



## UNDERGROUND SURVEY CONTROL NETWORKS

**BEAMS** is a small contract surveying company specialising in underground survey control networks. Owner – Director and Senior Surveyor Glenn Williams has extensive experience in establishing and documenting survey control to **ICSM SP1** and **legislative** standards.

**CHECK SURVEY – RETRAVERSE** that merges all data into a single calculation and 3D least squares adjustment. **COMPNET** software facilitates:

- Wall station and back stations
- Gyro directions
- GPS and total station traverses
- Archived electronic traverses from any manufacturer
- 2D plumbwires
- Manual entry of historic fieldnotes
- Plane flat earth grid, plane with base RL or UTM (eg MGA94) projected grid.
- Work starting anywhere in the proposed network.
- Flexibility to schedule sections of traverse around other mine activity.

**BEAMS surveyor** can verify and use the client's survey equipment, or supply all equipment to complete a project.

### **BEAMS equipment list:**

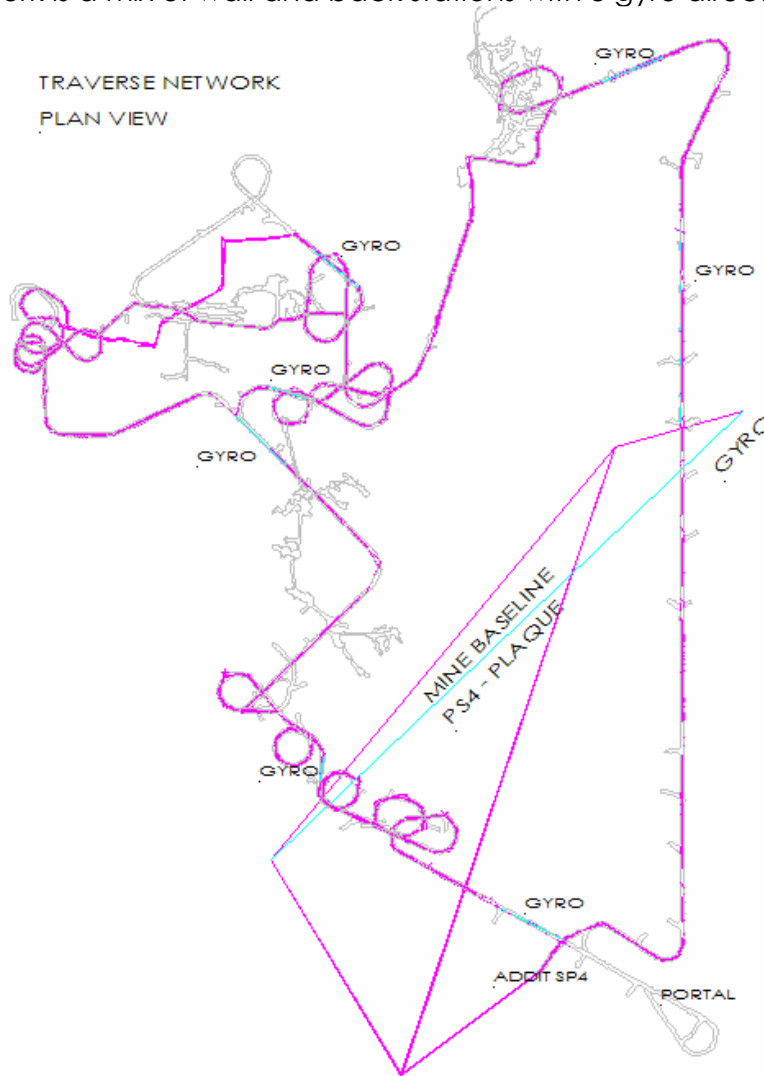
- Leica TCRP1203 R300 total station, current service and calibration certificates
- 5 tripods, 5 tribrachs, 5 prism carriers, 12 wall station spigots and 6+ leica round prisms
- 36Volt Bosch hammer drill and consumables
- Gyro and GPS hired as required.
- Nissan non-turbo underground ute with lockable equipment boxes – currently approved for use at Mount Isa Copper Operations
- Custom built optical plummet, optical up - laser down
- Compnet v2.8 software and Liscad v9.0.3 engineering surveying software
- Public Liability (\$20,000,000) and Professional Indemnity (\$5,000,000) insurances.

