

Work Safety of Temporary Works and Tower Cranes -

Engineering Design to Eliminate Risk for Construction Temporary Works

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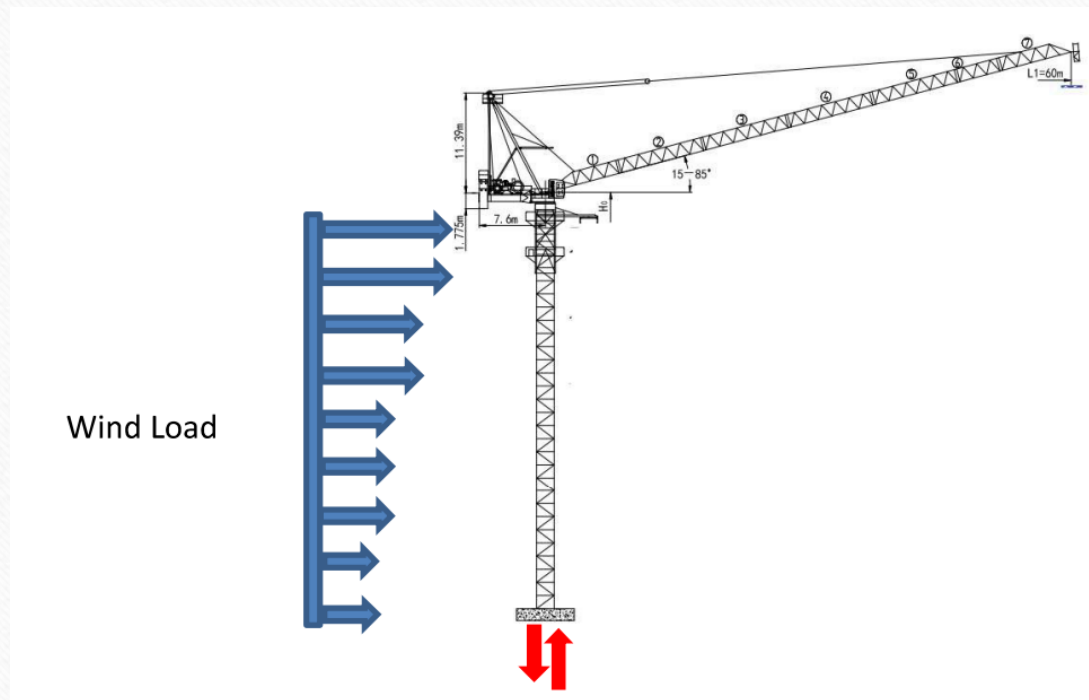
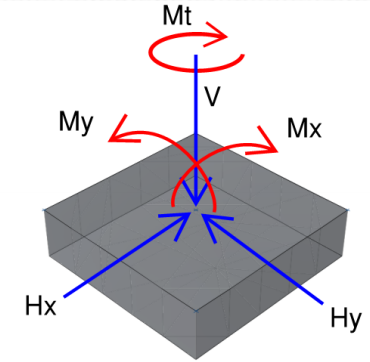
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- 2. Temporary Steel Platform Design
- 3. Temporary Support for Demolition
- 4. Temporary Support for Concreting for Superstructure Elements

1. Tower Crane Base Design



Loading Consideration:

