SURVEYING

Reference: CS-12

High quality survey data is the essential foundation for reliable resource estimation and accurate quarry design. GWP Consultants LLP (GWP) offers a surveying capability that is fully integrated with our site-investigation, mine planning and design activities.

Our surveys incorporate a high level of detail which has been demanded by the GWP consultancy requirements and ensures that the information is suitable for even the most complex projects. We are confident that our integrated and methodical approach to surveying results in overall savings for our clients in cost, time and effort.

Survey Systems

The GWP survey department utilises the latest UAV and survey technologies.

Leica GPS systems are used in conjunction with the SmartNet network, to survey and set out to cm accuracy which minimises post processing time and the need for site control.

For areas that are not conducive to the use of GPS such as woods, built-up areas or deep pits we use Trimble robotic total stations which allows one man surveying and can reduce the requirement of a survey assistant. The department also uses a long range laser scanner from Measurement Devices Ltd. This allows the rapid acquisition of thousands of points and ensures that inaccessible features such as high quarry faces or hazardous areas can be surveyed from a safe distance.

For larger surveys or inaccessible sites a drone survey can be undertaken. The drone is flown over the study area at low altitude; whilst in flight the on-board high resolution camera takes a series of overlapping photographs with photogrametric software. Point cloud and aerial imagery is computed.

Prior to the commencement of the drone survey a number of ground control points are installed around the site. These points are accurately surveyed using Leica GPS. The GCP's are then used to geo-rectify the aerial imagery. The point cloud data is used to create a Digital Terrain Model with accuracies up to 6cm RMS which is comparable to conventional survey techniques.

The investment in technology by GWP means that all features can be recorded accurately and safely. This reduces the requirement for repeat surveys and guarantees that the data is suitable for a wide number of applications.

Digital Terrain Models

Data recorded on site is downloaded and processed using LSS software to produce a 3D Digital Terrain Model (DTM). The DTM is the fundamental basis for volumetric calculations, surface excavation designs, section and plan preparation, and for the interpretation, modelling and visualisation of geology and geological structures.

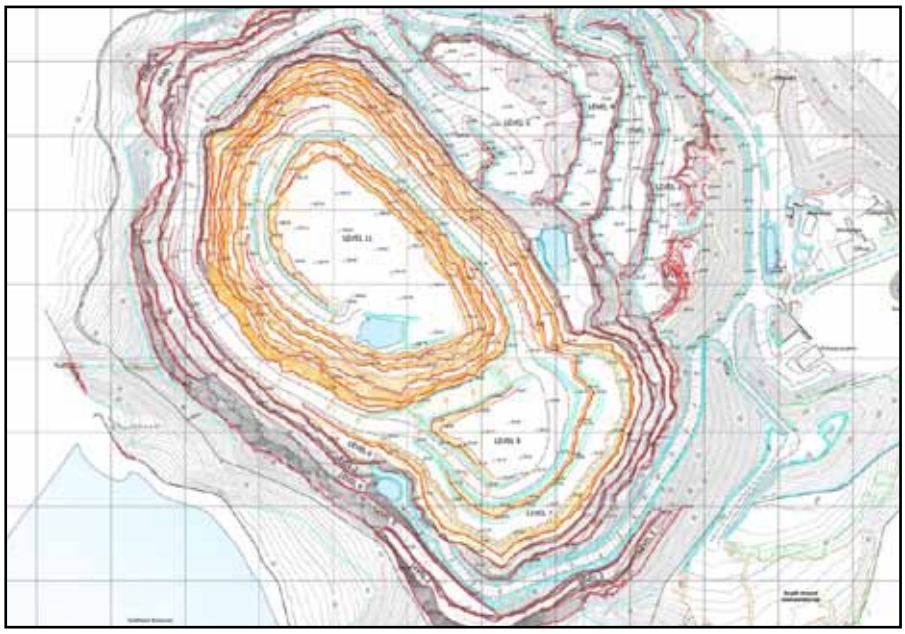
Textured surfaces or images can be draped onto the DTM to produce 3D visual "fly-through" models that can be issued to clients.

Design data and control co-ordinates can be uploaded to the survey instruments for setting out.

Surveying Services

Surveying and related services provided by GWP include:-

- Topographical surveying, at all scales from quarry excavations to small gardens.
- Surveying geological and geotechnical features such as faults, discontinuities, bedding planes, joint inclinations, weathering surfaces and base of overburden levels where exposed in quarry faces.
- Setting out and surveying for landfill cell engineered clay liners and caps, and producing related Construction Quality Assurance (CQA) drawings.
- Setting out and surveying of drilling and instrumentation locations, excavation limits, tips and restoration contours.
- Setting up control targets for use during laser profiling operations prior to face blasting and for photogrammetric surveys, including control for aerial surveys.
- Computation of overburden volumes for excavation, *in situ* resource and recoverable reserve estimation, tip and stockpile volumes.
- Surveying surface structures, quarry plant, stockpiles and silt settlement and attenuation ponds.
- Computation of placed waste and available void space volumes in landfill cells.
- Pit design, including layout of benches, ramps, haul roads, tips and lagoons; preparation of phase plans, setting out and construction supervision; design of the final void, computation of mineral and waste volumes.



Selected UK Experience

Cement Industry

Survey of farmland surrounding an operating cement works in support of quarry design and reserve evaluation for a planning application.

Annual surveys with computation of material excavated for comparison with quarry production figures.

Specialist Surveys

Monthly monitoring survey to quantify the extent of any ground movement occurring in and around a World Heritage Site as part of the conditions for a quarry extension.

Topographic Surveys

Topographic surveys of buildings, utilities and gardens for private and commercial developments.

Aggregates Clients

Numerous surveys to support reserve evaluations and quarry designs

Site survey including logging of boreholes as part of investigations for a report on the stability of slopes above the quarry and the design of remedial works.

Site survey for geotechnical investigations and calculations with proposals for long term stabilisation measures for a slip.

Survey of aggregate quarry extents, exposed faces and benches, quarry floor and tips for quarry design and evaluation purposes.

Local Authority Clients

Topographical survey of a quarry and surrounding land as part of an assessment of mineral reserves and working methods and provision of a restoration scheme.

Key contacts

For details and to discuss your requirements, please contact the following:

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