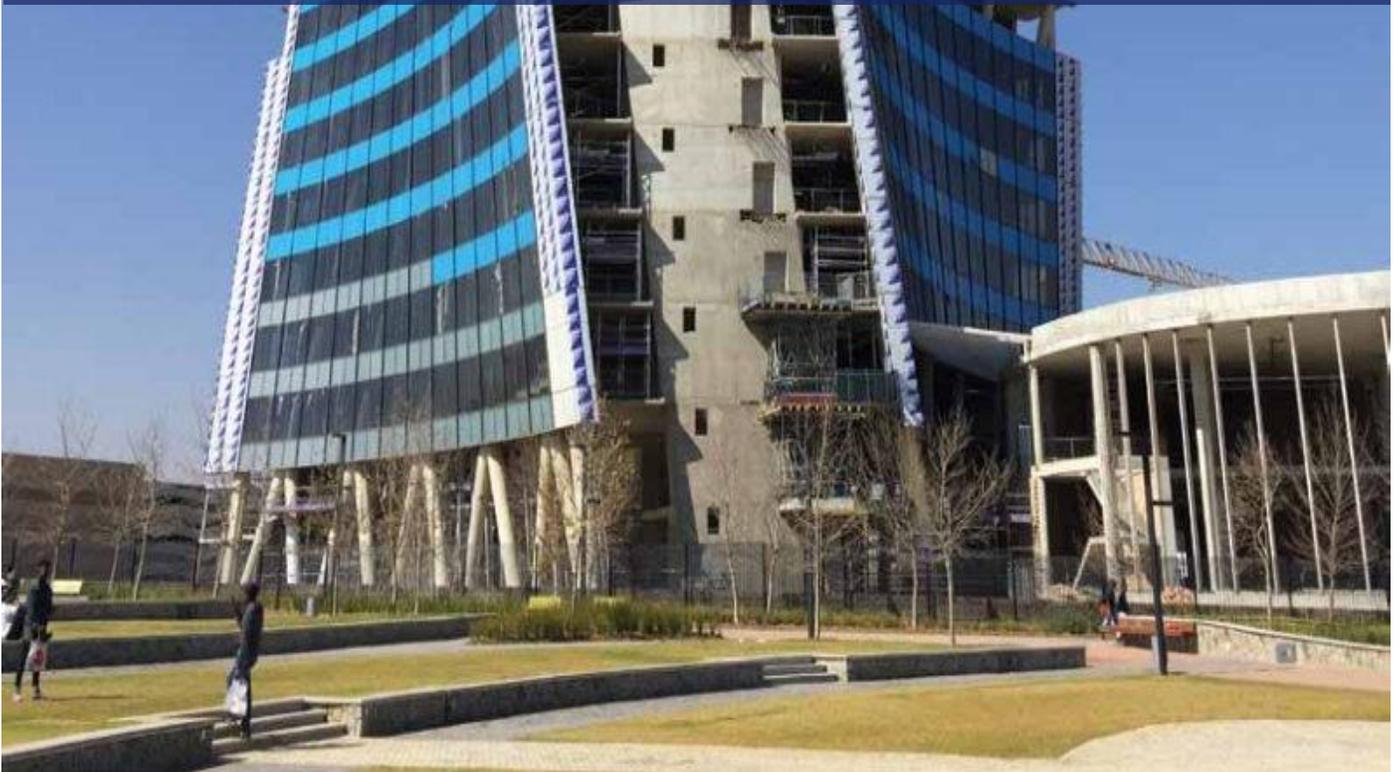


SOMERS



# POST-TENSIONED SLABS

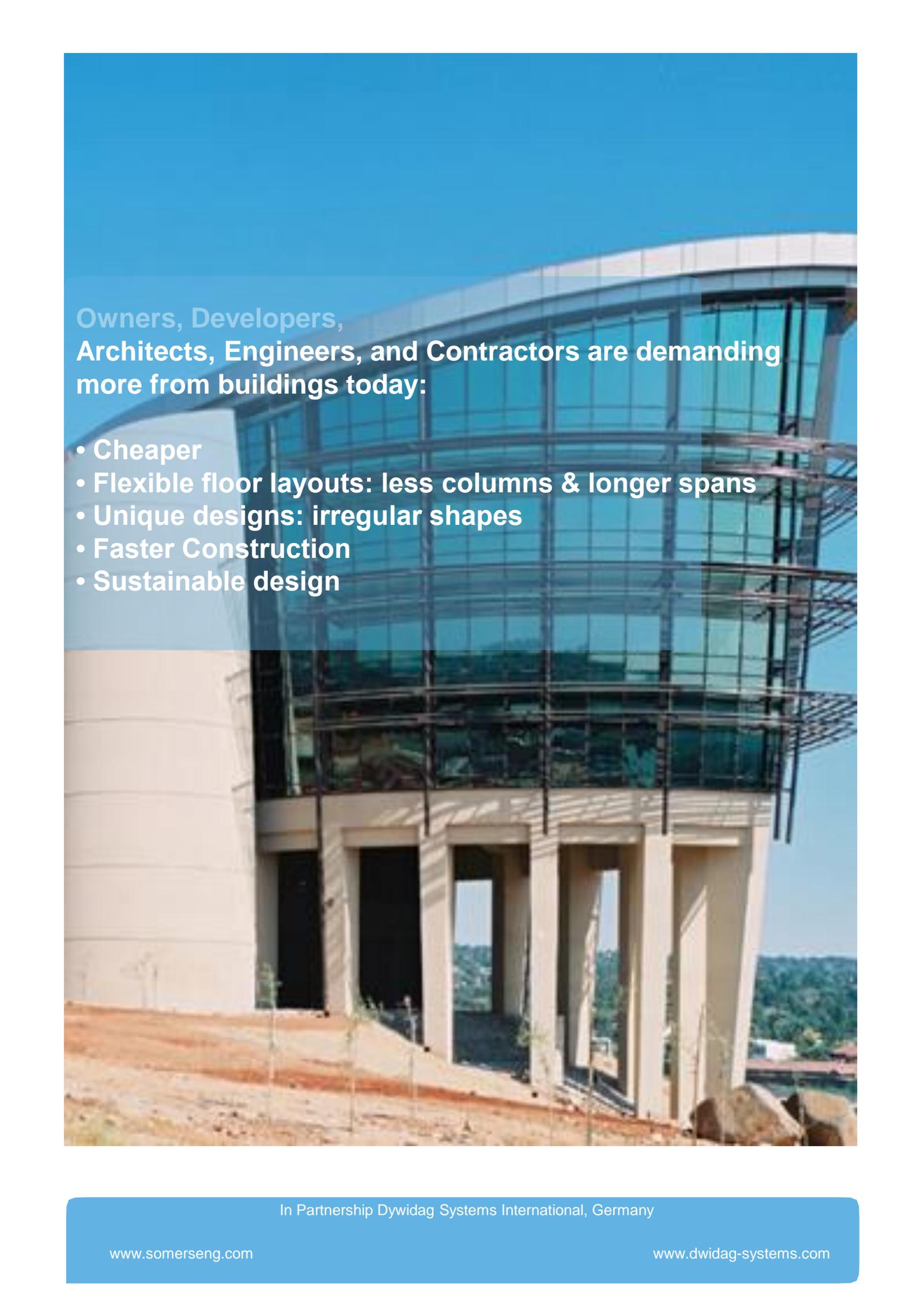
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A photograph of a modern building under construction. The building features a curved glass facade and a concrete structure. The sky is clear blue. The building is situated on a hillside with some trees and a road visible in the background.

**Owners, Developers,  
Architects, Engineers, and Contractors are demanding  
more from buildings today:**

- **Cheaper**
- **Flexible floor layouts: less columns & longer spans**
- **Unique designs: irregular shapes**
- **Faster Construction**
- **Sustainable design**

