)	21	19	16	14	12	11	10
Permissable Tensile Force (kN)	20						

UF128384 - Uni-Compression Prop 4700 - 5600mm							
Extension Length (m)	4.7	4.85	5	5.15	5.3	5.45	5.6
Permissible Compression Force (kN)	66	62	58	54	50	46	42
Permissable Tensile Force (kN)	31						

Wind loadings:



UF128600 - Uni-Compression Prop 5600 - 6500mm							
Extension Length (m)	5.6	5.75	5.9	6.05	6.2	6.35	6.5
Permissible Compression Force (kN)	47	44	42	39	37	35	32
Permissable Tensile Force (kN)	31						

UF128610 - Uni-Compression Prop 6500 - 11000mm							
Extension Length (m)	6.5	7.25	8	8.75	9.5	10.25	11
Permissible Compression Force (kN)	34	27	22	18	15	12	10
Permissable Tensile Force (kN)	31						

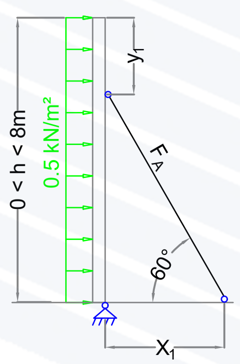
PRE-FORM (PTY) LTD

Push-Pull Prop Plumbing Allowable Spacings

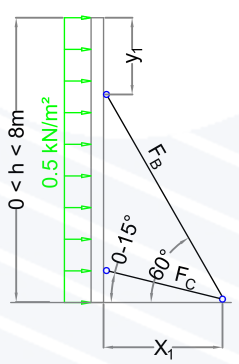
Notes:

1. Assumed all concrete pressure is taken up by the Tie Rods.
2. Push-Pull Props is for plumbing and wind pressure resistance. Not for shoring and single sided wall applications.
3. Refer to Push-Pull Prop Anchor with Excalibur for anchor point data, or contact supplier of anchor point equipment for loading resistance.
4. Refer to Push-Pull Prop Allowable Axial Load Resistance data for selection of Props.
5. Table is calculated as per illustration. Other configurations will have to be re-calculated. Contact Pre-Form Technical Department for assistance.
6. Spacing of props is to resist wind pressure, more props might be required for plumbing. In general props are placed at 1.25m for plumbing (2.5m gangforms).

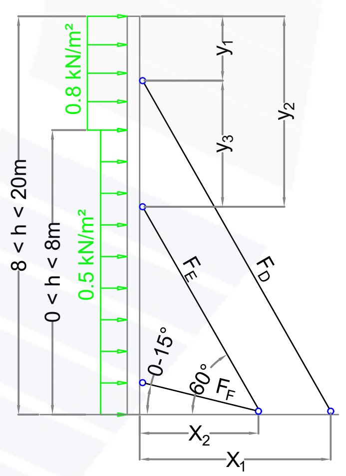
	Formwork Height (m) **h**	Max prop spacing (m) **L**	Axial Prop Loading (m)						Top (m)		Bottom (m)	
			F_A	F_B	F_C	F_D	F_E	F_F	Y_1	Y_2	X_1	X_2
1 Plumbing Stay	1	3.5	2.5						0.3		0.4	
	2	3.5	5						0.6		0.8	
	3	3.5	7.1						0.9		1.3	
2 Plumbing Stays	3	3.5		9.4	2.2				1		1.2	
	4	3.4		12.2	2.8				1.2		1.6	
	5	2.7		11.7	3				1.6		2	
	6	2.2		11.5	4				1.8		2.4	
	7	2		12.3	2.6				2		2.9	
	8	1.9		11.6	3				2.2		3.3	
	9	1.6		11.7	3.7				2.3		3.8	
3 Plumbing Stays	9	2.2				12.5	10.2	4.1	1.5	4	4.3	3
	10	2				12.6	10.3	4.2	1.7	4.5	4.8	3.2
	11	1.8				12.4	10.2	4.1	1.8	4.9	5.3	3.5
	12	1.6				12.3	10.2	4	2	5.3	5.8	3.9



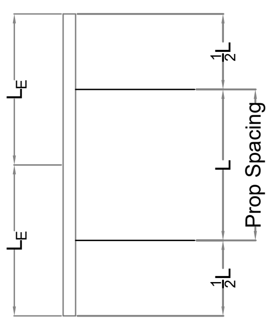
1 Plumbing Stay



2 Plumbing Stays



3 Plumbing Stays



PRE-FORM (PTY) LTD

Push-Pull Prop Anchor System with Excalibur

1. Excalibur Screwbolt:

1.1. Vist http://excaliburscrewbolts.com if more information regarding Excalibur Screwbolts are needed.

2. Technical Data:

2.1. Tensile strength = 800N/mm²
2.2. Material is BS3111/9/2.1.A
2.3. Treatment = case hardened

Rapid Push-Pull Base Plate T2:

Pin shear restriction is 21kN per pin.
F_{perm} = 23 kN for one 16/100 Excalibur on 20Mpa concrete, irrespective of load direction and angle.
F_{perm} = 36 kN for two 16/100 Excaliburs on 20Mpa concrete, irrespective of load direction and angle.

3. Embedment:

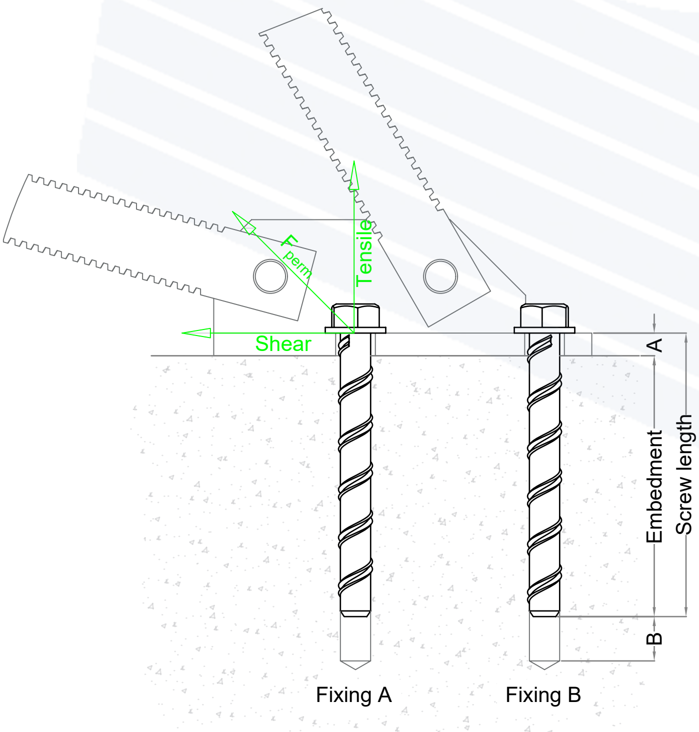
3.1. Minimum 4.5 x bolt diameter for concrete and brick.

