

Succeed with a Strong Project Partner

Please add us to your Subcontractor List



Vertical Concrete Slipforming Services

With us as project partner you benefit in multiple ways, giving you the edge you need to succeed:

- You are working with the world leader in slipform technology.
- We offer a package of system design, equipment and onsite supervision on every project to ensure safety, quality and your success.
- Expert help is always available to you and others for the design and planning phases.
- You have a partner you can rely on. We have been in business for over 50 years with hundreds of successful projects all over the world.
- You have access to our world-wide technical know-how and network of experts who can solve any slipforming problem.

Your Project + Our Expertise

We specialize in the slipforming of vertical concrete structures with uniform and varying cross-sections such as:

- Building Cores
- LNG Tanks
- Offshore Platforms
- Bridge Pylons and Columns
- Chimneys
- Hyperbolic Cooling Towers
- Telecommunication Towers
- Air Traffic Control Towers
- Water Tanks and Towers
- Power Generation Buildings
- Silos and Storage Bins
- Wind Turbines

ADVANTAGES

- ⇒ This technology becomes very competitive starting at around 60ft of height.
- ⇒ No cold-joints - construction can be continuous, resulting in maximum durability and a long service life.
- ⇒ Speeds of between 7 ft to 30 ft per 24 hours are possible.
- ⇒ No form ties required and no form holes to fill.
- ⇒ No rebar bolsters required. Sliding guides provide accurate rebar cover.
- ⇒ Continuous process. No form stripping and setting required.
- ⇒ Superior concrete finish with no form fins to clean up.
- ⇒ Safe and protected work environment for your crew.

Want to find out more about slipforming?

www.slipform.us

For proposals and pricing for your projects, please contact:

Construction Technologies & Engineering, Inc.

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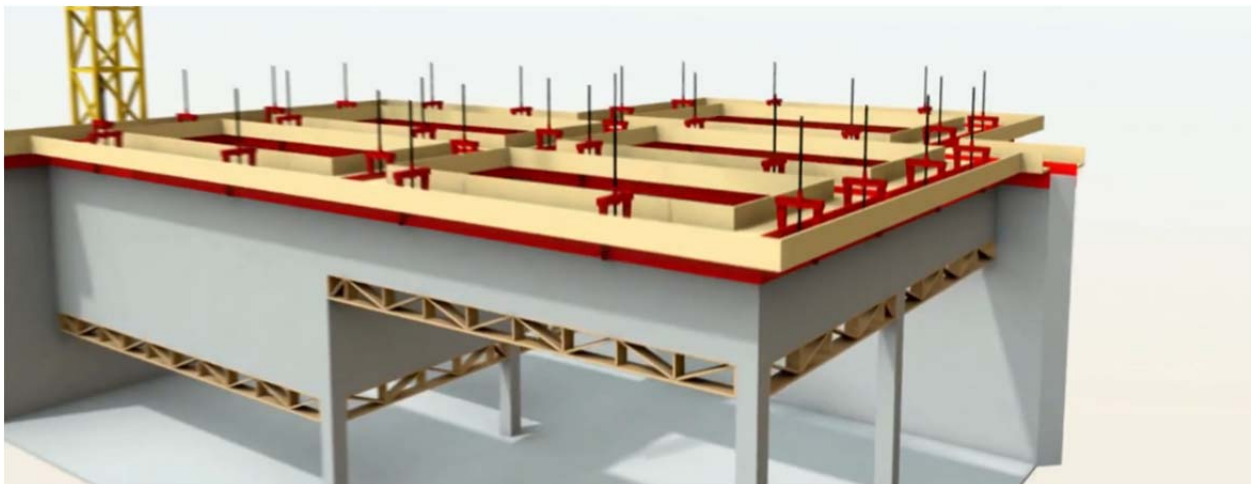
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Some Gleitbau Projects -