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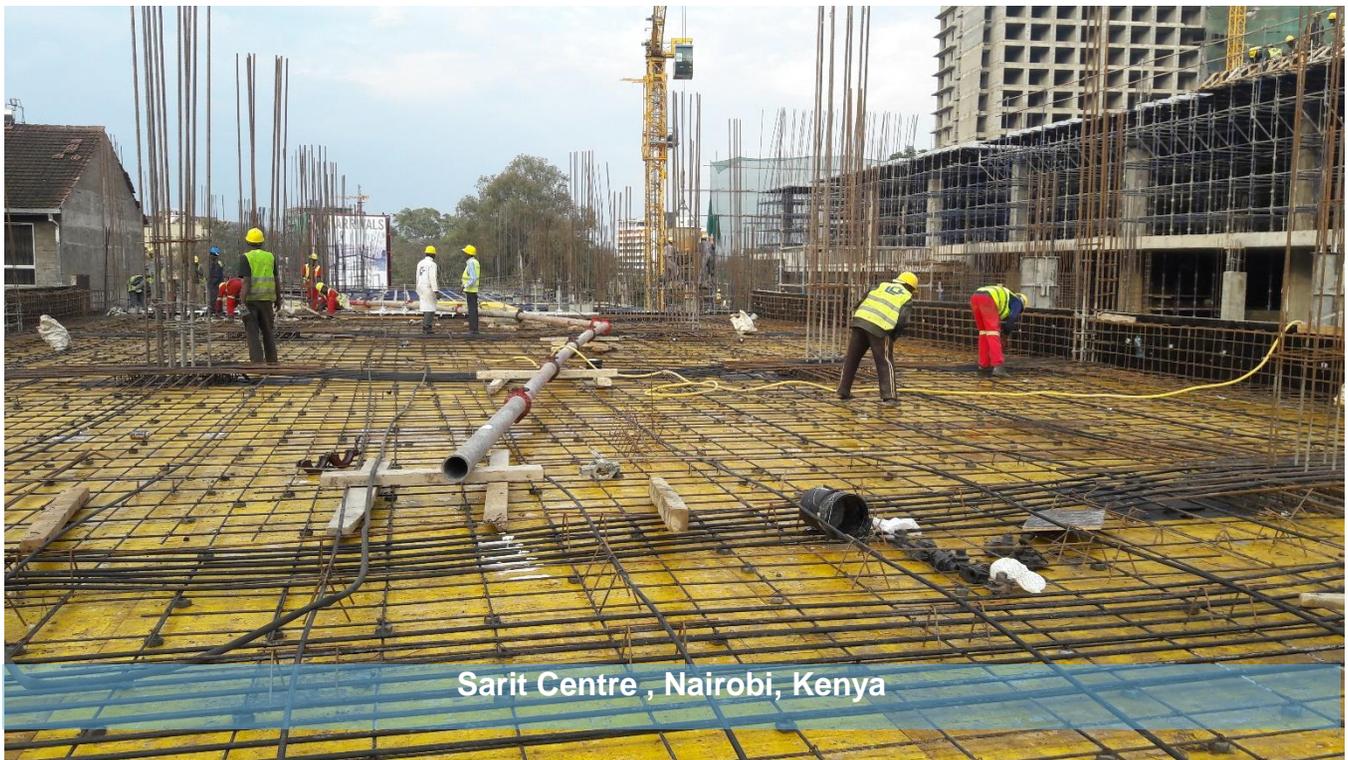
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# POST TENSIONED CONCRETE

In traditional reinforced concrete the steel reinforcement remains inactive until the formwork is removed. In post tensioned concrete high tensile steel tendons are placed and stressed making the reinforcing steel active.

The also can easily be observed when holding together several books by pressing them laterally. Under such pressure the whole row gains enough stiffness and strength to ensure its integrity.

The tendons are placed in a curved profile and in addition to the compression to the perimeters, an upward force is generated that will counteract the applied forces relieving the structure from the gravity effect and is the reason why early demolding is possible within 3 days so that the formwork can be re-used.



Sarit Centre , Nairobi, Kenya

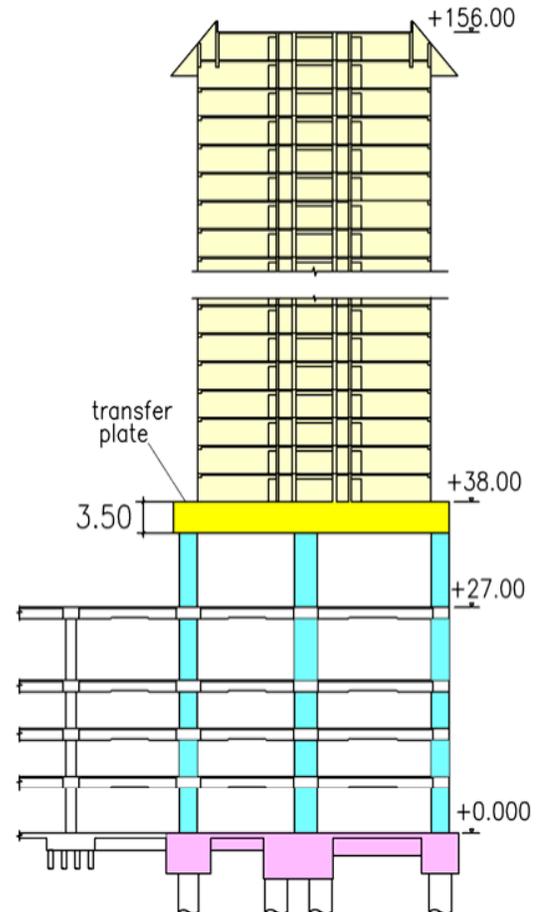
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# DESIGN FREEDOM

