Setting the standard

Slipforming services to meet construction challenges

A P.C. Harrington company
Speeding healthcare

Three main service cores – one at 58m and two at 84m high – were slipformed to speed the construction of the new Royal London Hospital designed to meet the requirements of the 21st century. The building also supports a helipad for the London Air Ambulance service.
Welcome to our world!

Slipform International has over 40 years’ experience of providing slipforming solutions and services to the construction industry. In that time, we have constructed well over 1500 structures using our in-house designed jacks and slipform equipment.

We began using the slipform method of construction in the early 1960s and today Slipform International is the leading contractor in this specialised sector. Since those early days, we have continuously developed our system and have accumulated a huge amount of experience on a wide variety of construction schemes.

Our portfolio contains projects ranging from 200m high bridge piers in Hong Kong and 15m high cores in London – to cement silos in the intense heat of the desert and chimneys for Scottish oil refineries at temperatures of -15°C.

Slipforming techniques can bring time and cost savings, while retaining the high quality standards required in today’s market place, to projects such as service cores, towers, silos for cement, foodstuffs, sewage and liquified natural gas, bridge piers – and even escape shafts for underground infrastructure systems.
What is slipforming?

Slipforming is an economical, rapid and accurate method of constructing reinforced concrete, or post-tensioned concrete structures. At its most basic level, slipforming is a type of movable formwork which is slowly raised, allowing the continuous extrusion of concrete.

The structures that our slipforming system has helped to build have ranged in height from eight metres to more than 200 metres – and from a simple plan shape to the most complex. Tapering structures such as chimneys, bridge piers and telecommunication towers are now common applications.

Flexible application
Our system is modular, allowing great flexibility in its application. The system can be used for the formation of straight walls and walls with curves and tight radii – and can accommodate tapering structures and varying thicknesses of wall.

Safety & stability
The slipform system is a very safe way of constructing a tall structure. The ‘rig’ uses scaffold tube handrails with cladding or sheeting which provides an enclosed environment in which to work.

Our advanced system utilises a jack climbing on a 48mm diameter steel tube which has considerably greater stability than a smaller diameter solid rod. This enables jacks of higher capacity to be employed, with the consequent increase in yoke centres and platform area.

Protection & rigidity
Three levels of platforms are commonly used with this system.

The upper platform – or top deck – acts as a storage and distribution area and can incorporate guide templates for the vertical reinforcement bars. It provides weather protection and adds rigidity to the overall assembly which significantly influences the accuracy which can be achieved. Typically, items such as reinforcement, door frames and mechanical equipment to be cast in to the wall are stored on this deck. This reduces congestion on the middle platform, level with the top of the shutter, where operations are carried out in safe and sheltered conditions.

From the working deck – the middle platform – concrete is poured and reinforcement is fixed.

The lower platform, supported on rigid suspended scaffold frames, provides access for the finishing trades to the newly formed concrete as it emerges from the shutter. Boxouts and other embedments are also exposed from the hanging scaffolding.

Climbing capacity
Our system climbs on a six tonne rated jack which, for larger cores, gives us the capacity to support a placing boom. This reduces the crane utilisation and increases the concrete pour rate over the traditional crane-and-skip method.

We use robust hydraulic jacks, controlled from a central power unit, and fitted to substantial steel yokes. The yokes form part of a rigid assembly which incorporates steel formwork and steel walings.

Reducing programme time
The use of the slipform system is extremely varied. Clients in city centres often slipform for only eight hours a day, whereas contractors in industrial areas look for the advantages of slipforming on a 24-hour basis – either way, using slipform will reduce programme time on site.

This section shows a typical slipform rig in position during a pour with the upper, middle and lower working levels clearly visible.
Additional space frame used to carry and spread the load of a concrete placing boom and other large imposed loads on the top deck.

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>Fastest method of constructing vertical structures</td>
<td>Rate of rise can be 7-8m per day (24-hour slide) or, 2.5-3m per day (day shift only) resulting in reduced construction periods and consequent cost savings.</td>
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<tr>
<td>No construction joints are necessary and through ties are not used</td>
<td>Water retaining structures and nuclear structures benefit from these features of slipform construction.</td>
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<tr>
<td>Accommodates requirements of even the most complicated structures</td>
<td>Openings, tapering profiles, reductions in wall thickness and large embedments can be accommodated.</td>
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<td>Tall or repetitive applications</td>
<td>The use of slipform results in significant cost benefits when compared with traditional formwork and / or jumpform systems.</td>
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<tr>
<td>Inherent efficiency</td>
<td>These are derived from concentrating plant, material resources and labour for a relatively short period – resulting in cost and time benefits for applications in both urban and remote areas.</td>
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<tr>
<td>Adverse weather disruption unusual</td>
<td>Given adequate plant, programme requirements can be met in all but the most severe of weather conditions.</td>
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Our portfolio

Many of our slipforming projects are carried out for main contractors appointed by developers of structures which are designed for people – places where the general public work, live or visit. By adopting slipforming techniques, construction time can be saved and a great finish achieved.