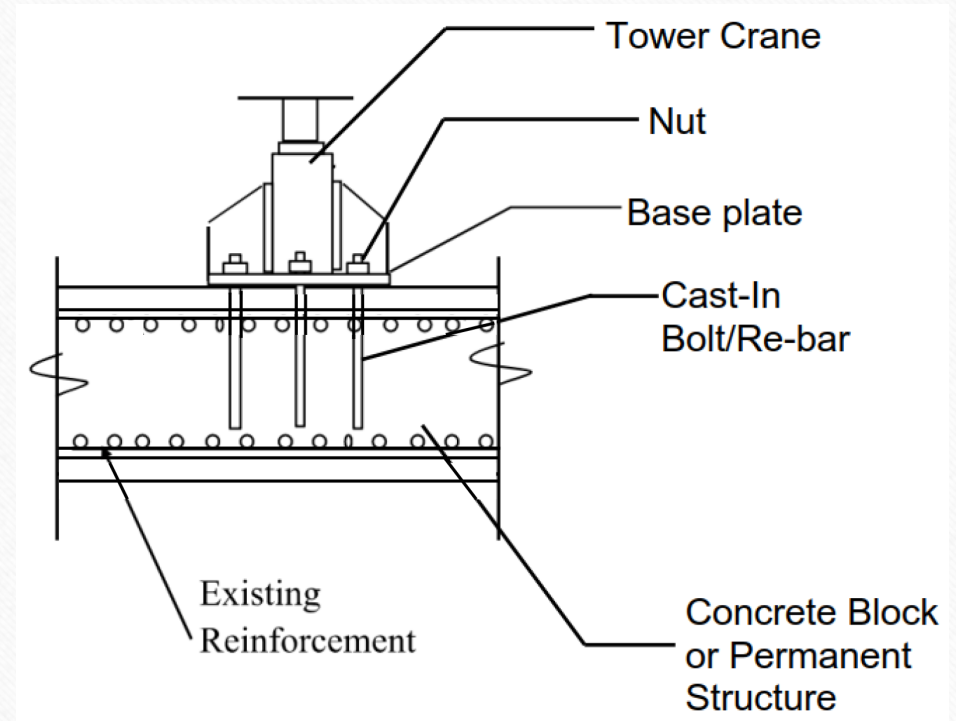
1. Wind Loads (e.g. Wind along X axis)
2. Self-Weight of Tower Crane
3. Loading From Lifting Construction Materials

Base Design Load:

1. Shear Force(剪切力)
2. Axial Load(Compression or **Tension**)
3. **Bending Moment(彎曲力矩)**
4. Torsion(扭力)

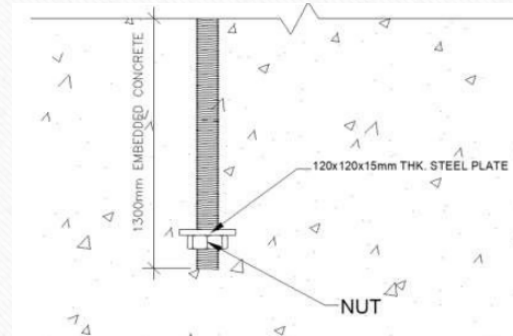
1. Tower Crane Base Design

- Base Plate Design
 - Connection Design (e.g. Cast-In Re-Bar/Bolt)
 - Steel Plate Design
 - Existing Structure Check
 - Stability Check for The Tower Crane Base Support
 - Bearing
 - Sliding
 - Overturning
 - Flotation

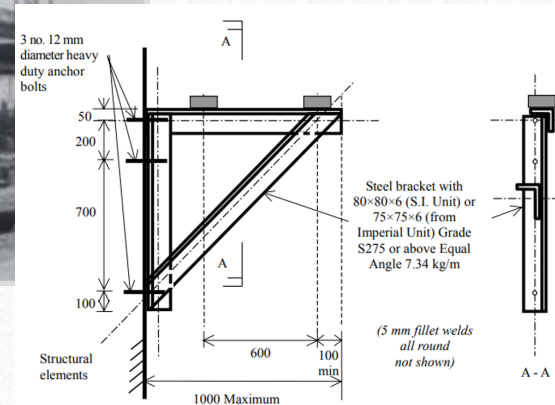
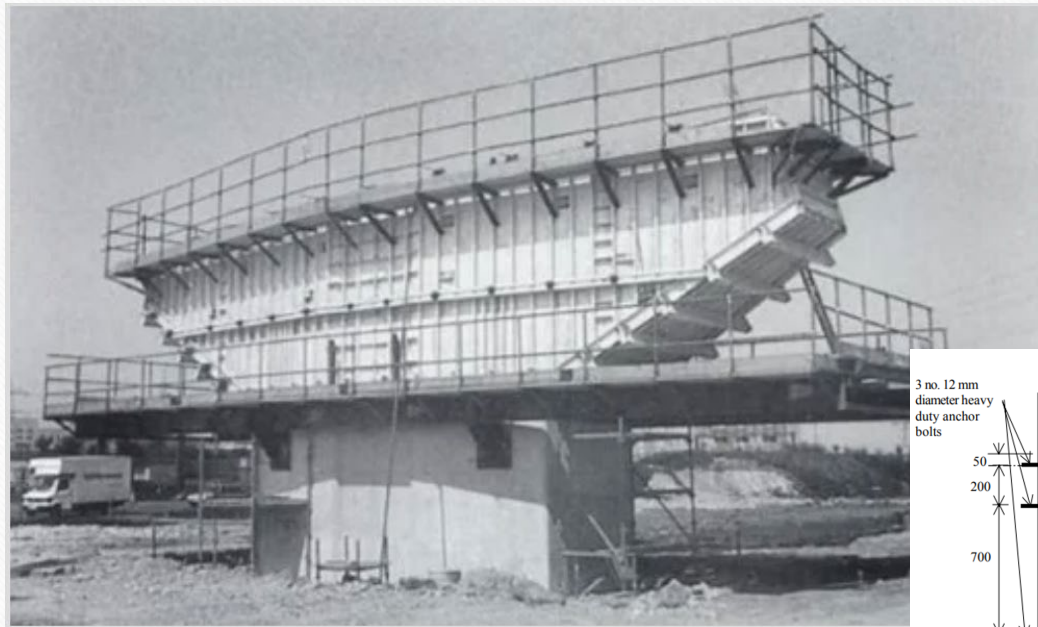