4. Edge distances:

4.1. Minimum 5 x bolt diameter a reduction factor must be applied.
4.2. If more than 10 x bolt diameter no reduction factor is needed.

Excalibur Screwbolt Data for non-cracked concrete

Size	Diameter (mm)	Length (mm)	Maximum Fixing Thickness **A** (mm)	Depth Clearance **B** (mm)	Drill bit size (mm)	Drill Clearance (mm)	Embedment (mm)	20 MPa Tensile (kN)	20 MPa Shear (kN)	30 MPa Tensile (kN)	30 MPa Shear (kN)	60 MPa Tensile (kN)	60 MPa Shear (kN)
06/030	6	30	3	12	6.5	8	30	-	-	1.5	-	-	-
06/050	6	50	20										
06/075	6	75	35				45	-	-	4	4.1	-	4.1
06/100	6	100	50										
06/150	6	150	100										
08/050	8	50	14	16	8	10	40	4.2	4	4.2	4	5.8	4
08/075	8	75	39				60	-	-	6	7.2	8.1	7.2
08/100	8	100	50										
10/060	10	60	15	20	10	12	50	5.3	8	5.3	8	8.2	8
10/075	10	75	30										
10/100	10	100	50				75	9.5	13.1	9.5	13.1	13.7	13.1
10/120	10	120	70										
12/075	12	75	20	24	12	14	60	7.5	17	7.5	17	11.5	17
12/100	12	100	46				90	12.2	17	12.2	17	19.1	17
12/150	12	150	96										
16/100	16	100	28	32	16	18	120	16.2	21.6	-	-	19.1	22.8
16/150	16	150	58										
16/200	16	200	108										
20/100	20	100	28	40	20	22	170	25.5	33.2	-	-	36.1	47
20/150	20	150	58										
20/200	20	200	108										



Edge Reduction Data for 20 MPa concrete

Excalibur	Edge (mm)	20	30	40	50	60	70	80	90	100	110	120	130	140
8	Tension	0.6	0.6	0.7	0.7	1								
10	Tension	0.6	0.7	0.8	0.9	1								
12	Tension			0.6	0.7	0.7	0.9	1						
16	Tension				0.7	0.8	0.9	0.9	1					
8	Shear		0.5	0.7	0.8	0.9	0.9	1						
10	Shear			0.3	0.4	0.5	0.7	0.9	1					
12	Shear					0.4	0.4	0.5	0.7	0.8	0.9	1		
16	Shear							0.3	0.4	0.5	0.6	0.8	0.9	1

Bolt Spacing Reduction Data for 20 MPa concrete

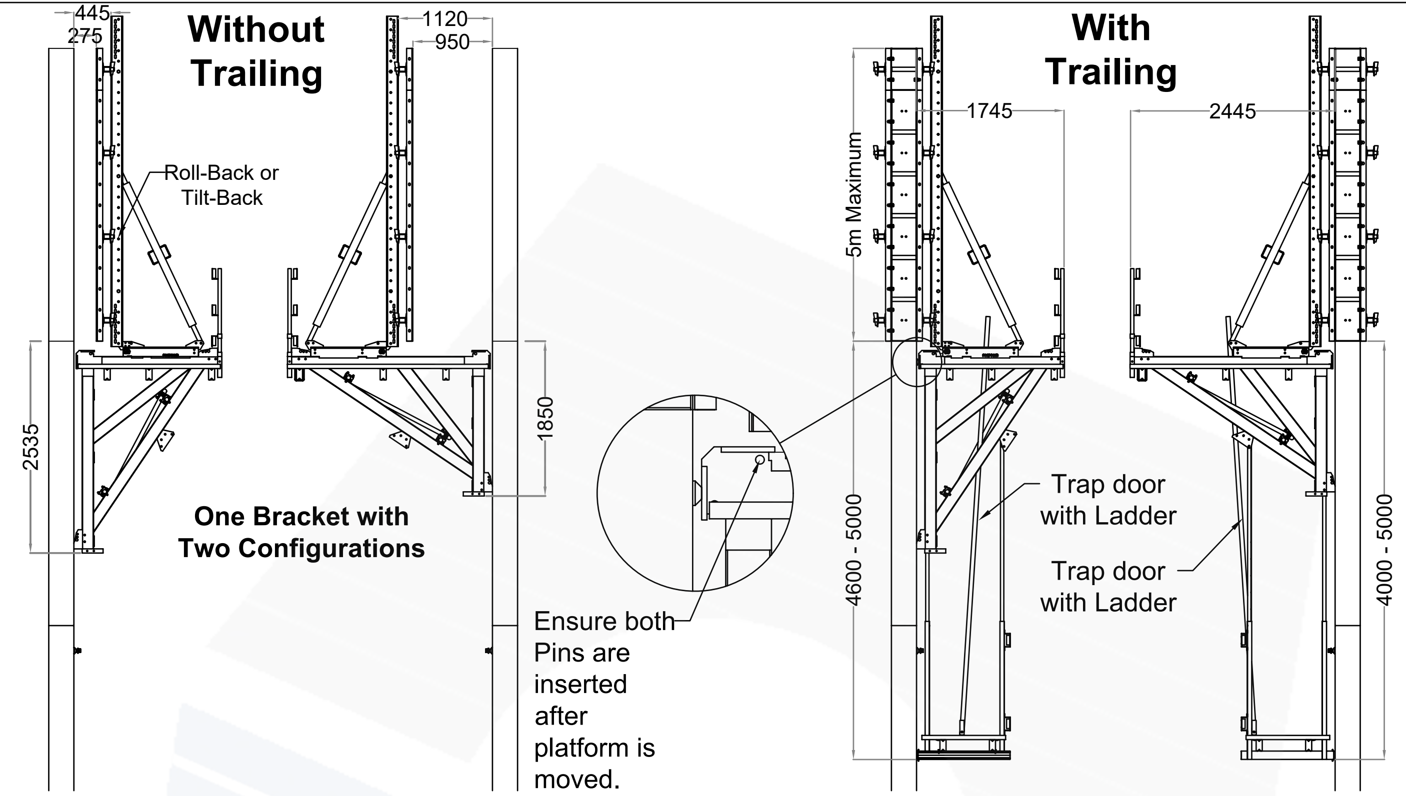
Excalibur	Edge (mm)	30	40	50	60	70	80	90	100	120	140	170	200
8	Tension	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1				
10	Tension		0.7	0.8	0.8	0.8	0.9	0.9	0.9	1			
12	Tension				0.7	0.7	0.7	0.7	0.7	0.7	0.8	1	
16	Tension				0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	1