Buildings



Buildings



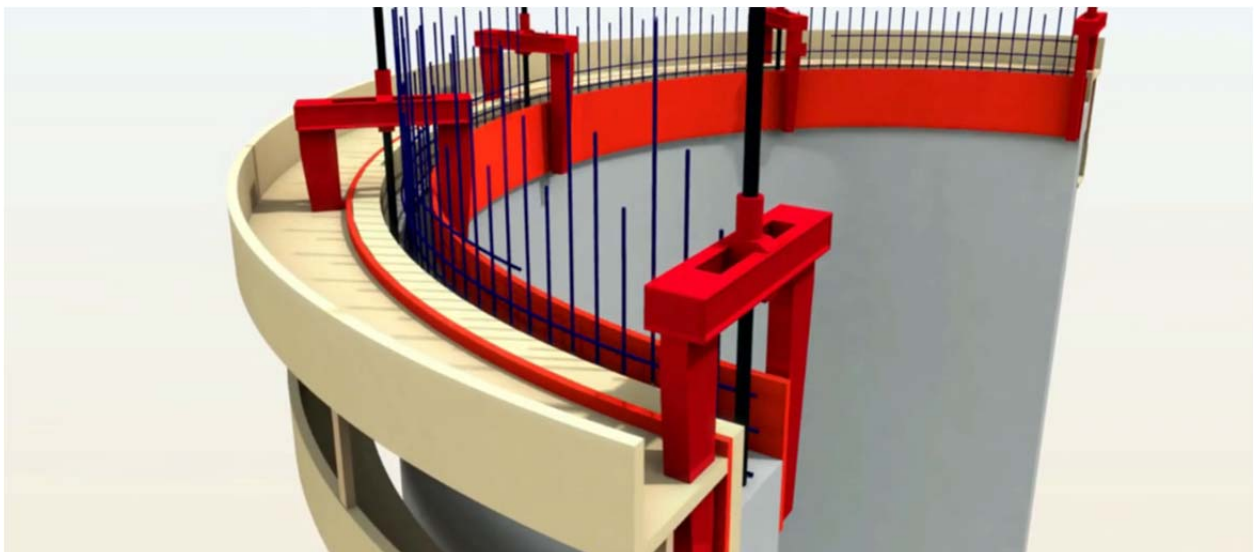
Buildings



Buildings



Buildings



Basic Technology



Bridge Pylons and Columns



Towers



LNG Tanks



LNG Tanks



Wind Turbines, Cooling Towers and Chimneys



Power Generation Buildings

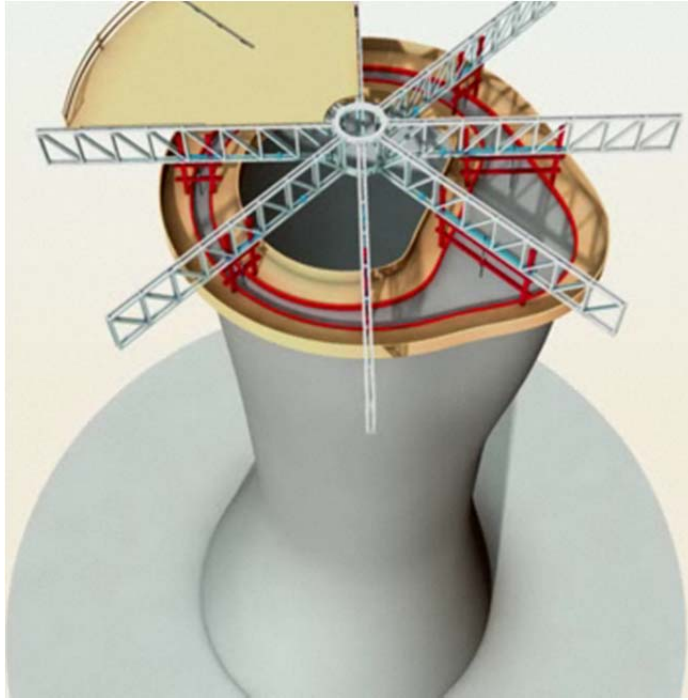


Offshore Oil Platform



Offshore Oil Platform





Extreme Geometries with Changing Cross-Sections and Tilt

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--- Technical Section Below ---

VERTICAL CONCRETE SLIPFORMING COMMON QUESTIONS

Preparation & Planning

Q(1): How much lead time is required to start a slipform project?

That depends somewhat on the complexity of the project. As a rough guide, assume 6 to 10 weeks for design and preparation of slipform equipment to be ready for shipment. Shipping to the US takes about 4 weeks to the east coast and 6 weeks to the west coast. So from the time the order is placed to the time the equipment can be picked up at a US port is anywhere from 10 to 16 weeks. The supplier normally commits to a delivery schedule in his proposal. In general, early involvement in a project is beneficial. Small changes during the design and planning phases can greatly facilitate the slipforming process.