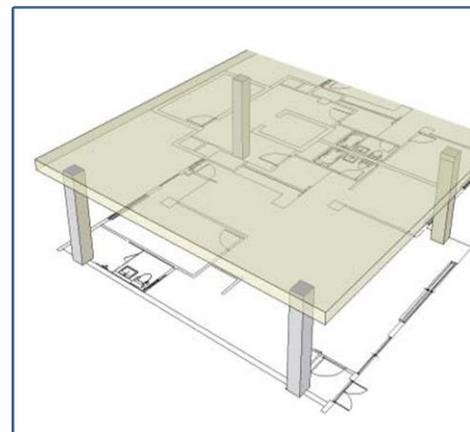
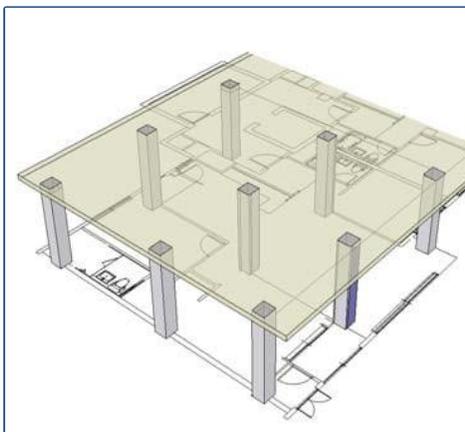
The introduction of Post Tensioned slabs by Somers Engineering into East & Central African market is changing the way Architects ,Engineers & developers can design more innovative structures and with greater flexibility.



Transfer plates, such as the above example in New York receive a multitude of loads from above and transfer them to a few supports below to create wide open spaces, or to straddle over obstruction as in this exam



Elevation of an 80+ multistory super-structure resting on a transfer plate supported on widely spaced columns

