

Case study

Basement construction on a small urban site

Small, urban sites present considerable design and logistical problems for basements especially when watertightness is added to the equation. Chris Robinson of Corus explains how the construction team for a London redevelopment used Hydrobarrier's sheet piling solution.

Hydrobarrier was used on a cramped site that required a habitable basement for a luxury redevelopment by installing sealed sheet piling using silent piling techniques, saving time and valuable land area.

The site was underlain by up to 1.5m of made ground overlying up to 2m of terrace gravel, in turn overlying stiff London Clay. The groundwater table at the site was recorded at 2.5m below ground level within the terrace gravels, which meant that the basement had to be watertight.

A guest pavilion and a garage were to be constructed over part of the basement and the garden reinstated over the completed basement. Structural engineer for the project, Gathard Brooke & Partners, determined that the most economic method of construction would be for the basement retaining structure to carry a significant proportion of the superstructure loading.

The solution offered by Corus Hydrobarrier was for a permanent steel sheet pile structure. The sheet pile walls were designed to act as both a retaining structure and to carrying axial loads from the superstructure.

By using piling as a permanent retaining structure the basement area was maximised within the confines of the site. Axial loads of up to 250kN/m run were to be carried by the sheet pile walls.

Designing the sheet piles to carry axial loads mitigated the need for additional load bearing elements and minimised extensive temporary works.

Nearby properties meant that noise and vibrations had to be kept to an absolute minimum. Hydrobarrier's suggestion for a silent piling technique was accepted. It involved jacking the piles into the ground rather than impact or vibration driving, generating virtually no vibrations and very little noise.

The cramped site necessitated careful sequencing of the various construction processes to minimise congestion on the site. There was minimal space to store materials on site so careful planning of the works and 'just in time' deliveries of the sheet piles to site were achieved.

Corus Hydrobarrier provided a turnkey solution and a single point of responsibility for the construction of the watertight sheet pile walls and base slab connections, as well as a warranty to guarantee watertightness. The firm's first project, using permanent steel sheet piles for a watertight underground structure in Exeter was completed in 2000 and since then the business has been involved in an increasing number of similar contracts.

The firm combines the optimum solution of pile design with the selection of the most appropriate sealant system and installation method. In the case of the central London basement, LX20 and LX25 piles were used according to the height of soil being retained and the design durability. Prior to delivery to site the piles had a temporary sealant (patent pending) applied to the interlocks under factory-controlled conditions. They were therefore

delivered to site ready to be installed.

The sheet piles were installed in a trench, which served two purposes: it controlled water used to jet the piles through the terrace gravels and allowed the piles to be installed in such a way that the pile heads were driven to level thus minimising wastage.

The sheet pile interlocks were permanently sealed by seal welding the pile interlocks once the basement had been excavated to formation level and a blinding layer added. Non-destructive weld testing ensured the integrity of the permanent seal welding. The use of steel sheet piling has the obvious advantage that it can easily be welded to form a permanently tanked watertight structure rather than the construction of a drained cavity.

An additional constraint, from the planning authority was that the two mature trees on the site had to remain, with minimal disturbance to the root balls. This led to a relatively complex plan geometry for the basement which was not a problem for the sheet piling solution as special

corner piles were fabricated on site to allow the required basement layout to be constructed.

The design of the sheet pile walls allowed for the basement to be excavated to a maximum depth of 3m prior to the installation of a propping system at pile head level. Once the propping system was installed the basement excavation could continue to full depth whilst construction of the guest pavilion could commence concurrently.

Hydrobarrier started on site in January 2002 and installed the sheet piles in 13 days, saving the main contractor almost 2 weeks of the contract programme. 860m² of sheet piling was installed to form a basement with a plan area of 280m².

As well as designing and constructing the watertight sheet pile walls, Corus Hydrobarrier designed and constructed the watertight connection between the basement walls and the basement slab. Despite the number and complexity of constraints the solution will be hidden from view once the sheet piles have been faced with slate.

• Further information: John Theos, Corus Hydrobarrier (tel: 01724 405 741 e-mail: hydrobarrier@corusgroup.com).

The sheet pile walls act as a retaining structure and carry axial loads from the superstructure



860m² of sheet piling was installed to form a basement with a plan area of 280m²





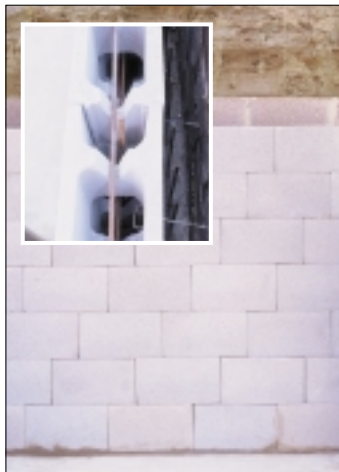
May Gurney has recently finished a 1050mm diameter contiguous bored pile wall for Geoffrey Osborne Ltd at Shortlands Junction, Bromley, Kent. It was part of a project involving the installation of 1100 piles to allow a new rail line, the Ravensbourne Chord Lines, to pass underneath the Chatham lines to prevent delays due to bottlenecks at this busy junction.