Notes:

1. 16mm Excalibur can be used with standard prop base plate.
2. Only Fixing A or Fixing B have to be used.
3. Both Fixing A and Fixing B can be used for higher load support.
4. Excalibur is a suggested fixing method, rawl bolts, chemical anchors, etc. can also be used.

PRE-FORM (PTY) LTD

PF-160-240 Climber Configurations



PRE-FORM (PTY) LTD

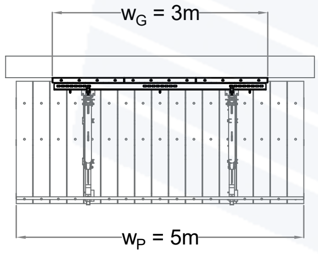
PF-160-240 Climber Mass Estimation

Example:

w_G = 3m Gangform
h_S = 4m Gangform (Shutter) Height
w_P = 5m Platform Width

- Climber in 2400mm Configuration with Trailing
- 4m Soldier

* Mass of slings or spreaders must be added.



Crane Requirement:

Table 1 = = 0 kg
Table 2 = 5m Wide and 4m Soldier = 1200kg
Table 3 = 5m Wide Trailing = 343 kg
Table 4 = 3m Wide and 4m High = 1556 kg
Total = 0 + 1200 + 343 + 1556 = **3100kg**

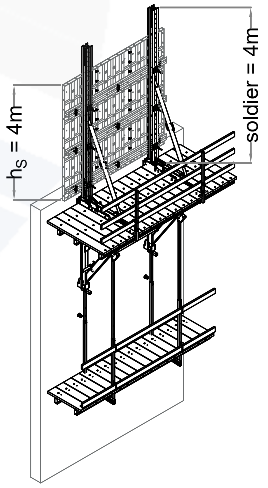


Table 1 — 1600mm Configuration (Mass (kg))

Platform Width (m)	No Soldier	3m Soldier	4m Soldier
1	352	691	763
1.5	395	734	806
2	440	779	851
2.5	483	822	894
3	527	866	938
3.5	571	910	982
4	616	955	1027
4.5	659	998	1070
5	703	1042	1114
5.5	748	1087	1159
6	793	1132	1204

Table 2 — 2400mm Configuration (Mass (kg))

Platform Width (m)	No Soldier	3m Soldier	4m Soldier
1	365	704	776
1.5	417	456	828
2	471	810	882
2.5	524	863	935
3	577	916	988
3.5	630	969	1041
4	684	1023	1095
4.5	736	1075	1147
5	789	1128	1200
5.5	843	1182	1254
6	897	1236	1308

Add 70kg for platforms with Trapdoor and 5m Ladder.

Table 3 — Trailing System

Platform Width (m)	Mass (kg)
1	136
1.5	163
2	188
2.5	215
3	240
3.5	266
4	290
4.5	317
5	343
5.5	368
6	394

Table 4 — Estimated HD Gangform Mass (Mass (kg))

Gangform Width (m)	3m High	3.5m High	4m High	4.5m High	5m High
1	526	587	644	704	762
1.5	695	786	872	963	1049
2	864	985	1100	1221	1336
2.5	1032	1184	1328	1479	1623
3	1201	1383	1556	1738	1911
3.5	1392	1604	1806	2018	2220
4	1582	1825	2056	2298	2529
4.5	1773	2046	2306	2579	2838
5	1964	2267	2555	2859	3147
5.5	2145	2488	2805	3139	3457
6	2345	2709	3055	3420	3776

Access included. For Large panels reduce with 6%

Add to Estimate Total Mass (kg)

PF-160-240 Climber Anchor Loads and Reactions

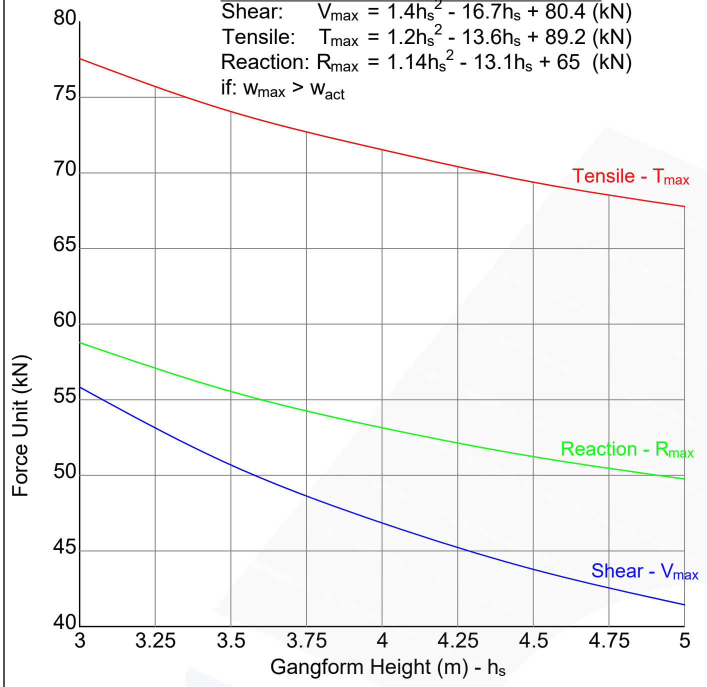
Maximum Load Polynomial Formulas:

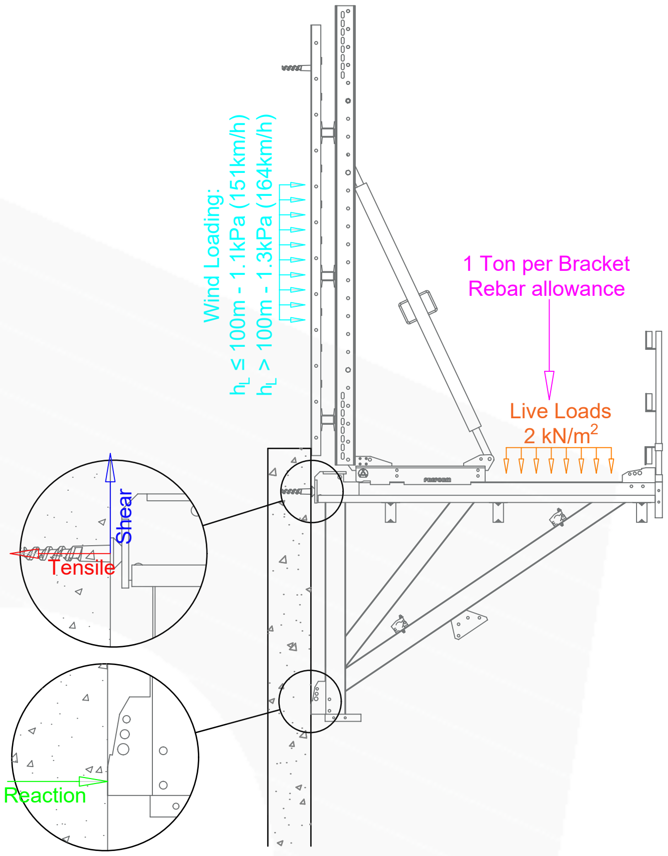
Shear: $V_{max} = 1.4h_s^2 - 16.7h_s + 80.4$ (kN)

Tensile: $T_{max} = 1.2h_s^2 - 13.6h_s + 89.2$ (kN)

Reaction: $R_{max} = 1.14h_s^2 - 13.1h_s + 65$ (kN)

if: $w_{max} > w_{act}$





Example:

Shutter height of 3.5m at 75m above ground (h_L)
Actual width = 2m per bracket
Allowable width = 4.3m per bracket
M24x200 Anchor wit Grade 8.8 to be used

Actual V = $(w_{act}/w_{max}).V_{max} + 2.4 = (2/4.3)\text{x}51 + 2.4 \approx 26.5$ kN
Actual T = $(w_{act}/w_{max}).T_{max} + 2.4 = (2/4.3)\text{x}74 + 2.4 \approx 37.5$ kN
Actual R = $(w_{act}/w_{max}).R_{max} + 2.4 = (2/4.3)\text{x}56 + 2.4 \approx 28.5$ kN

Anchor bolt check:
$V_u/V_r + T_u/T_r \leq 1.4$
26.5/131.5 + 37.5/148.6 = 0.45 .... < 1.4 ...OK

Actual Loads vs. Maximum Loads:

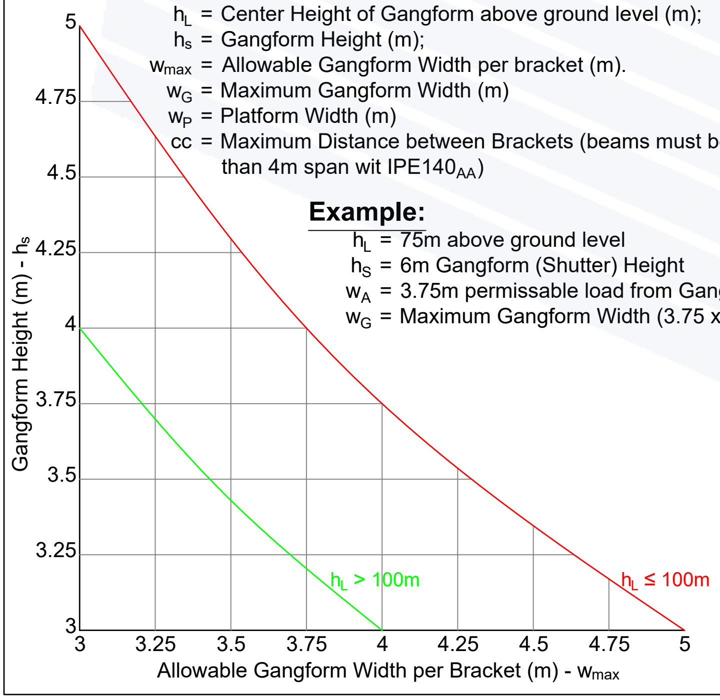
Actual V = $(w_{act}/w_{max}).V_{max} + 2.4$
Actual T = $(w_{act}/w_{max}).T_{max} + 2.4$
Actual R = $(w_{act}/w_{max}).R_{max} + 2.4$

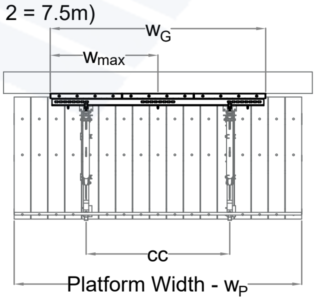
Allowable Gangform Widths

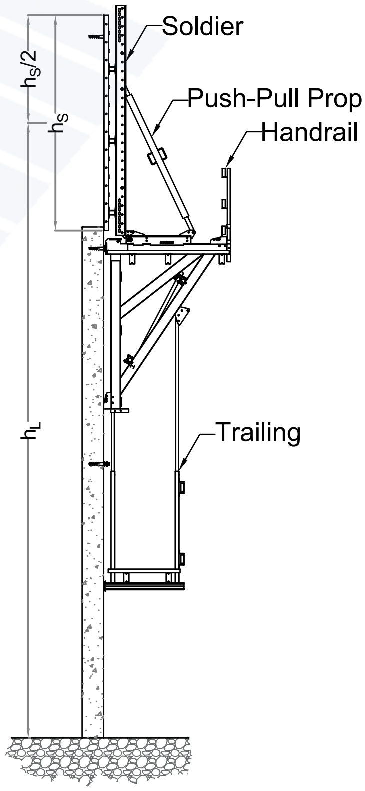
h_L = Center Height of Gangform above ground level (m);
h_s = Gangform Height (m);
w_{max} = Allowable Gangform Width per bracket (m).
w_G = Maximum Gangform Width (m)
w_P = Platform Width (m)
cc = Maximum Distance between Brackets (beams must be designed for more than 4m span wit IPE140$_{AA}$)