Q(2): How is the slipform equipment shipped and delivered?

The slipform equipment is typically sent CIF to a US port and then FOB back to the supplier's workshop, in standard box containers (20ft or 40ft). Transport from port to site and back to port is normally taken care of by the general contractor. Of course, shipping terms can vary and be as agreed upon between the parties.

Q(3): Do you need a crane?

A crane is required for assembling the forms and setting them in place. Depending on the project, a crane may also be necessary during sliding to supply concrete and rebar. Dismantling of the slipform is also best done with a crane. For every project, the slipform supplier will indicate what is needed in the way of crane support.

Q(4): How long does it take to set up a slipform operation?

Depending on project size, from a few days to several weeks. The slipform supplier will manage the form setup and also commit to a time frame before the job starts.

Q(5): What are the power requirements?

Electric power or a generator will be needed for the hydraulic pump, the lighting plant, string lights and to run the small power tools used on the slipform. The slipform supplier will specify the requirements for every project.

Q(6): Do you need water at the work point?

Water is needed for cleaning the forms and for concrete finishing. Also the workers need to stay hydrated. A suitable water tank is normally placed inside a steel frame that can be picked by the crane or winch and delivered to the work platform. Refills may be necessary. A typical tank size is 300 gallons or so.

Q(7): What do you need from the general contractor?

This depends mostly on the project, it's location and also on the contract. The slipform company will supply the system and an experienced, hands-on supervisor. The general contractor may be asked to supply additional labor to help erect and dismantle the forms. Many times the GC will place the rebar and concrete during slipforming. Electric power is typically supplied by the CG. Whatever makes the most sense within the context of the project. For remote sites, the GC may provide accommodation for the slipform personnel. These items are normally agreed upon during the proposal and contracting phase.

Q(8): Do you need a special type of concrete?

The concrete mix is an important factor for achieving good quality in slipformed construction. Some parameters of the concrete mix (setting time, slump, etc.) should be reviewed, but there is no special concrete required for general slipforming. A typical 'pump mix' with 3 to 4 in. of slump is mostly adequate. For contractors new to slipforming, we can provide our input and review the intended concrete mix and give our recommendations. We can also provide an expert who will design a suitable concrete mix for specific projects.

Q(9): How is the concrete delivered?

Concrete can be delivered to the slipform level in buckets or by concrete pump. If buckets are used, they can be delivered by winch or tower crane.

Q(10): How is the concrete vibrated?

Conventional pocket vibrators are used to consolidate the concrete.

Q(11): How is rebar and post-tensioning placed?

Rebar and post-tensioning ducts are placed continuously as the slipform operation progresses. Horizontal rebar and duct must fit in the gap between top of formwork panels and the cross-arm of the yokes, so as not to interfere with the slipform motion. Vertical rebar is installed with lap splices. Longer bars equate to fewer splices and thus less rebar. The weight of the rebar pieces must be such that they can be easily installed by the workers.

Q(12): How far can the rebar stick up?

This is a function of handling, placing and stability. The slipform process does not restrict the height of the rebar. As a rule of thumb, the length of vertical rebar should not exceed 20 ft. Horizontal rebar should not be longer than 30 ft. Larger diameter bars may need to be shorter to allow handling and installation by the workers. The slipform system can be fitted with guides that will stabilize tall rebar and keep it vertical, even in high winds.

Weather

Q(13): What happens to the concrete when it rains?

Rain is not a problem for the sliding process. Excess water normally drains off. It is not actively mixed into the concrete. A wet/dry vacuum (Shop-Vac) can be kept on the work platform for extra insurance in

case of a surprise downpour. In wet climates, the work area can be covered by a lightweight roof structure supported by the slipform equipment.

Q(14): Is concrete strength affected by rain?

No, because the water either drains away or is actively removed. As it does not become part of the mix, it will not weaken the concrete. A roof added to the slipform equipment can shield the concrete from any rain.

Q(15): Can you enclose the work areas for weather protection?

Usually only the young concrete below the form is protected from the weather (wind, sun, cold temperatures). This is typically done by hanging tarpaulins from the work platforms, right next to the concrete surface. The lower work platform is also fairly easy to enclose. This will protect the workers from the elements and also provide a visual barrier. This can increase worker comfort, especially on very tall structures. For very cold conditions, the enclosed spaces can be heated. At working deck level, plywood sheeting can be erected to shelter from direct wind. A roof is usually not provided but can be added fairly easily if required.