• Further information: May Gurney Technical Services, Trowse, Norwich NR14 8SZ (tel: 01603 727 272; fax: 01603 727 402; web: maygurney.co.uk).

Hotel project gets Stepoc treatment

A new building at a hotel complex at Bagshot in Surrey, containing a basement to accommodate plant and services for pool and leisure facilities, is benefiting from Forticrete's Stepoc retaining wall system (see front cover).

Stepoc is a concrete wall building system that produces results quickly and simply. The wall is built dry and blocks locate together using jaws on one end and ribs on the other. Horizontal and vertical reinforcement bars are then added, depending on the structural requirements, before concrete is pumped into the structure.



Each block incorporates flow cavities which allow concrete to be pumped in and cascade throughout the structure, expelling air and eliminating segregation without the need for vibration.

The project at the Pennyhill Park Hotel and Country Club required a basement up to 3.5m deep with two changes of level through the various stages of an extension, to house a health spa, pool and other leisure facilities. The project, which is of steel frame construction with a brick outer face, is managed by the hotel's own facilities management team, employing sub-contractors for the site preparation and construction work.

Civil and structural engineering consultants Dixon Hurst Kemp of Horsham designed the basement retaining wall with

an outer face of dense concrete block, a cavity to be filled with poured concrete reinforced with steel mesh, and an inner wall of Stepoc.

Stepoc is used extensively for retaining, basement, sheer or bund walls, in addition to providing a solution for providing foundations on uneven sites.

• Further information: Forticrete (tel: 01298 23333; web: www.forticrete.co.uk).

Underground detection agency



A new service has been launched providing highly accurate and cost-effective underground detection and investigation for the construction and building industries. SUMO, a joint venture between Pipehawk plc, Geotec Surveys and Francise Concepts Ltd, offers advanced ground probing radar technology

coupled with radio frequency locators, a fibre optic tracing system in addition to the traditional metal detection methods. Operators can locate and mark out clay and plastic pipes, power and telecommunications cables, including fibre optics and metal pipes. The concept is currently being piloted in South East England but other franchises are planned for elsewhere in the UK.

• Further information: Sumo Services Ltd, Sterling Barns, Knowle Lane, Cranleigh, Surrey GU6 8JP (tel: 01483 548 789; fax: 01483 548 788; freephone: 0800 587 5867; email: info@sumoservices.com; web: www.sumoservices.com).

Ground works sister company launched

To further establish its position in the ground-works sector, Groundforce has launched a sister company, Piletec, which will supply piling equipment and allied products on both a hire and sale basis.

Products include excavator mounted and freely-suspended vibratory hammers, impact hammers and pile breakers, with all the necessary hydraulic equipment and attachments for piling and foundation work. In addition, the company will provide technical advice.

A complete package can be offered from sheet piling to pile driving machinery and hydraulic bracing as



well as personal safety equipment.

• Further information: Bill Gorton, Piletec General Manager (mobile: 07740 591 605; call centre: 01279 429 962; email: billgorton@vpplc.com) or Matt Ferguson, Groundforce Design Manager (tel: 01423 852 284; email: matt.ferguson@vpplc.com).

Ground probing radar distributor

Ground probing radar company, PipeHawk plc, has reached an agreement with Radiodetection (China) Ltd for the Far East company to become a distributor for its PipeHawk II Ground Probing Radar System throughout China and Hong Kong.

Pipehawk II is a non-invasive detector used to pinpoint underground obstacles including plastic pipes and fibre optic cables. Radiodetection (China) adds the PipeHawk to its existing portfolio of location and avoidance, leak detection and evaluation devices, as well as CCTV inspection systems, pressure management tools and cleaning machines.

Pipehawk II finds both the depth and location and its icon-driven menu presents the raw radar data in a visual form. It is portable and has no trailing wires to become snagged.

• Further information: Mike Bushell, PipeHawk plc (tel: 01420 590 990; fax: 01420 590 920; email: mike.bushell@pipehawk.com).



Probing piles in Portishead

Aarsleff Piling had to probe the ground at every pile location prior to driving a pile at the Port Marine housing development at Portishead. The deep probing was required to locate any underground obstacles on the former dockside power station site, which is progressively being transformed by Crest Nicholson Residential.



Aarsleff used one of its Banut 700 self-erecting fixed leader piling rigs to drive a 278mm diameter, 8m long tubular steel mandral through fill to toe into the underlying clay in each of the 530 pile locations. The mandral was withdrawn and any obstacle logged. As it was not practical to remove the obstacles in areas where they were found, adjacent areas were investigated to find obstacle-free locations for the 250mm square, 10m – 17m long, precast concrete piles to be driven in.

Crest Nicholson is building approximately 900 houses, apartments and leisure facilities in the £90m first phase of the project, which is scheduled for completion in 2010.