Landmark structures

Featuring the largest slipform operation of its type ever undertaken in the UK, our team met the client’s requirement for the construction of three concrete cores within a 26 week period. Our work for the BP1 project at Canary Wharf, London, included the production of 405 linear metres of external and internal walls, placing of 20,000m³ of concrete, 3,530t of reinforcement, 16.3km of pull out bar, plus 1695 embedment plates and 4402 box outs. Had a slipformed solution not been adopted, some 152,000m² of formwork would have been necessary to complete the job!
Retail therapy

This major shopping mall development – Westfield London – in conjunction with London Transport, involved the construction of 23 cores – varying in height from a modest 13m to an impressive 30m. Slipform International was engaged as a subcontractor to the concrete frame contractor, P.C. Harrington. Slipforming proved beneficial in providing quick vertical concrete construction, allowing the frame to be built to a faster programme.

Regeneration solution

At the MediaCityUK development, adjacent to Salford’s famous Lowry Centre, Slipform International was the first to commence work on the superstructure. As slipform subcontractors, our team completed six towers up to 43m high for Buildings A & B. Slipform methodology was chosen to speed up construction to meet a project completion date of 2010. The BBC will be the main occupants of this scheme which is part of a wider regeneration programme for Salford Central Urban Area.
Our portfolio – industrial solutions

Slipforming techniques provide clients in the industrial sector with fast and often innovative solutions to their construction needs. By discussing schemes with our clients at an early stage, our entire team – designers, engineers and managers – is able to contribute to achieving overall project objectives.

Back on track

Our work on the new coke silo at the Sohar aluminium smelter in Oman provided a much needed and timely solution for the client. With a late design change and the raw materials to be stored in the silo already on order, it was imperative that we made up for lost time. As well as slipforming the external walls of the silo, we also slipformed the 10m high internal walls which saved weeks and brought the project back on track.
Simultaneous and speedy

A total of seven silos were slipformed for the new Gulf Cement plant in Fujairah. The largest silo, for clinker, was 40m in diameter. The four cement silos were 20m in diameter and we slipformed two silos at the same time to make the most efficient use of machinery and materials. We saved weeks for the contractor by slipforming the six 26m high internal columns in the raw meal silo simultaneously with the outer wall.

Slipforming with post-tensioning

Our project at Buxton Cement Works in Derbyshire, UK involved the slipforming of seven circular silos, ranging in diameter from 12 to 25m, with heights from 40 – 60m. The three cement silos, two clinker silos and the CF silo all feature post-tensioning, the ducting and anchors for which were installed from the slipform. The CF silo also involved six separate triangular columns within the silo, for the first 20m of height which were slipformed with the walls. The silos were cast in just a few weeks, rather than the months that it would take if conventional shuttering systems had been used.
Our portfolio – supporting infrastructure

The economies to be achieved by choosing a slipformed approach to construction can equally be applied to the infrastructure which supports our community. The strength and finish of the structures, combined with the speed of construction, make slipforming an obvious choice.

Fine finish

Where architectural or other considerations dictate, the finish achieved from the slipforming operation can include surface features on those structures or elements of buildings that will remain exposed. For example, the architectural finish achieved on the control tower at the UK’s Gatwick Airport was produced directly from the sliding form with a minimum of hand finishing. The proportions and geometry of such features require careful consideration and Slipform International can provide guidance if consulted before dimensions are finalised.

Photograph © BAA Limited see www.baa.com/photolibrary
Bridging the gap

Spanning the 900m Rambler Channel and ranking amongst the world's longest cable stayed bridges, the three main pylons of the spectacular Ting Kau Bridge in Hong Kong were constructed using slipform.

The robust nature of the slipform equipment enabled it to cope with the difficult changes in plan shape of each tower and to carry the soffit support for the transition slabs. Designed to withstand typhoon conditions, the slipform assembly used standard equipment in the construction of these towers which ranged in height from 162m to 194m. At times progress exceeded 4m per day with an excellent finish and within very small tolerances. Following our success with the main piers, the contractor also decided to use the slipform system for a number of the approach span piers.