Q(16): What happens in high winds or if a hurricane or tornado strikes?

The limiting factor may be the concrete pump or tower crane. Worker comfort and safety must also be considered and expressed as a limiting wind speed. The slipform itself has a wind capacity that depends on its configuration. As a rough guide, slipforms can operate in winds up to about 45 mph (72 km/h). If wind speeds in excess of 70 mph (112 km/h) are expected, the slipform system must be secured to the protruding rebar.

Tolerances

Q(17): How do you keep the formwork level?

The formwork is leveled by water hose or horizontal laser. On every jacking rod, there is also a level control clamp which is installed above the jack. When a jack hits this clamp, the jack will stop. This assures that no one jack can “run away” from the rest. These level control clamps are advanced in a fixed increment which is determined by the clamp itself. Hence, checks with a laser are only needed once in a while.

Q(18): How do you keep slipform construction true and vertical?

The slipform is constantly controlled by vertical lasers pointing up from fixed locations on the foundation. The supervisor steers the form system according to these laser readings.

Q(19): How do you make adjustments?

The formwork is adjusted by manipulating the jacks individually and if necessary by selectively shimming between the yokes and the forms. The yokes can also be adjusted. This should only be done by an experienced supervisor, one who is familiar with the nuances of the system from prior work. Procedures

for adjustments and control i.e. plumb, level, constant diameter, rotation, etc. are typically outlined in a method statement before the start of construction.

Q(20): How accurately can one slipform?

That depends on the project, but ± 1 in. (25mm) for every point of geometry is achievable. For tall structures, that compares very favorably with ACI 347-04 which calls for deviations not to exceed $H/600$. That is 4 in. for a 200 ft tall structure.

Q(21): What is normal slipform tolerance?

That depends on the project, but ± 1.25 in. (32mm) for every point of geometry is a routine tolerance. Please note that final tolerance is not simply a question of reading a laser. Taller structures especially are in constant motion from wind and temperature effects. The top of the structure is virtually never at its theoretical plumb position, making laser readings and form adjustments part science and part experience. For wall thickness, a tolerance of $\pm 3/8$ in. is reasonable. That is a $3/16$ " deviation for each face.

Production

Q(22): How fast can one slipform?

That again depends on the project. Typical slipform rates are 10 ft to 16 ft (3m to 5m) per 24 hours, but can be as low as 6.5 ft (2m) per 24 hours and as fast as 33 ft (10m) per 24 hrs.

Q(23): Can you interrupt a slipform operation?

Yes. On some projects, slipforming and construction in general is only allowed during the daytime. This may happen with an inner city project and is due applicable city ordinances. On other projects the slipform process has to be interrupted every weekend. Stopping a slipform operation simply leads to a regular construction joint as in conventional construction.

Q(24): Do you have to work continuously / 24 hours a day / 7 days a week?

It is not mandatory, but the goal of every slipform operation is to work 24 hours a day / 7 days a week, because that leads to the greatest possible productivity. This benefits the owner, the contractor and all those impacted by the construction activities. Not working around the clock means you are not taking full advantage of the technology.

Q(25): How are wall openings handled?

Wooden frames and blockouts are inserted into the forms as the slipform rises. With the concrete being level with the platform floor, simply place the frames onto the wet concrete and adjust the rebar accordingly. This is a standard procedure for all sizes of openings. These blockouts can be stripped later on, from the finishers' platform.

Q(26): What kind of inspection is required?

This depends largely on the owner and client. Concrete testing is best done at ground level, especially if a concrete pump is used. This minimizes disruptions to the work in the event that a concrete load is out of specification. The slipform superintendent will have a geometry control plan in force and daily reports can be submitted if so desired.

Q(27): What maintenance is required during slipforming?

Maintenance during slipforming is mainly focused on the hydraulics. Checking of hoses and fittings, making sure the gauges are working properly. This is normally done by the superintendent provided by the slipform supplier. At times, the forms may need a bit of cleaning to ensure a smooth operation. This is done by manually scraping the top of the form faces as they are being lifted.

Q(28): Are any embeds left behind in the concrete?