• Further information: Terry Bolsher, MD, Aarsleff Piling Ltd, Hawton Lane, Balderton, Newark, Notts NG24 3BU (tel: 01636 611 140; fax: 01636 611 142; email: terrybolsher@aarsleff.co.uk; web: www.aarsleff.co.uk).

Software designed Human Transporter

VisSim software for modelling and simulation of complex dynamic systems was used to design the Segway Human Transporter, an innovative enhancement to personal mobility. It allows users to travel faster and further than walking and is expected to be beneficial to the emergency services in built-up areas,



commuters, parcel delivery services and for short errands.

The vehicle, which utilises dynamic stabilisation technology via gyroscopes and tilt sensors, software and electric motors to produce a balanced ride. This is similar to the way in which the human body generates data from the inner ear and processes it in the brain to stop people falling over.

A powerful simulation tool was needed to simulate how the body

moves and VisSim from Adept Scientific was chosen.

• **Further information:** Anna Moorhouse, Adept Scientific plc, Amor Way, Letchworth, Herts SG6 1ZA (tel: 01462 480 055; fax: 01462 480 213; email: anna.moorhouse@adeptsience.co.uk).

Dublin's icon restored

As part of the restoration of the Ha'Penny Bridge, across the river Liffey in Dublin, Metalock Engineering UK carried out, on behalf of Irishenco Construction, a series of magnetic particle inspection checks on various critical components. Repairs to damaged parts were made using metal stitching techniques.

As the footbridge is a List 1 structure and considered an icon in Dublin, it needed extra care and attention in its restoration and, where possible, much of the original material was retained.

Metalock's work involved repairing 43 tie-end rods caps and cracked diaphragm rib plates as well as repairing construction webs and installing new corbel sections to replace those broken off over the years.

Originally constructed in 1816, the bridge is an assembly of elliptical arch



ribs, probably cast in Coalbrookdale to a design accredited to Thomas Telford. It closed in March 2001; the deck was removed and new sections fabricated to match the bridge's distorted elliptical shape. New ductile iron ornamental railing sections were cast. Most damage occurred as a result of expansion from corrosion products due to moisture ingress through broken sealing materials.

• **Further information:** Mike Fish, Metalock Engineering UK, Paragon Way, Bayton Road, Exhall, Coventry CV7 9QS (tel: 024 7636 0084; email: sales@metalock.co.uk; web: www.metalock.co.uk).

Retaining the views

A Macwall segmental concrete retaining wall system has been specified to create walls to stabilise an area of sloping parkland in Newcastle Great Park, a major new commercial and residential development on the outskirts of Newcastle-upon-Tyne.

Sited adjacent to the A1 Newcastle by-pass, the development, designed by architect John Simpson, is set in natural parkland and construction is scheduled to take place over a 12 month period. 2500 residential homes will be built by a joint venture between Persimmon Homes and Bryant Homes, in a series of small villages. In addition, attention is being paid to the natural environment with sustainable urban drainage systems (SUDS) playing a major part. Drainage is via a storage pond using reed bed technology which required levels to be raised to create a large terraced area bounded by a footpath with steep banking sloping down to the parkland. The MacWall segmental wall system from Maccaferri has been used to support this slope. Approximately 7500 blocks were used by Colton Excavations Ltd to construct the wall, which has a surface area of 750m², runs for 300m and has a maximum height of 3.2m.



A 300mm layer of free draining aggregate is placed behind the blocks and a geotextile layer is used to separate this from soil fill. Layers of Paragrid, a polyester soil reinforcement grid, were used in the backfill.

• **Further information:** Abi Shelton, Marketing Assistant, Maccaferri Ltd, 7400 The Quorum, Oxford Business Park North, Garsington Road, Oxford OX4 2JZ (tel: 01865 770 555; fax: 01865 774 550).

Self-compacting concrete developments

Self-compacting concrete has developed by taking advantage of the new generation of modified polycarboxylate superplasticisers. Grace Construction Products has a range specially developed for use with self-compacting concrete including its proprietary ADVA technology, such as the Flow 300 superplasticiser series,

Grace V-MAR 1 and V-MAR 2. The ADVA 300 products are low-dosage, high-range water reducing admixtures with low viscosity, while V-MAR 1 & 2 are stabilising agents that increase concrete cohesion and resistance to segregation.

• **Further information:** Neil Austin (tel: 01925 824 824).

Norwegian wood

The Nordic Timber Council has published a guide, entitled *Wood Works*, which provides architects and specifiers with real examples and innovations for using timber from all over the world.

Over the centuries wood has provided all kinds of structures, from boats and small houses to high-rise buildings and bridges. The guide gives photographic examples of these projects, detailed information on sustainability and other environmental factors, together with the physical properties of timber.

• **For a copy of the guide call Nordic Timber Council (NTC) brochure hotline 01543 433 988. Further information:** Katie Brett, Wyatt International on behalf of the NTC (tel: 0121 454 8181; email: kbrett@wyatt-inter.co.uk).