1. Tower Crane Base Design

- Recommended Tower Crane Base Design
 - Tower Crane should be installed on The Permanent RC Structure/Temporary RC Block (Stability of RC Block Should Be Further Checked)
 - Cast-In Bar/Bolt With Nut Should be Adopted
 - Double Nut Should Be Used
 - Provide The Extra Steel Plate and Nut Inside The Concrete Structure
 - Prevent to Install The Tower Crane on The Temporary Steel Section (e.g ELS) by Welding. If Needed, Bolt and Nut System Is Recommended



2. Temporary Steel Platform Design



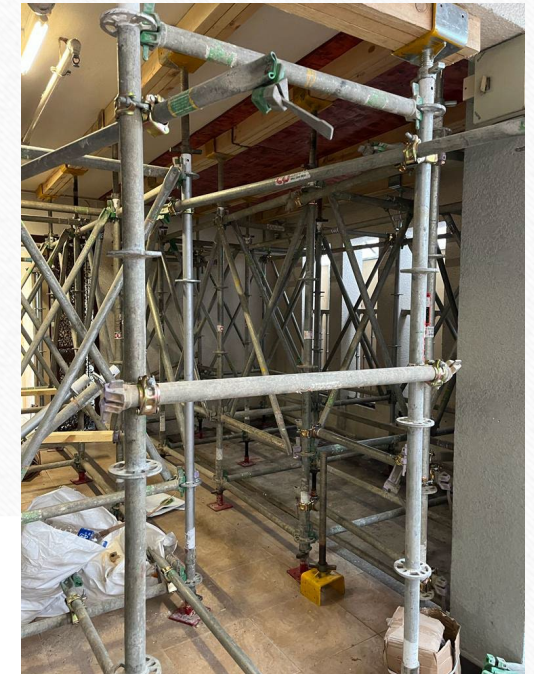
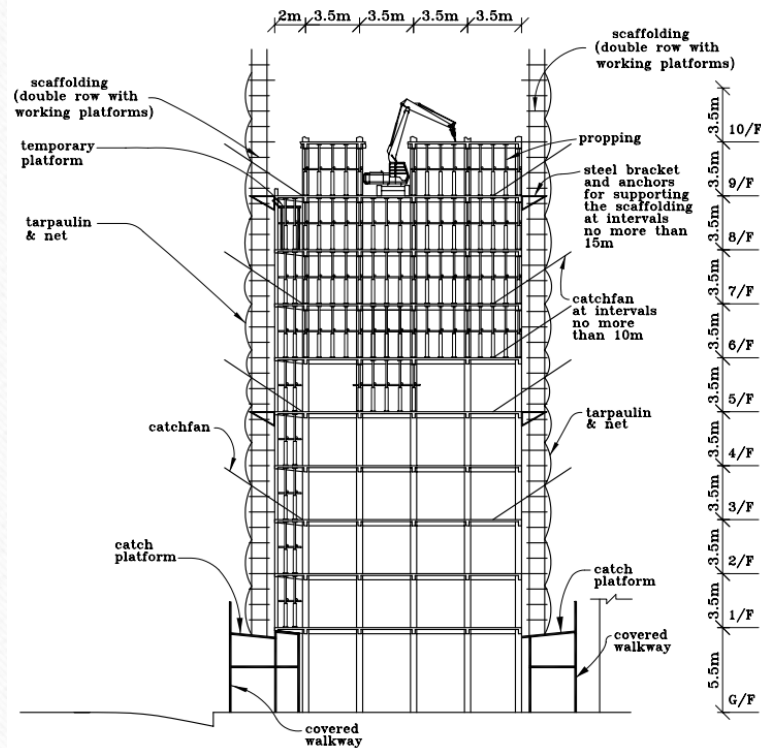
Loading Consideration:

1. Structure Self-Weight
2. Construction Live Load
3. Mechanical Plant Load
4. Temporary Wind Load

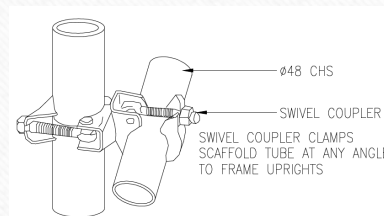
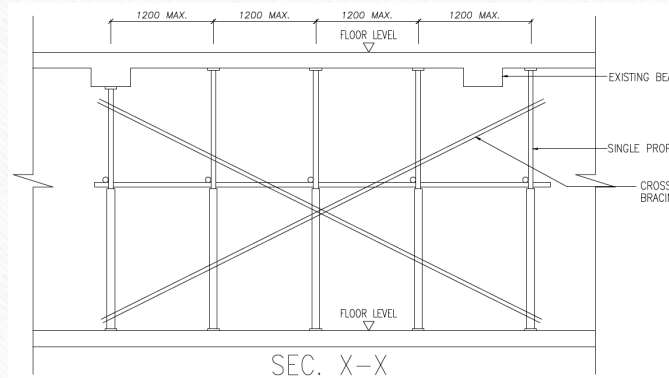
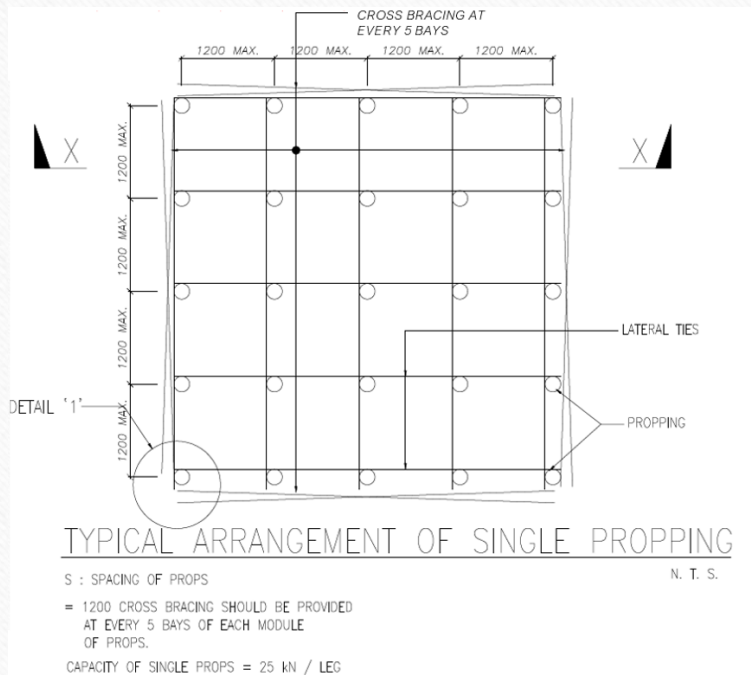
Checking:

1. Supporting Steel Member Sections
2. Steel Connections
3. Supporting Structure Capacity

3. Temporary Support for Demolition



3. Temporary Support for Demolition



Loading Consideration:

1. Structure Self-Weight
2. Debris Load
3. Construction Load
4. Mechanical Plant Load

Checking:

1. Base Plate Capacity
2. Propping Capacity
3. Cross Bracing and Horizontal Tie To Provide Sufficient Lateral Restraint

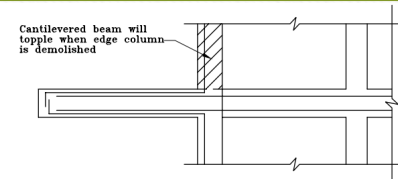
3. Common Problems Occur in Demolition



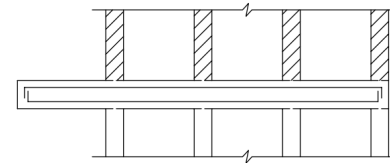
No Tie to Props



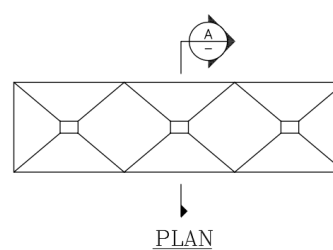
Props Do not Support The Ceiling



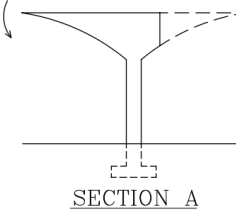
CASE 1. Main reinforcements in cantilevered beam bent up at columns. The cantilevered beam may topple when the column/walls are demolished.



CASE 2. The load on the cantilevered beam is counter-balanced by the loading above the beams, the cantilevered beam may topple when the counter balance load is removed.



This part of cantilevered beam/slab may topple when the balancing cantilevered beam/slab is removed.



CASE 3. When one side of a balanced cantilevered beam/slab is removed, the remaining cantilevered beam/slab may topple.

Loss of Counter Balance for Cantilever Structure

4. Temporary Support for Concreting for Superstructure Elements

Temporary Support System For Concreting
(Formwork + Falsework)

- Formwork(Material)
 - Timber
 - Aluminum
 - Metal
- Falsework(Material)
 - Metal



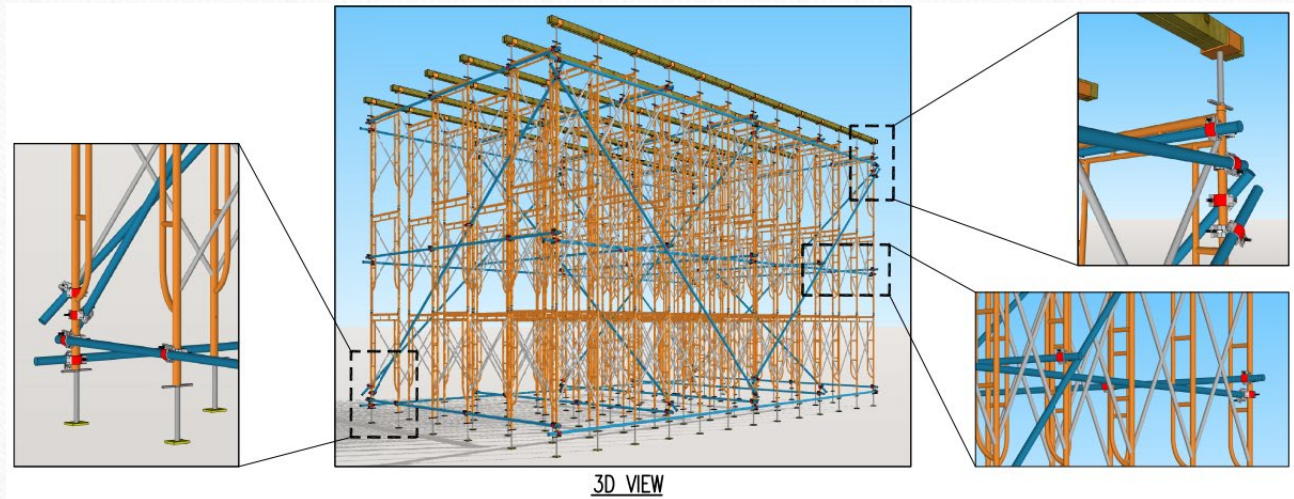
4. Temporary Support for Concreting for Superstructure Elements

