Spotlight

Underpinning

Ground force

Underpinning techniques are being refined as new technologies and materials reach the market. *NCE* looks the latest developments.

Back to base

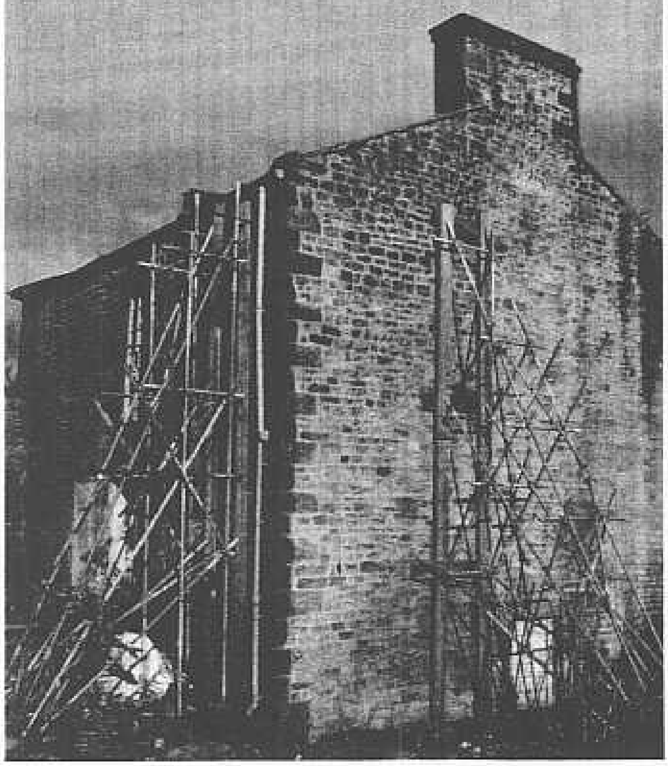
Roger Bullivant is using jacked down minipiles to underpin three listed buildings on a site in central Lancaster, all of which have been affected by subsidence.

"Our works are designed to create new foundations within each building to cater for greater loadings," explains Bullivant underpinning manager Andrew Miller.

Bullivant has cast a 450mm deep reinforced concrete slab within the basement of each of the stone buildings and is driving a total of 40 minipiles through pre-formed voids in these rafts.

The piles are formed from 175mm diameter recycled steel tubes and are being installed to a depth of 13m through gravels into sandstone using a hydraulic jack down rig exerting 800kN of force.

"We chose a vibration free method of working so as not to cause further distress to the structures," says Miller.
www.roger-bullivant.co.uk



Mass market

Underpin & Makegood has been working since March on a contract to stabilise a house in north west London by mass concrete underpinning.

Subsidence to the left hand side of a two-storey traditional masonry extension had been caused by movement of desiccated London clays underlying the foundations. This had been exacerbated by the felling of a large plane tree nearby.

Access to the site in Hamilton Terrace was difficult: The work had to be carried out below basement level, requiring spoil to be removed and concrete imported via a scaffold tower and hoist.

The traditional "hit and miss" underpinning method used involves excavating isolated pier bases under the existing foundations – in this instance to a depth of 3m – before mass filling with concrete to within 75mm of the soffit of the existing foundation. After curing, the void is rammed with a semi-dry, cementitious mortar to mitigate any further settlement caused by longer term shrinkage

occurring as the concrete cures. After one underpinning "base" is completed, the next can start.

To prevent the work causing heave to the foundations, the underpinning sections are lined with an anti-heave material before concrete is placed.

Underpinning depths are evaluated using site investigation data, taking into account the plasticity of the clay, the depth of root activity and an assessment of soil desiccation.

At this site, Atterburg limit test results indicated desiccation to a depth of 2.5m and live tree roots were discovered at 2.4m, hence the design depth of 3m.

The underpinning is due to be completed later this month.
www.underpin.com

Raft rescue

Croydon-based subsidence repair specialist Withers appeared recently on Channel 4's *Room for Improvement*.

At just over £110,000, the contract value is high for the domestic property featured and indicates the severity of the subsidence at the three-bedroom bungalow in Chessington, Surrey.

Withers proposed a piled raft solution consisting of 55 bored 250mm diameter piles and a 250mm thick reinforced concrete raft to support the building.

In a highly plastic clay subsoil with trees surrounding the front of the property (on a slightly sloping site), 10m deep piles sleeved for heave in the top 3m was an economic and far safer solution compared with a traditional hand dug approach.

The piles were installed internally with a TD 308 Piling rig, which can negotiate the width of an internal door frame, removing the need for walls to be demolished.

Withers used its technology-based management system, withersnet, to fast track the project and allow the client, WCJ Engineers access to the job file at all times via the internet for up to date information.

Withers had total responsibility for all the enabling works, piling, raft construction and subsequent reinstatement and repair works.

The occupiers also used the piling to their advantage by creating a modern extension to their property.

Withers' website includes a video link to the Channel 4 programme.
www.withers-group.co.uk

The bungalow before work began

Infirmary injection

Renovating the Old Infirmary at Stonyhurst College in Lancashire this spring required a fast, non-intrusive method of ground improvement.

The Grade I listed buildings are up to 400 years old. Indeed, Oliver Cromwell is reputed to have slept on a table there the night before the Battle of Preston in 1648. Over many years, gradual settlement of the central core of the Old Infirmary has taken place, mostly due to leakage from stone drains.

"We needed to make sure of level access, and there was no point in levelling the floor without curing the problem," explains Brian Edmondson, technical director of consulting engineer TD Bingham.

Conventional solutions such as piling were ruled out because of restricted access in the basement, and also the time factor. "Pinning through a wall and then piling on either side is very simple to do on drawings, but it's sometimes very difficult in practice, especially with all the drains down there," says Edmondson. "It could have taken six months."

Having used Uretek processes before in the Isle of Man, he recommended resin injection.

Where ground conditions are suitable, resin injection has the advantage of minimal disruption; no excavations are needed, and there is little or no dust or mess. Uretek's methods are fast to apply, and restricted access is usually no problem, as only a hose needs to be brought to the application point, with the rest of the equipment staying on the truck.

Over the past 25 years, Uretek has pioneered and developed two main processes for resin injection: the floorlifting method, which fills voids and re-levels sunken flooring, and the deep injection method, which provides an alternative to piling and underpinning when dealing with subsidence. Different applications demand varying degrees of expansive force, and the resins are selected on a case by case basis to produce the optimum results.

Resin injection under way

The buildings at Stonyhurst are almost 400 years old

The most powerful resin available is Geoplus, with an expansive force of up to 10,000kPa – 20 times that of other polymers. Geoplus is used for deep injection work, and has the added advantage that it does not add significant weight to the surrounding ground.

While the resin is injected the compaction effect is verified in real time using a laser level placed on the floor or wall, which monitors lift. No overlift occurs because the set-off time of the material is almost instantaneous.

At Stonyhurst, two teams from Uretek spent a total of 14 days injecting resin at 1m intervals to a depth of 5m under the load bearing walls in the Infirmary basement, filling voids and consolidating the brick fill and sandy clay.

The desired ground improvement was achieved, enabling alterations to the building to proceed without delay.

"We are very pleased with the work," says Michael Hartley of Cassidy & Ashton, architect for the renovation projects. "The Uretek treatment has allowed reconstruction work on the Old Infirmary to proceed on schedule."
www.uretek.co.uk