There are no slipform system embeds in the concrete other than the jacking bars. Those can be retrieved at the end of the slide, if so desired. If the jacking bars are removed, the holes thus left in the concrete can be grouted. Grouting is normally done by the general contractor.

Q(29): Can the concrete be finished for better appearance?

The concrete can be conveniently finished from the lower work platform. Typically a mechanized rub finish is provided, using a rotating sponge disk. Special finishes are also possible such as “eggshell smooth”, often used on flour silos.

Q(30): Are the jacking bars lost?

No, they can be retrieved at the end of the operation, provided they were kept unbonded during slipforming. This is normal practice and achieved with a tight-fitting pipe around the jacking bars. This pipe is attached to the yoke or jack and moves with the forms.

Potential Problems

Q(31): Can the formwork get stuck on the concrete?

A properly operated slipform system will not get stuck on the concrete. A novice however may certainly get into trouble. This highlights the importance of using experienced people to run a slipform operation. Hence, it is wise to contract with a company that also provides the necessary supervision together with the slipform equipment.

Q(32): What happens when a jack fails?

Hydraulic seals can start leaking or the grippes wear out. Replacing a jack is a routine operation and spare jacks are always on hand.

Q(33): What happens when a pump fails?

Normally, a spare pump will be available. In the unlikely event that the spare pump also fails, a slipform system can also be jacked up manually.

Q(34): Can the jacking bars buckle?

The bars cannot buckle inside the tight-fitting holes in the concrete. However, when the bars pass through openings and blockouts, the bars run exposed and must thus be braced at suitable intervals and as determined by analysis. This check is normally done by the slipform company.

Labor

Q(35): How many people are required to run a slipform operation?

This is very much job dependent. Each operation requires at least one expert supervisor and sufficient carpenters, ironworkers and laborers to keep up with production, i.e. the slipform speed will remain more or less constant. On a typical project, the slipform supplier will send an expert to set up and supervise the work, while the general contractor supplies the skilled trades people.

Q(36): How do you get the unions to cooperate?

Slipforming has been used on many union and non-union projects. As a safe and convenient work procedure, this technique is supported by unions. Also, the labor force is broken up into shifts which facilitates working around the clock. This also keeps the work hours reasonable for the individual workers.

Q(37): How do the workers take bathroom and meal breaks?

There are no defined breaks during a shift, but workers can take breaks individually, to eat and frequent the toilet. By having staggered, individual breaks, the slipform operation can continue without interruptions.

End of Job

Q(38): How do you retrieve the jacking bars?

The jacking bars are pulled out at the end of the sliding operation (or every 250 ft to 300 ft on higher structures) with a pulling machine supplied by the slipform company.

Q(39): Do you have to fill the jacking holes?

The jacking holes are normally grouted. This is up to the owner and has nothing to do with the slipforming operation. Grouting preempts any water from collecting in the holes.

Q(40): How is the formwork dismantled and removed?

Depending on the project, either by tower crane or by winch. The slipform supplier will give guidance in this regard at bid time and provide a method statement as part of his project submittals.

Q(41): How long does it take to dismantle a slipform operation?

Depending on the project, from a few days to a few weeks. Generally speaking dismantling takes about half as long as the initial assembly. The slipform supplier will give guidance in this regard.

Q(42): Who cleans the forms and ships them back?

Basic cleaning of forms is done on site and the general contractor normally ships the forms back to an agreed upon US harbor.

Q(43): Can you add floors, roofs and diaphragms after slipforming a structure?

Yes. For example on a slipformed stair case structure for a high-rise building, steel or concrete floors are added after slipforming has taken place. Roof structures can be lifted with the slipform equipment itself e.g. roof of a silo or chimney elements. This is mostly a matter of structural detailing. Installation by strand jack lifting can also be done, especially for heavier elements. These are routine operations associated with slipforming and the supply company offers a wealth of know-how and equipment in this regard.

Q(44): Do you sell the equipment and forms?

No. As proper supervision is an integral part of achieving good quality and geometry, the supplier will only rent out the form system with supervision included. This protects the contractor, the equipment supplier and the reputation of slipforming in general. Also, the slipform company supplies secondary services on every project such as help with form design, concrete mix design, site logistics, etc. which materially contribute to the success of the project.

For additional questions, please do not hesitate to contact us.



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