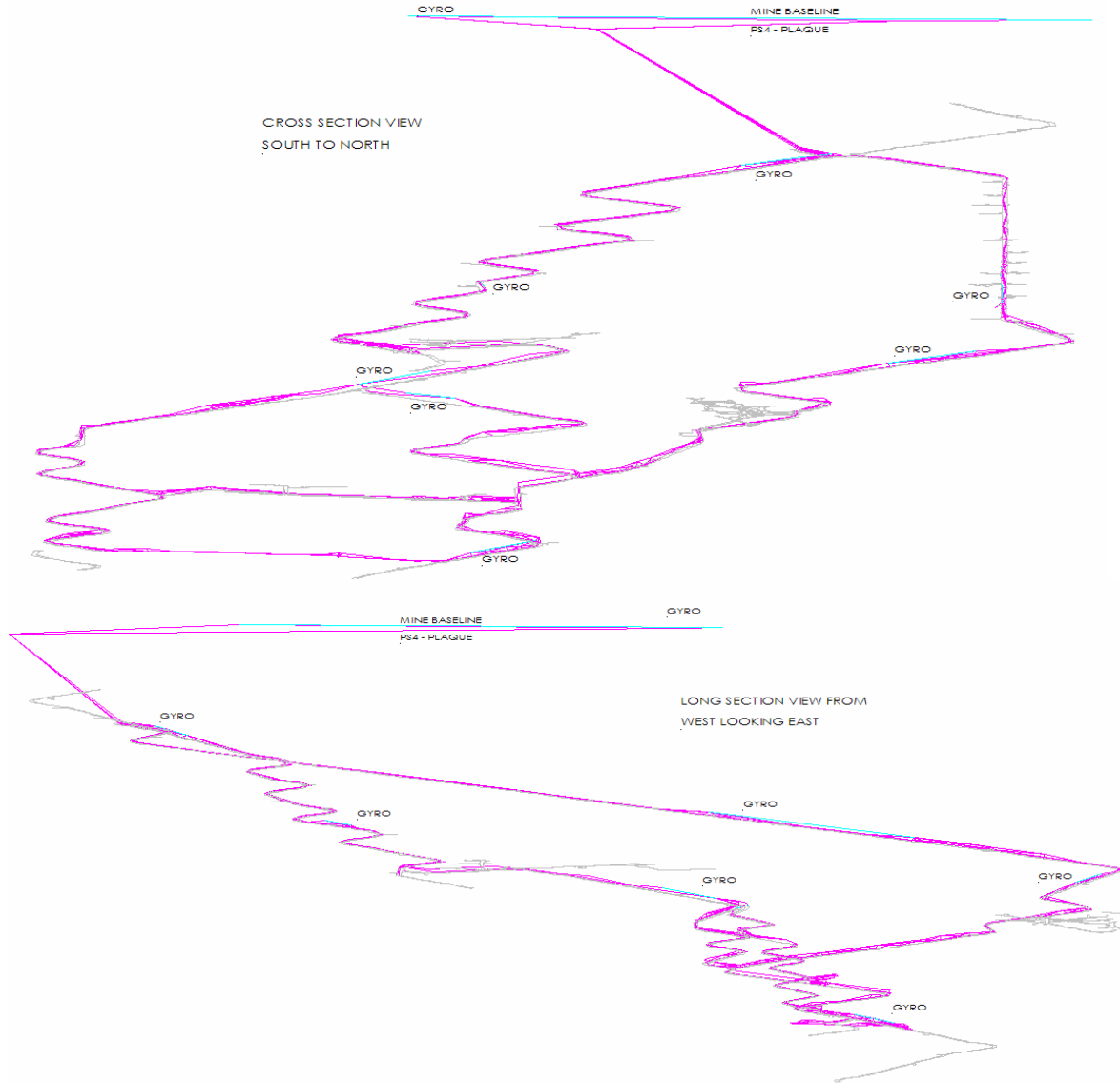
### **PROCEDURES:**

Traverse is on force centred temporary points (TPs) and resembles a traditional single line traverse. All lines between TPs are measured in both directions. Each wall station is measured from 2 or 3 TPs. A measurement is 4 sets of 2 face observations (8 pointings to every target). Leica Sets of Angles program automates the process for rapid electronic data recording. Traverse files are downloaded and processed in Compnet. Compnet calculates standard deviation of all horizontal & vertical angles and slope distances. It

reduces measurements and calculates first pass coordinates. Effective reporting of traverse malfunctions and editing tools enable swift correction errors calculation of adjusted coordinates. Separate traverses with common stations are easily merged into a single calculation.

Following images are of an underground network comprised of 22 separate traverses. The network is a mix of wall and back stations with 8 gyro directions.





**TRAVERSES THROUGH GROUND PRONE TO MOVEMENT:**

Traverses through ground prone to movement are executed in a very short space of time. The mathematical quality of the network is not compromised. Discrepancies detected when the traverse is revisited at a later date are confirmation of local ground movement. It is up to the mine surveyor to decide if he accepts the closer local stations or recommences his work from beyond the unstable area.

**METHODOLOGY – THEORY AND PRACTICE:**

Traverse planning and careful wall station placement are essential to both speed and quality in the traverse.

**The Practice:**

Method used is conventional traversing on force centred temporary points (TPs). All wall stations are measured from a minimum of 2 but usually 3 TPs. All lines between TPs are

measured from both ends. There are most often 2 wall stations adjacent to every TP. Every line measured becomes part of a triangle. Every line is common to at least 2 different triangles.

The Leica **Sets of Angles** program is used to observe and record angles and distances. When resuming work at the start of a new shift, a 2 TP overlap on to wall stations in previous work uses 6 wall stations common to both previous work and the new traverse. Electronically recorded measurements are downloaded in Compnet **3d Least Squares Adjustment** Software. Editing, processing, final adjustment and reports are facilitated in Compnet.

**The Theory:**

A mathematical solution is not possible unless all information is correct within specified limits.

The triangular geometry ensures that traverse is always closed even though traverse is advanced without a return leg in a single heading.

Measurement of each point from multiple stations introduces a high level of redundancy. Redundant solutions refine error ellipses to smaller limits and improve the quality of the network.