- Loading Consideration:
 - Self-weight of RC Concrete (Normally 2450kg/m³)
 - Self-weight of Formwork
 - Others(e.g Workers but not Critical load case as long as construction Live Load is allowed)

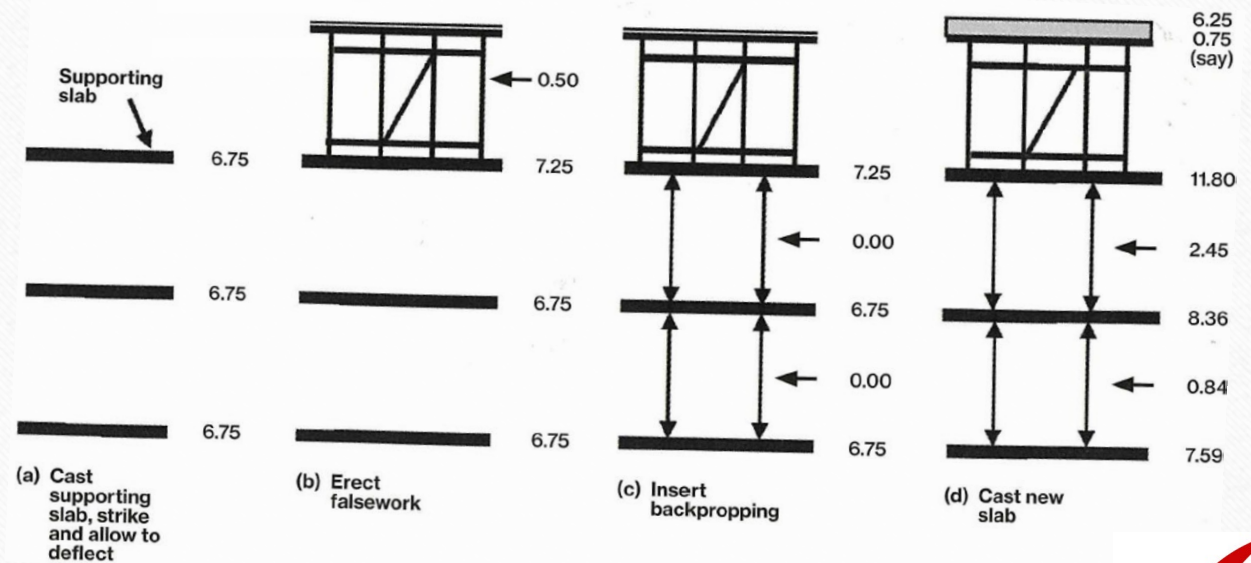
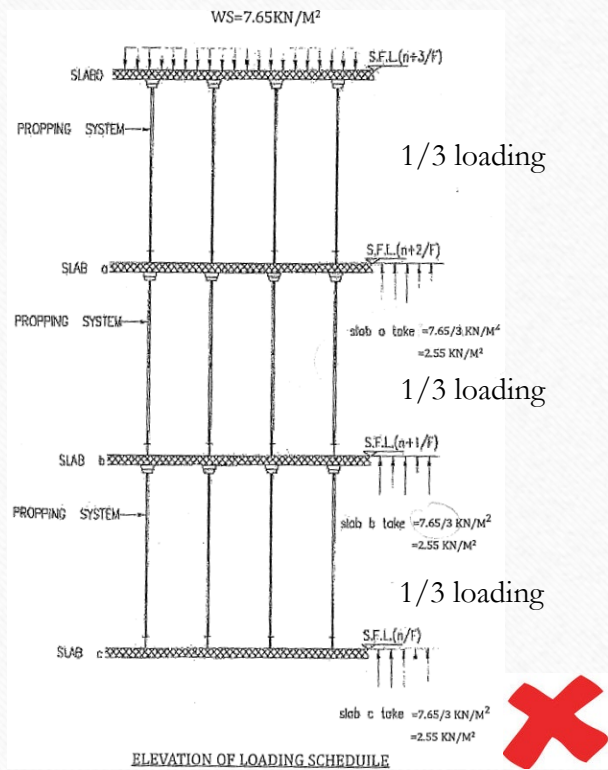