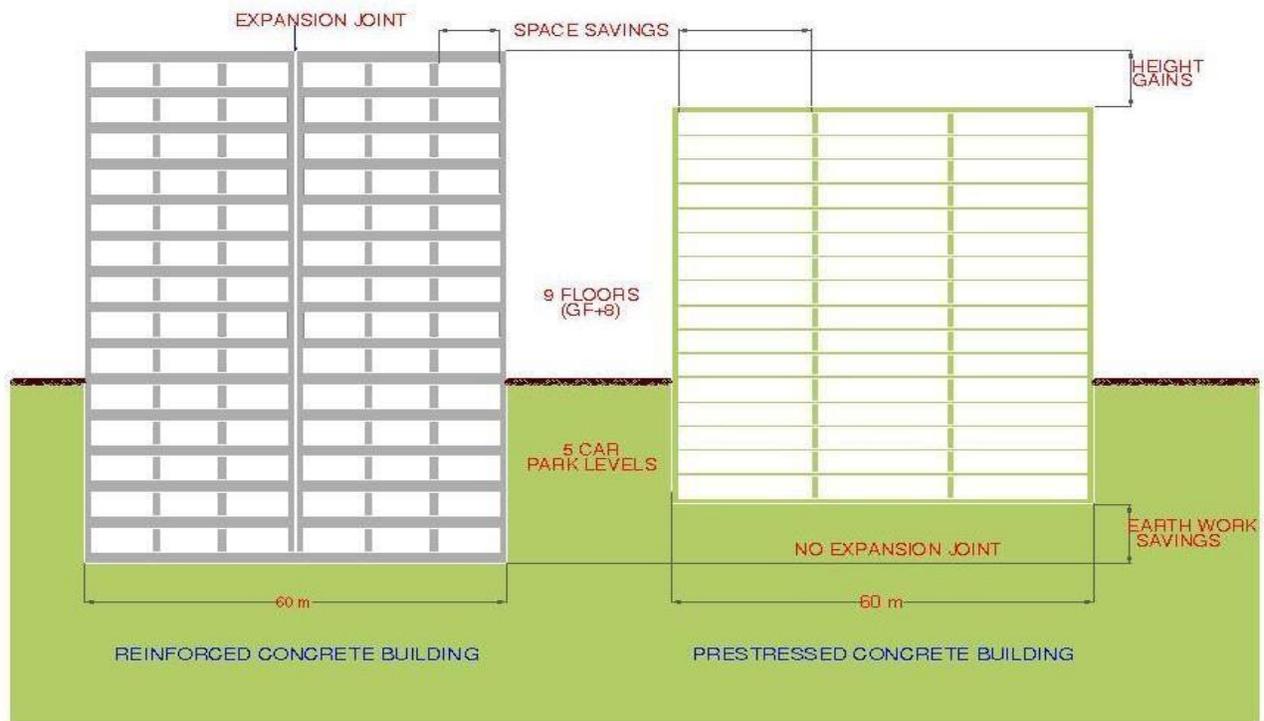


Trend from (5~6m) to (9~10m)

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# DESIGN FREEDOM

To maximize the benefits of post-tensioning at the building project level, the effects of reduced member sizing should be applied early in the design process



The RC beams were originally 1.2m deep with the conventional design. With introduction of PT, the beams depth reduced to 0.65m .  
Large spans achieved with post tensioning, for example, The PVS Temple in Nairobi with beams spanning 18m.

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# COST COMPARISON

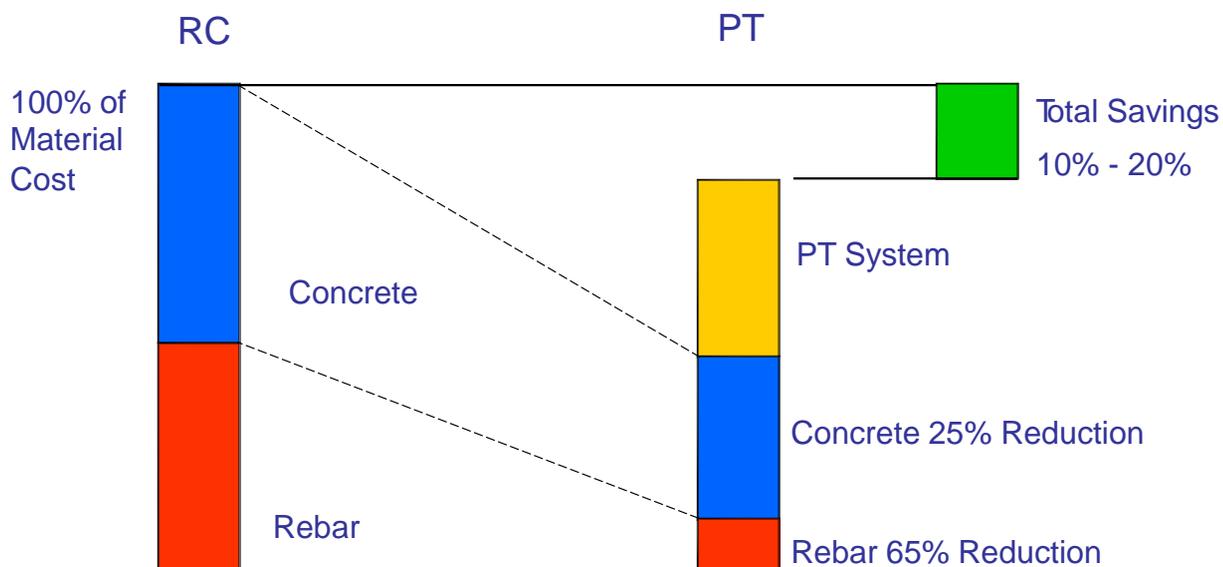
Post-tensioning offers direct cost reduction over conventionally reinforced slabs primarily by reducing concrete and rebar material quantities as well as rebar installation labor. Typically, savings between 10% - 20% in direct cost are achieved

Factors contributing to direct cost reduction:

- Thinner slab (1/3 of RC alternative) with less reinforcement
- Reduction of material quantities and cost
- Reduction of labor and material handling costs
- Reduced total building height and cladding cost
- Reduced total building height and cladding cost
- Reduction of beams and steps-Simplified and cheaper formwork
- Rapid reuse of formwork- Less formwork needed on jobsite

## Cost Structure of RC vs. PT Slabs

In a typical slab with spans over 7 meters, the net savings in material cost can range between 10% - 20% of original RC alternative. This survey did not include other benefits such as Time saving, cladding, plumbing, electrical, lift installation, painting and other finishes.



