

Pinner Wood School Ground Investigation and Stabilisation Scheme

Project Profile

Client: Harrow Council Children's Capital Project Team

Designer: Peter Brett Associates

Date: Nov 16 - Feb 18

Value: £2.0m



A partial ground collapse measuring 3m diameter and 2m depth had occurred in the car park to the frontage of the school. Peter Brett Associates (PBA) were appointed by Harrow Council to carry out initial investigations using dynamic probing to prove the depth of the feature and to highlight any other areas of weak strata in the area. Following these preliminary investigations we secured a contract to fully investigate the site and treat any historic chalk mine workings that were located. The scheme was designed and supervised by PBA and was submitted for a Ground Engineering Award in 2018 (Ground Investigation Project of the Year category). The scheme also featured in the Channel 5 Documentary Series on Sinkholes, episode 2. (<https://www.my5.tv/sinkholes/season-1/episode-2>).

Preliminary site investigation and treatment works Phase 1 was undertaken while the school was occupied, and involved drilling and grouting treatment of the 3m diameter feature, which was proven to be an old mine shaft, using Klemm KR902 rotary percussive drilling rigs and injecting a 10:1 PFA/OPC grout mix using a screed pump. An additional shallow strata anomaly located to the side of the school was treated by compaction grouting. Probe drilling was carried out around the shaft in a spiral grid to intercept any workings running from the shaft towards the school and also proving the area around the treated feature to the side of the school.

108 holes were drilled and 486 tonnes of grout injected in this phase. 6 investigation holes recorded significant strata anomalies and were cased using 88mm dia plastic casing, specialist subsurface survey company Geoterra then used downhole laser scanning which proved that the anomalies were historic chalk mine workings.

Desk studies and historical searches were also carried out by PBA which identified known chalk mine workings in the area however there were no records of mine workings on the school site.

Additional investigation works Phase 2 to determine the full extent of the located chalk workings. It was at this point (April 2017) that Harrow Council decided that due to the risks associated with mine workings that the school should be immediately evacuated until the investigation and stabilisation work was completed.

774 probe holes were drilled to an average depth of 28m around the school. 35 of these holes were cased using 88mm plastic casing and laser surveyed by Geoterra which enabled production of a complete 3D point cloud model of the mine and allowed quantification of the extent and volume of the workings (open volume of 1751m³.) The probing works also highlighted other strata anomalies with weak ground that would require treatment.



Pinner Wood School Ground Investigation and Stabilisation Scheme (Cont'd)

Project Profile

Client: Harrow Council Children's Capital Project Team

Designer: Peter Brett Associates

Date: Nov 16 - Feb 18

Value: £2.0m



Treatment works Phase 3. The treatment phase of the project used 2 drilling & grouting methods;

- Method 1—Bulk infilling of the open chalk workings with a 10:1 grout mix (PFA:OPC) injected via the 35 original Site Investigation boreholes that had located voids.
- Method 2—Compaction grouting to consolidate and improve the remaining loose and soft ground in, around and above the chalk workings, by injecting controlled volumes of mortar grout in ascending stages at specified pressures. Compaction grouting 'densifies' or compacts the weak host material through the introduction of series of connected 'bulbs' of grout which provide a grid of grouted 'inclusions' in the host material.

On this site we used a 6:2:1:0.1 mix of sand, PFA, cement and bentonite for the compaction grouting which was injected using 'end of casing' techniques. 101mm diameter rotary percussive casing was drilled to full depth of the borehole and then used as the injection tube, the casing was then withdrawn in stages thus allowing the complete control and monitoring of the mortar grout volumes and pressures.

3 nr Klemm KR904 rotary percussive drilling rigs were used to carry out the compaction grouting works around the school, while a Klemm KR 904 mini rig was used to carry out the treatment works within the school courtyard. The mini-rig required craning into position as there was no other suitable access into the courtyard.

Each of the rig setups had a Mortar mixing plant that could mix and inject the compaction grout to the boreholes.

The quantities of work completed in Phase 3 included;

- Bulk grouting—3417.7 tonnes of 10:1 grout injected.
- Compaction grouting—526 boreholes completed and 1,648 tonnes of compaction grout injected.

During the investigation and stabilisation works continuous monitoring of the school and hard standings was carried out using laser levelling and crack monitoring.

Close liaison was maintained with the Client, Designer, key school personnel and the local community to ensure that the project was completed within the expected timeframe and also to ensure that minimal disruption was caused. The evacuation of the school enabled the works to be accelerated ensuring that all treatment works were completed by the middle of December 2017. On completion of the stabilisation work the site was reinstated in line with Client requirements.



Pinner Wood School Ground Investigation and Stabilisation Scheme (Cont'd)

Project Profile

Client: Harrow Council Children's
Capital Project Team

Designer: Peter Brett Associates

Date: Nov 16 - Feb 18

Value: £2.0m



Letter received from the pupils at Pinner Wood School when they moved back into the buildings following the treatment works.



Dear Team at Forkers,

Thank you for your help and that you volunteered to recover our school. You are our super heroes in action. You made our Pinner Wood dream come true, you put a great, big smile on some of our faces. We all are thankful.

From All at Pinner
Wood.

Designed by Rehaan Yr 4