4. Temporary Support for Concreting for Superstructure Elements

- Recommended Design for Temporary Support for Concreting for Superstructure Elements:
 - Limit The Spacing for The Metal Propping
 - Provide The Horizontal Ties for The Propping
 - Provided The Bracings for Propping
 - Provide Base Steel Plate With Bolt Fixing on The RC Structure



4. Temporary Support for Concreting for Superstructure Element



4. Temporary Support for Concreting for Superstructure Element

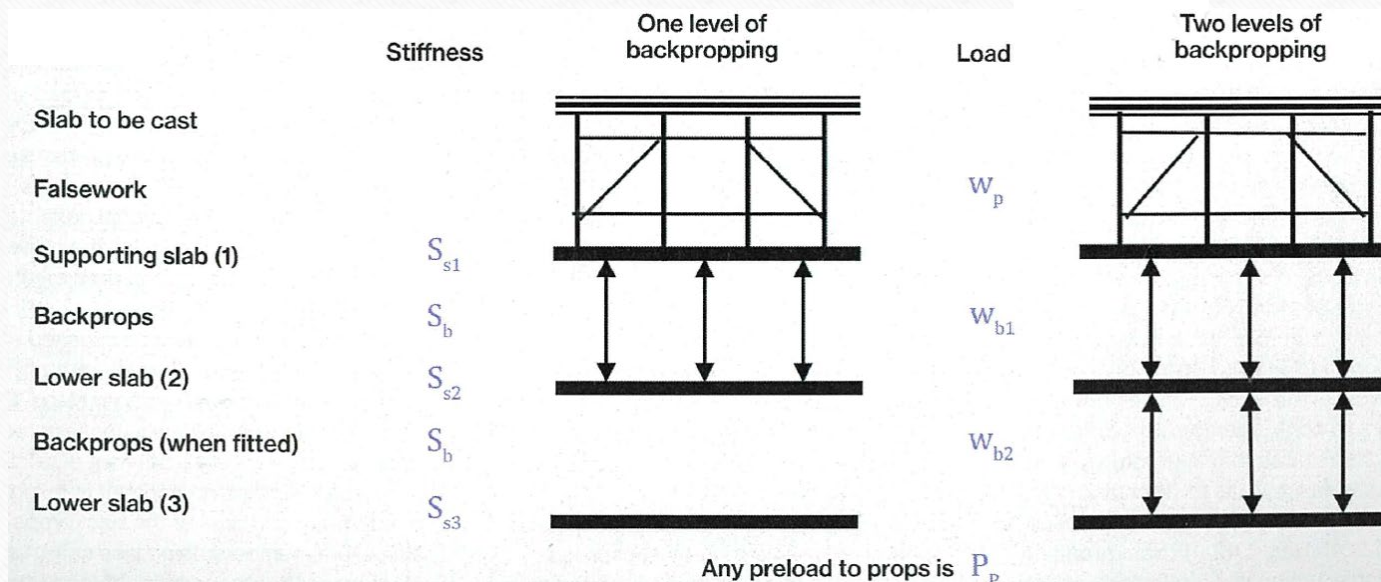


Table 1: Method 1 percentage of load transfer for flat slabs less than 350mm thick

Location	Load	No backprops fitted	One level of backprops		Two levels of backprops	
			On slab	In prop	On slab	In prop
New slab cast on falsework	W_p	100%	100%	-	100%	-
		100%	-	100%	-	100%
Supporting slab		100%	70% W_p	-	65% W_p	-
Backprops	W_{b1}	None	-	30% W_p	-	35% W_p
Lower slab (2)		-	30% W_p	-	23% W_p	-
Backprops	W_{b2}	None	-	None	-	12% W_p
Lower slab (3)		-	-	-	12% W_p	-

Conclusion



The temporary works are dangerous elements if any design mistake is made. Therefore, in the design stage we are always thinking about these two questions: ‘

- (i) Are the temporary supports enough?
- (ii) Is the temporary work safe enough?’



THANK YOU

END