Example:

h_L = 75m above ground level
h_S = 6m Gangform (Shutter) Height
w_A = 3.75m permissable load from Gangform per bracket
w_G = Maximum Gangform Width (3.75 x 2 = 7.5m)







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Retrievable Anchor Screws Limits

Recommended Nominal Embedment Clearance (mm)	
M20x120	136
M20x200	163
M24x140	188
M24x200	215
M24x280	240
M30x360	290
M36x430	290

T_a = Ultimate Tensile of Anchor (kN), T_r taken into account
T_r = Ultimate Tensile Capacity of the internal bolt (ISO 6g)
T_u = Ultimate Tensile Design Load
V_r = Ultimate Shear Capacity of the internal bolt (ISO 6g)
V_u = Ultimate Shear Design Load
f_{cu} = Compressive Concrete Strength (MPa)
φ_s = Safety Factor of the Anchor in Tension, taken as 0.67

Anchor Maximum Limitations			
Anchor	Force	Bolt Grade	
		4.8	8.8
M20x120	T_r (kN)	53	81.4
	V_r (kN)	45.9	90.8
M20x200	T_r (kN)	53	104.8
	V_r (kN)	45.9	90.8
M24x140	T_r (kN)	76.8	84.6
	V_r (kN)	66.5	131.5
M24x200	T_r (kN)	76.8	148.6
	V_r (kN)	66.5	131.5
M24x280	T_r (kN)	76.8	151.9
	V_r (kN)	66.5	131.5
M24x280 H/D	T_r (kN)	76.8	151.9
	V_r (kN)	66.5	131.5
M30x361	T_r (kN)	123	243.2
	V_r (kN)	104.5	206.6
M36x431	T_r (kN)	180.1	355.9
	V_r (kN)	151.1	298.6

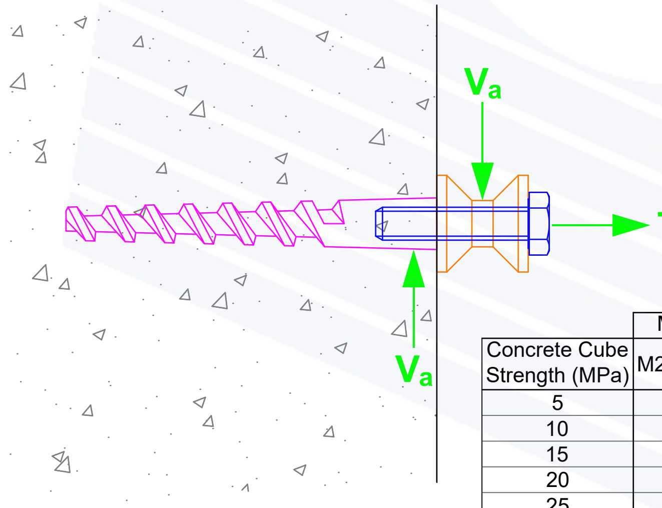
Load Reduction Factors for Spacing and Edge Distance on Anchors								
Anchor Designation	Tension Only Loads				Shear Loads			
	Anchor Spacing (mm)	Load Reduction Factor	Edge Distance (mm)	Load Reduction Factor	Anchor Spacing (mm)	Load Reduction Factor	Edge Distance (mm)	Load Reduction Factor
M20x120	240	0.7	107	0.7	286	0.6	53	0.5
	480	1	120	1	480	1	45.9	1
M20x200	275	0.7	100	0.7	300	0.6	53	0.5
	550	1	200	1	550	1	45.9	1
M24x140	245	0.7	106	0.7	283	0.6	76.8	0.5
	490	1	140	1	525	1	66.5	1
M24x200	275	0.7	100	0.7	300	0.6	76.8	0.5
	550	1	200	1	550	1	66.5	1
M24x280	231	0.7	107	0.7	280	0.6	76.8	0.5
	462	1	213	1	493	1	66.5	1
M30x361	263	0.7	116	0.7	360	0.6	123	0.5
	526	1	210	1	587	1	104.5	1
M36x431	322	0.7	140	0.7	430	0.6	180.1	0.5
	643	1	257	1	712	1	151.1	1

Linear interpolation can conservatively be applied to the above values as per the discretion of the designer. Recommended to use spacing and edge distances greater or equal to a reduction of 1.

Anchor Tensile Load Capacity Polynomial Formulas:

M20x120: $T_a = \varphi_s[-1.57\times10^{-2}.(f_{cu})^2 + 3.296.f_{cu} - 14.619$
M20x200: $T_a = \varphi_s[-7.34\times10^{-2}.(f_{cu})^2 + 8.9426.f_{cu} - 61.192$
M24x140: $T_a = \varphi_s[-1.52\times10^{-2}.(f_{cu})^2 + 3.2896.f_{cu} - 10.564$
M24x200: $T_a = \varphi_s[-6.27\times10^{-2}.(f_{cu})^2 + 8.3748.f_{cu} - 53.447$
M24x280: $T_a = \varphi_s[-7.95\times10^{-2}.(f_{cu})^2 + 10.611.f_{cu} - 55.269$
M30x360: $T_a = \varphi_s[-7.54\times10^{-2}.(f_{cu})^2 + 12.711.f_{cu} - 11.101$
M36x430: $T_a = \varphi_s[-1.171\times10^{-1}.(f_{cu})^2 + 18.491.f_{cu} - 15.932$

This formulas can be used to design the tensile load application for anchors as long as the shear- and tensile steel failure load limitations presented in above table is not exceeded.
The maximum concrete vale to substitute f_{cu} in the polynomial formulas should not exceed 56.7MPa.



