

Scaffold and Post-Tension Floor

Construction sequence is significantly important to determine whether the post-tension floor would be able to bear the load. One of the important elements in construction is scaffolding system and temporary falsework. The main function of scaffold is to bear the load of concrete floor prior to strand stressing as well as the live load that may occur while commencing the construction.



For live load that occurs during the construction, calculations can be based on ACI 347 and ASCE 37. Both standards specify the following information:

ACI 347, section 2.2.1 mentions about vertical live load that the live load is no less than 50 PSF (244 KG/M²), if a trolley or tow truck with engine is used, the live load should be at least 75 PSF (366 KG/M²). However, the live load used in design once DL+LL, the value must be at least 100 PSF (488 KG/M²) or if a trolley or tow truck with engine is used, DL+LL must be at least 125 PSF (610 KG/M²).

ASCE 37 provides a usage table of live load for design purposes as follows:

Table 2 Classes of Working Surfaces for Combined Uniformly Distributed Loads

Operational Class	Uniform Load ^a <i>psf (kN/m²)</i>	
Very light duty: sparsely populated with personnel; hand tools; <i>very small amounts of construction materials</i>	20 (0.96)	————— [98 kg/m ²]
Light duty: sparsely populated with personnel; hand operated equipment; staging of materials for <i>lightweight construction</i>	25 (1.20)	————— [122 kg/m ²]
Medium duty: concentrations of personnel; staging of materials for <i>average construction</i>	50 (2.40)	————— [244 kg/m ²]
Heavy duty: material placement by motorized buggies; staging of materials for <i>heavy construction</i>	75 (3.59)	————— [366 kg/m ²]

^a Loads do not include dead load, D; construction dead load, C_D; or fixed material loads, C_{FML}.

Once the live load calculation applied to scaffold is completed, proper material and scaffold spacing can be chosen. However, the law specifies safety ratio of metal scaffold as two and wooden scaffold as four. When scaffolding is selected to bear the construction load, all loads are transferred through the scaffold to the bottom floor. Therefore, the bottom floor must be able to take the transferred load as well.

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For example, in order to place the concrete in the fourth post-tension floor that is 0.20 m thick with construction load of, in this case, approximately 250 kg/m² and the load of scaffold is $2400 \times 0.20 + 250$ which equals 730 kg/m². When the scaffold system is selected and load handling is sufficient, check the third floor to see how much it was designed to take load and whether it can take 730 kg/m² of load about to be transferred to. If the third floor is 0.20 m thick and take SDL is 300 kg/m² and LL is 300 kg/m², it means that the third floor, when the strands are stressed at 28 days of concrete age will be able to take a total load of 600 kg/m². Since the concrete of the third floor is less than 28 days old, it may not be able to take the full load as designed. Hypothetically, it is assumed that the load capacity is only 75% (determined by the age of the concrete) of the design which is $0.75 \times 600 = 450$ kg/m², so the excess load is left around 280 kg/m².

For that reason, the excess load must be transferred down onto the second floor. See figure below. If the second floor has the same load capacity as the third floor and the concrete age is more than 28 days, then the maximum load capacity is 600 kg/m².



Special Considerations

1. In constructing the first post-tension floor that has lean concrete as shutter, it is important to beware of settlement or outflow of the ground under the lean concrete.
2. In constructing the second post-tension floor that has only one lower floor, the only lower floor must be able to take load of the second floor when the strands are not yet stressed as well as any possible live load occurred during construction.
3. In floor system with excessively long span which requires deep band beam, scaffold and lower floors must be able to sufficiently take load from the band beam. Back falsework may be done in more than one floor.

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Reference document

1. ACI 347-04; “GUIDE TO FORMWORK FOR CONCRETE”
2. ASCE 37-02; “DESIGN LOADS ON STRUCTURES DURING CONSTRUCTION”
3. อ.เสริมพันธ์ เอี่ยมจะบก; “การออกแบบนั่งร้าน”