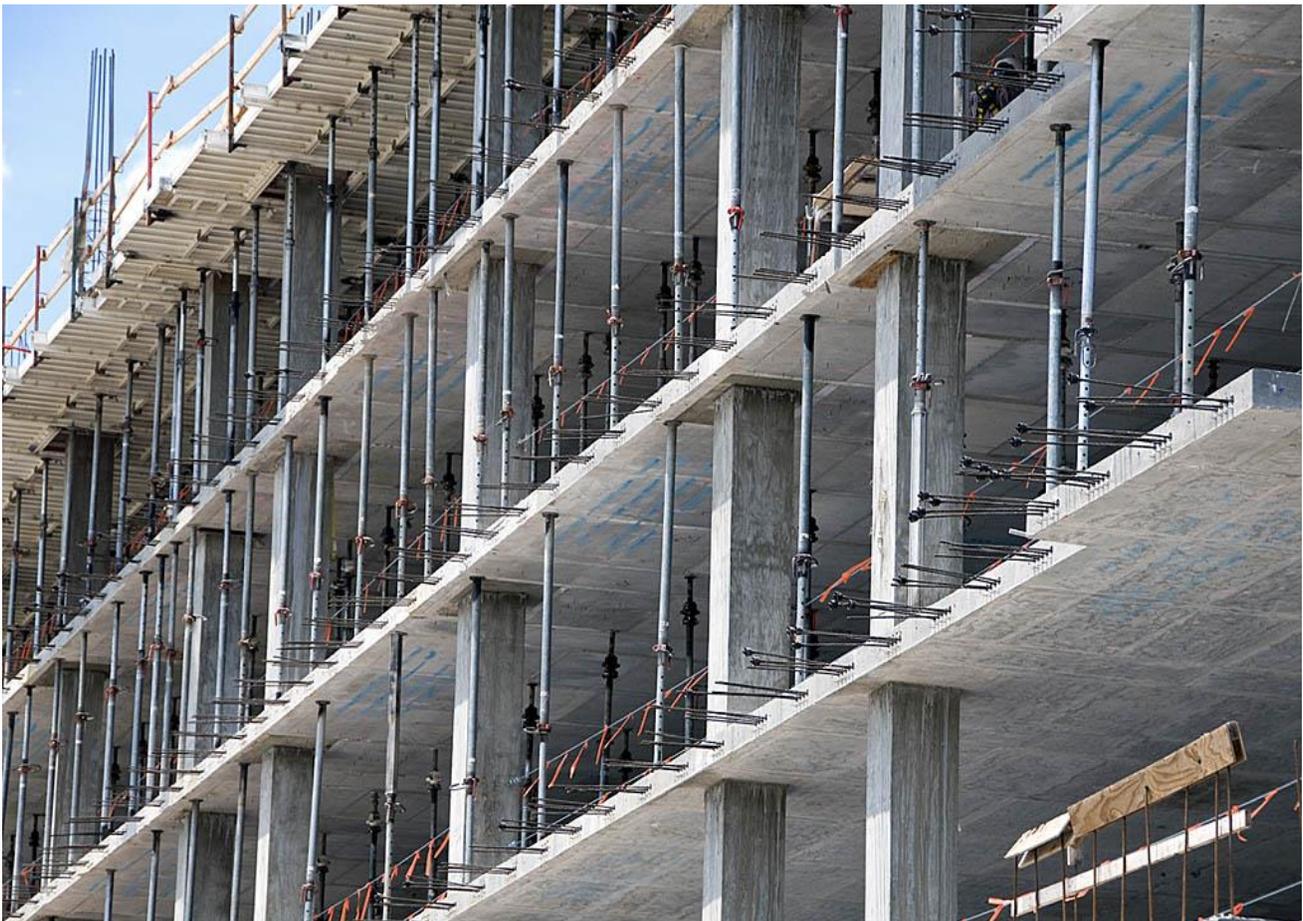
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# DESIGN SOLUTIONS

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Somers Engineering in partnership with world leading post tensioning company Dywidag Systems International, Germany provides a complete design of the Post tensioning applications. Somers uses the latest software and up to date international practice in post tensioning.

Somers specialists help Architects, Engineers, Quantity Surveyors, Project Managers and Developers with the most appropriate solution on their specific project either at early design stage or to convert traditional designs into post tensioned concrete and do the cost benefit analysis.