Formula for Combined Tension and Shear:
As per SANS 0162-1:Part 13.11.4

$V_u/V_r + T_u/T_r \leq 1.4$

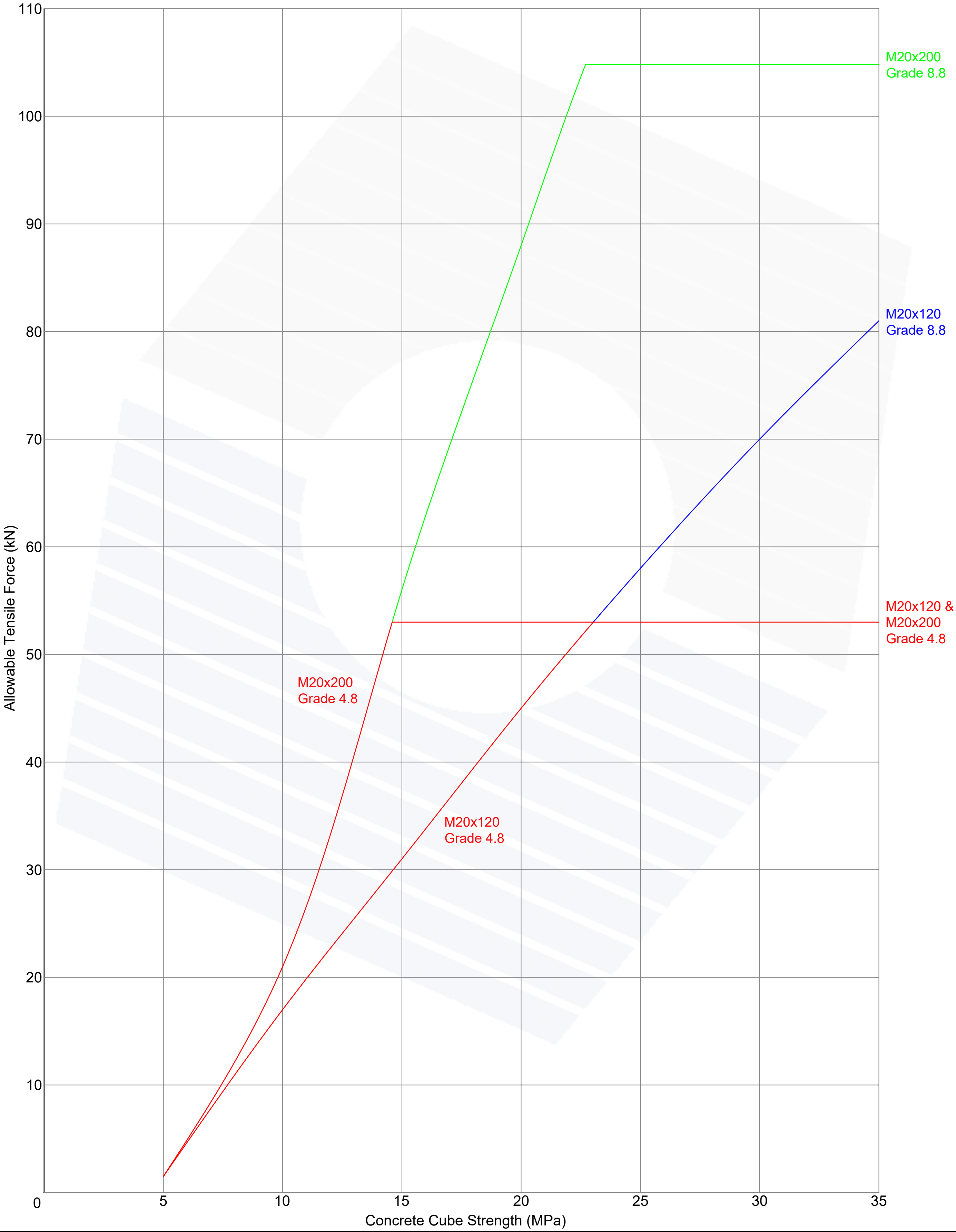
Concrete Cube Strength (MPa)	Maximum Tensile Load vs Concrete Cube Strength for Grade 4.8 Bolts (kN)							
	M20x120	M20x200	M24x140	M24x200	M24x280	M24x280 H/D	M30x361	M36x431
5	1	1	1	1	1	1	51	74
10	17	21	21	21	43	58	108	157
15	31	56	35	56	86	106	163	235
20	45	88	49	89	125	149	213	307
25	58	116	62	117	160	189	260	373
30	70	131	74	141	164	190	302	433
35	81	131	85	149	164	190	305	446

Notes on Maximum Tensile Load Vs Concrete Strength Tables and Limit Graphs:
The Tabulated values presented herein include the material safety factors.
These factors are applied to the Anchors tested or calculated failure values and not the maximum elastic limit of the Anchor itself, the designer should apply the necessary load factors to the ULS (ultimate design loads).
The ULS calculated by designer should be below values presented herein.

Concrete Cube Strength (MPa)	Maximum Tensile Load vs Concrete Cube Strength for Grade 8.8 Bolts (kN)							
	M20x120	M20x200	M24x140	M24x200	M24x280	M24x280 H/D	M30x361	M36x431
5	1	1	1	1	1	1	51	74
10	17	21	21	21	43	58	108	157
15	31	56	35	56	86	106	163	235
20	45	88	49	89	125	149	213	307
25	58	116	62	117	160	189	260	373
30	70	131	74	141	164	190	302	433
35	81	131	85	149	164	190	305	446

Retrievable Anchor Screws Tensile Limits M20 series

Notes on Maximum Limit Graph:
These factors are applied to the Anchors tested or calculated failure values and not the maximum elastic limit of the Anchor itself, the designer should apply the necessary load factors to the ULS (ultimate design loads).
The ULS calculated by designer should be below values presented herein.