Cleaner energy

As part of a flue gas desulphurisation scheme at EDF’s Cottam Power Station in Nottinghamshire, we were commissioned to slipform three 35m high silos – two 16m diameter limestone silos and a 28m diameter gypsum silo. Running a 24-hour slipforming operation, our team completed the work in just three months.
Our Service

We aim to be involved in a project at the earliest opportunity, so that we can advise the client’s project team on all aspects of the slipforming process and thereby contribute to the overall success of the scheme.

Our service covers consultancy at the start of a project, design of the system to suit the application and, ultimately, managing the operation of the slipform rig on site.

Consultancy
When the decision to use slipform has been taken, our technical staff will advise and help you choose the most practical and economical application for your project.

With our experience, we are able to quickly assess the most efficient use of the slipform shutter and the associated plant such as tower cranes, concrete pumps and hoists.

We can also provide guidance on the main contractor’s manning levels for the project and advise on the use of the slipform shutter to maximise programme savings.

Design considerations
Our team will always advise on all aspects of slipforming. Where required, this can include design liaison, detailing and location of reinforcement, formation of openings and the installation of embedments, such as connection plates for structural steelwork.

Operational matters
Slipform systems are offered on a subcontract basis and can cover the design, supply and control of the operation.

Standard modular equipment is utilised, wherever possible, to simplify the build process. This modular approach also permits the incorporation of non-standard components for the formation of unusual and complex shapes.

For service cores and some other applications, it is normal to operate on a dayshift only basis achieving up to 3.5m in height per day. This is particularly useful where local environmental constraints – such as noise restrictions in a residential area – prohibit work on site outside of the normal working day.

In the Gulf regions, it is usual for the shutter to be used to slipform between floor levels in one continuous operation. The shutter is then ‘parked’ whilst the main contractor fixes the dense reinforcement at floor levels.

Our slipform operators are on site throughout the period of the shutter assembly, sliding and dismantling. Many of our operators have been slipforming for over 30 years and can provide timely and practical advice to main contractors as the project progresses, keeping it on or ahead of programme.

During the slipform process, we employ rigorous control procedures which ensure construction to very close tolerances both in plan shape and vertically. We survey the shutter every 330mm of lift. Corrections are made, based on experience, to rectify any deviations during the previous lift.

Slipform – safety aspects

- All assembly work is completed from a safe starting position.
- Once assembled, our slipform rig remains intact until the structure is completed.
- Our slipform rig is a heavy duty, three deck system, with a fail-safe climbing operation.
- The system is treated as a scaffold platform – complete with regulation hand-railing and boarding.
- The main workforce is positioned on the middle deck – protected from the weather and craned skips, etc.
- Our slipform rig remains a safe working platform throughout.
- The ‘shrouding’ of our slipform rig prevents extraneous material falling from the platforms.
- Our system considerably reduces the time span for the work at heights.
- Our system provides a permanent safe platform for steel fixing.
- No requirement for hazardous materials other than concrete.
Design case study:
Innovative design saves time

The main hotel side of the building at the Snowhill Phase 3 project in Birmingham consisted of two separate cores – the main hotel core and, off at an angle some 12m away, a much smaller stair shaft. To slipform the cores simultaneously, it was necessary to link them together with an access walkway bridge.

Our design team came up with a solution which used existing slotted channel walings from the slipform system in a new application. These were used, together with some custom designed and fabricated struts, to form the basis of the truss structure. The rest of the structure was made from standard scaffold tube and fittings, which formed the diagonal bracing of the truss and hand railing for the deck level.
Our Culture

Our whole team is focused on customer service and the development of professional management systems has been at the heart of this commitment. The continuous improvement of health, safety, quality and the environment is a fundamental part of the service we deliver to our clients and reflects the care for the communities within which we work.

Our approach to Quality Assurance is underpinned by ISO 9001:2000 registered systems which are an integral part of our operation. Our achievement in the field of health and safety is recognised by the British Safety Council Five Star annual audit.

Taking the lead from our parent company, we are currently working towards the ISO 14001 environmental standard and implementing on site initiatives. In addition, we support and respect the environmental programmes of our customers, working with them to achieve their own targets.
“Our whole team is focused on customer service and the development of professional management systems has been at the heart of this commitment.”

Regeneration in London Docklands

On the site of the old London Arena at Crossharbour, a development of over 1000 apartments, 27,000m² of office space, a four star hotel and a car park for developers Ballymore involved Slipform International in the construction of ten cores varying in plan shape and height from 30m to 60m.