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# STRUCTURAL DESIGN

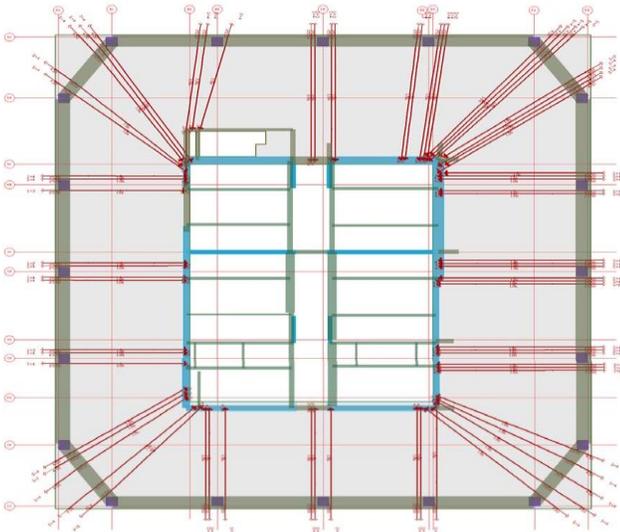
Post-tensioned slabs are designed by what is called load balancing. The tendons exert a set of forces: compression along slab perimeter, upward forces in the spans and downward forces over the supports.

Several elastic methods of analysis can be used to determine stresses in slabs under gravity loads and equivalent post-tensioning actions such as the Equivalent Frame Method (EFM) and the Finite Element Method (FEM). Stresses and deflections resulting from the elastic analysis are checked under Service Limit State (SLS) against allowable values imposed by the adopted code of practice.

Critical sections are checked under Ultimate Limit State (ULS) and, where a lack of resistance occurs, the addition of localised reinforcement is used to compensate. The punching shear is checked and if the corresponding resistance is insufficient, it is catered for by additional reinforcement or increased concrete thickness (drop caps). Alternatively punching shear reinforcement can be specified.

When an analysis is satisfactorily completed, structural detailing is carried out to show the layout and the dimensions of the slab; the distribution and profiles of the tendons; details of ordinary reinforcement; jacking forces and corresponding elongations in tendons due to stressing.

TYPICAL TENDON LAYOUT



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# MONOSTRAND UNBONDED SYSTEMS

The unbonded single-strand tendon system is quick to install; tendons can be easily deflected to avoid openings and to cope with irregular slab shapes. It requires no grouting.

The strand is manufactured by only approved suppliers and to the highest quality to BS 5896 Grade 20. The 15 mm diameter strands are commonly used and are coated with permanent corrosion-inhibiting grease and encased in high-density polyethylene (HDPE) sheathing.

Tendons are laid in the slab according to specific profiles before pouring concrete.

The strands are individually anchored at both ends to Somers unbonded monostrand anchorages that are embedded in the concrete to transfer compression to the slab after stressing.

Plastic reusable fittings facilitate the fixing of live anchorages to the side shutters. Pocket formers are used to provide access for stressing at the edge of the slab.

Stressing is performed using special hydraulic jacks.

Plastic caps filled with corrosion-inhibiting grease seal the strand end after stressing and cropping.



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# MULTISTRAND BONDED FLAT-SLAB SYSTEMS

## BONDED INSTALLATION



The multistrand flat duct system is normally adapted for bonded tendon. The strands are individually gripped in one flat anchor head unit and transmit their prestressing forces by means of flat type anchor plate casting unit. The strands are stressed individually by means of mono strand jack. There are three different methods to insert strands into ducts. The selection of the insertion method depends on the boundary conditions of the structure and the job site.

### Method 1: Pushing

To push strands into the duct on the job site is very economical and can be done either before or after casting the concrete. The pushing equipment can be installed remotely and connected flexibly to the insertion point. DSI strand pushers provide relatively high speed of up to 8 m/s and require minimal operating personnel of only two men. These advantages make this method the preferred standard for strand installation.

### Method 2: Pulling

To install strands while pulling them into the duct can be very efficient in special structures, for example where the loop anchorage is used. In normal cases, the whole bundle of strands is pulled through winching with a steel cable.

### Method 3: Pre-Assembled Tendons

The prefabrication of tendons either in the shop or in the field can also be very economical, especially with shorter tendons and short shipping distances. Special uncoilers or hydraulic winches are available to properly install the tendons in the structure.



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