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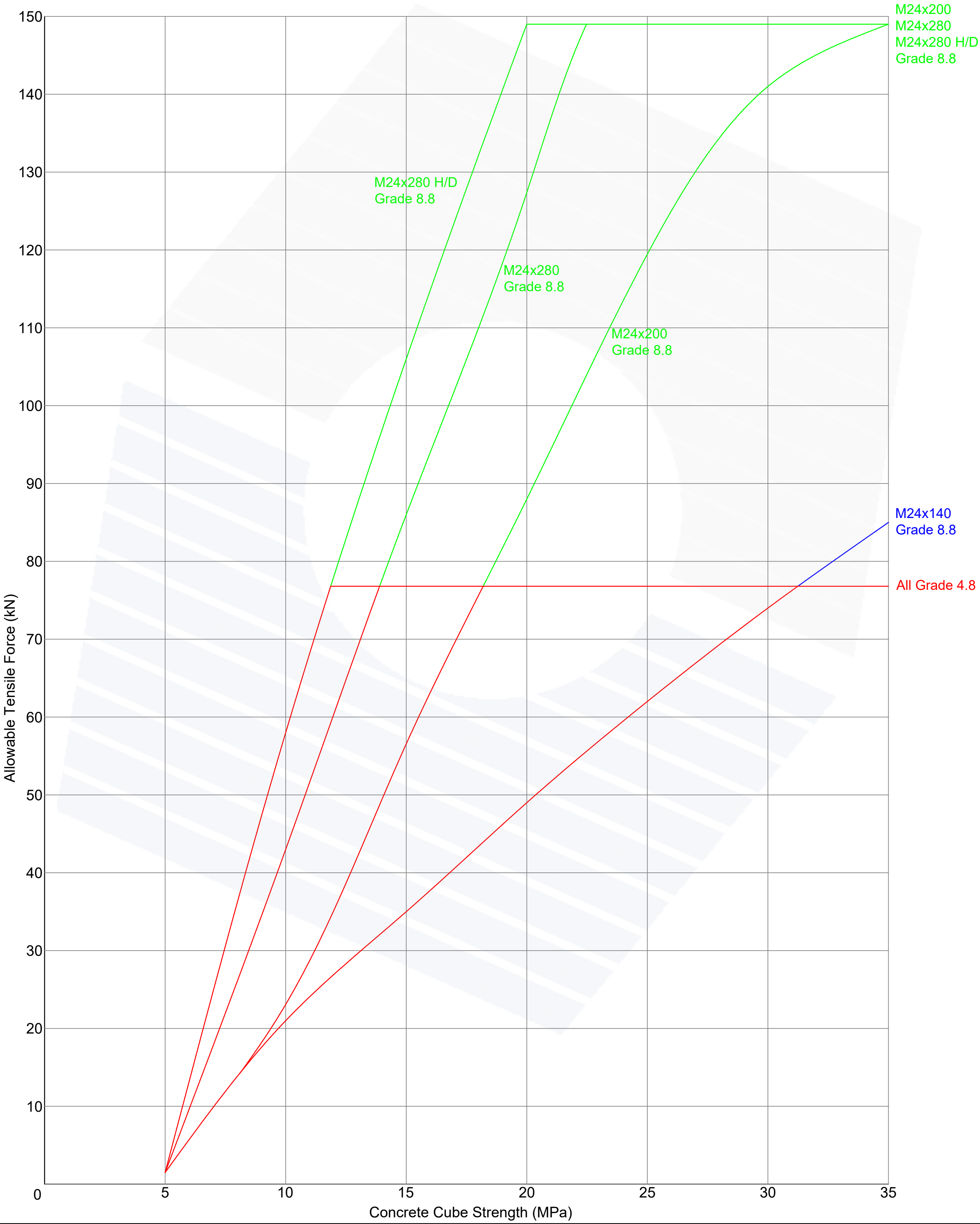
Retrievable Anchor Screws
Tensile Limits M24 series

Notes on Maximum Limit Graph:
These factors are applied to the Anchors tested or calculated failure values and not the maximum elastic limit of the Anchor itself, the designer should apply the necessary load factors to the ULS (ultimate design loads).
The ULS calculated by designer should be below values presented herein.



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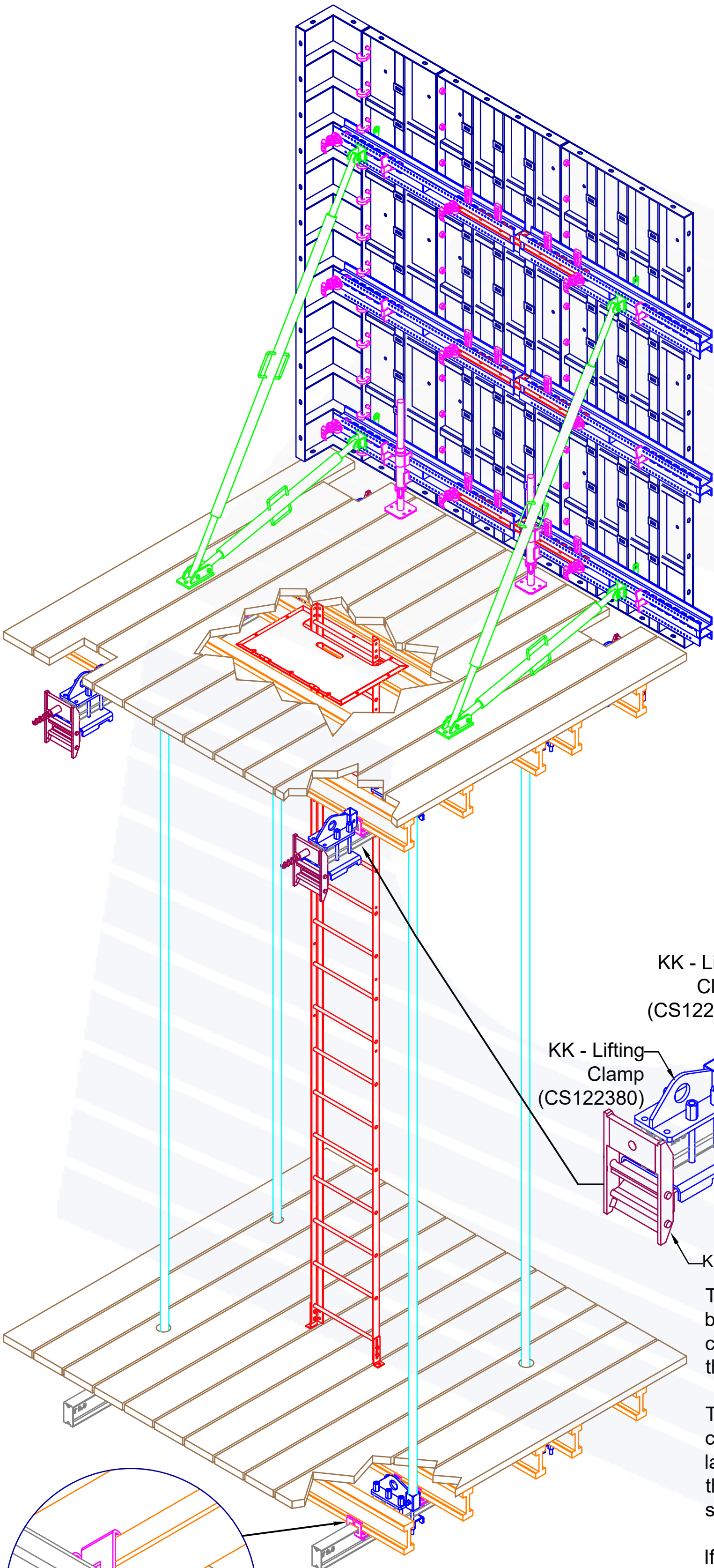
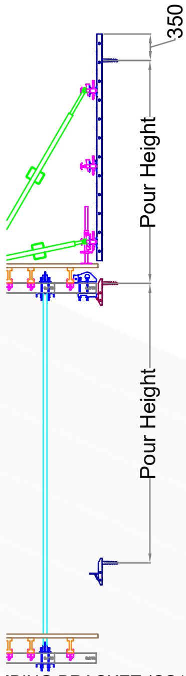
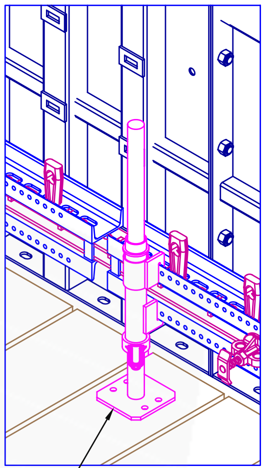
Adjustable Klik-Klak Typical Information



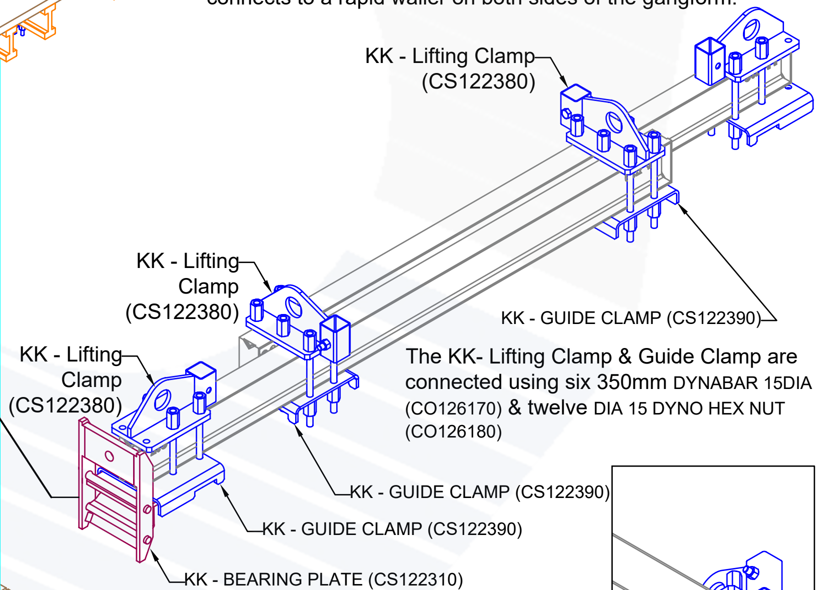


Klik Klak Anchor to be placed 350 from top of shutter (T.O.C)



KK - PLUMBING BRACKET (CS122370) on a RINGLOCK BASE JACK (RL108010)

The KK - Plumbing Bracket is used to plumb the wall shutters before casting. The KK - Plumbing Bracket connects to a rapid waller on both sides of the gangform.



The KK- Lifting Clamp & Guide Clamp are connected using six 350mm DYNABAR 15DIA (CO126170) & twelve DIA 15 DYNO HEX NUT (CO126180)

The KK- Lifting Clamp & Guide Clamp can be manipulated to accommodate a combination of 140_{AA} IPE and 160_{AA} IPE at the same time.

To achieve this the Guide on the two mid clamps should be flipped to allow for the larger 160_{AA} IPE to fit into the cut-out while the 140_{AA} can rest at its normal position, as shown in figure: KK-2

If two 160AA IPEs are used the standard position of the clamp should be used as shown in figure: KK-1

The KK- Lifting Clamp & Guide Clamp are used to connect the IPE Beams and as a guide to hold the IPE Beams on the KK - Bearing Plate (These are only added to the top Platform not to the trailing

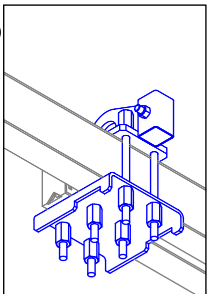


figure: KK-1

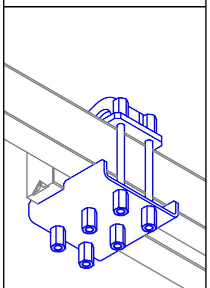
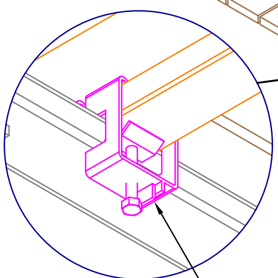


figure: KK-2



The HT/LVL Beam Clamp is used to fasten the HT20 Beam to the IPE Beam

HT/LVL BEAM CLAMP (FF103370)

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