

## Northern Gallery Access Works & Seven Sisters Temporary Stone Infill

<b>Client:</b>	Dudley MBC
<b>Value:</b>	£770k
<b>Date:</b>	2003/2004
<b>Type of Mine:</b>	Limestone

The Seven Sisters Limestone Mine in Dudley is listed as a national monument and is situated in a national nature reserve. The mine itself, however had become unstable and had suffered a number of collapses and crown holes and was at risk of total collapse and loss of the 'Seven Sisters' mine pillars that are exposed on the up-dip outcrop of the limestone seam. (Approx 38° dip).The mine was to be filled to remove the risks associated with collapse and the works undertaken falls into two areas.

1. The **Northern Gallery Access** works carried out to provide a new access to the stable Northern Gallery of the Seven Sisters mine which was to be developed to provide a Bat Mitigation area for the loss of the Seven Sisters mine habitat. In addition access was gained to construct a barrier system to allow infilling of the Seven Sisters mine.
2. **Infilling of the Upper Seven Sisters gallery with temporary stone infill.** This work was carried out as a nominated specialist subcontractor to main contractor for the infilling work – Wrekin Construction. The temporary stone infill will allow the mine and pillars to be supported while further investigations are carried out and a scheme is developed for the permanent support and re-opening of the gallery.

### 1. Northern Gallery access works

The new access adit was to be constructed through the backfilled and collapsed upper section of the mine along the line of dip of the mine which was up to 45° from horizontal.

Prior to constructing the new access adit a significant amount of preparatory work was necessary to ensure the stability of the exposed rock face overhanging the partially backfilled outcropping mine gallery.

An anchored concrete working platform was constructed outside the potential area of collapse risk and guide rails lowered into the mouth of the gallery up to 38° angle of dip. This allowed sections of pre-fabricated steel tunnel to be lowered or 'slid' into the gallery.

Once this "outer" portal section of the tunnel was in place it was surrounded in concrete and then imported dolerite stone was placed over the tunnel and filled against the face of the exposed work face to provide stability and protection.



Tunnel portal section prior to filling over



View of tunnel portal

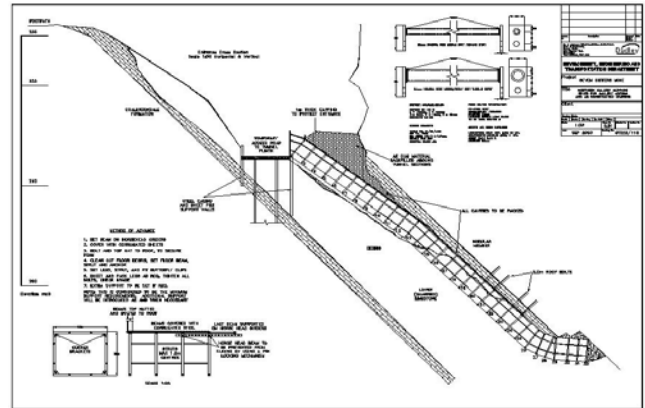
## Northern Gallery Access Works & Seven Sisters Temporary Stone Infill (contd)

Once portal works were completed the new tunnel was driven through collapsed and backfilled material into the Northern Gallery finished at the top of the scree pile. A bulkhead wall was formed around the end of the tunnel and the tunnel surrounded in concrete.

The tunnel is 40m long and driven down dip at an angle of 38°. Frames were set at 1.2m and bolted to the mine roof.



View down completed tunnel



Section through tunnel

Following completion of the tunnel, a working platform was constructed at the top of the gallery and the immediate gallery roof area protected with timbering and 'cogging'.

A barrier structure was then completed in the gallery to prevent infilling paste migrating from the Severn Sisters Gallery into the Northern Gallery area. The barrier, partially constructed against existing scree fill and partial in open upper areas was constructed in 13 steps over a height of 18m using 350m<sup>3</sup> of foam concrete pumped into the mine from surface. Geotextile was used to prevent loss of foam concrete into the scree.

On completion of the barrier continuous monitoring was carried out to ensure there was no leakage of infill paste from the adjacent Seven Sisters mine.

In order for the gallery to be fully utilized for a bat habitat, 600 tonnes of 150mm Jurassic limestone was imported and placed randomly down the slope of the gallery floor. To get this material into the gallery, a drop pipe and chute arrangement was constructed down the new tunnel, loaded by conveyor. This work was carried out in close liaison with Bat specialist – Dr Robert Stebbings Consultancy.



Northern Gallery showing supported working platform, barrier steps, and infilled limestone.



View of Northern Gallery from working platform

## Northern Gallery Access Works & Seven Sisters Temporary Stone Infill (contd)

### 2. Infilling of Upper Seven Sisters Gallery with temporary stone infill

The mine gallery was classed as high risk and therefore had to be filled by non man entry methods.

The surface assess and dip of the gallery allowed the 40mm down crushed stone to be fed into the mine using a series of conveyors.

An 80m long 65hp primary conveyor with 42” belt running from the compound area fed a 30m long secondary conveyor running parallel to the mine entrances. A series of 4 bridge belts between 6 and 15m long fed the stone into the gallery.

Once in the mine, the stone was distributed and stored using a Joy-continuous miner “slusher” dragline type unit. The unit was resourced with 2 x 200m ropes allowing the drive and return units to be set up outside the high risk zone.

A total of 10,000 tonnes of stone was placed in the mine, with the final placement made by an excavator sitting outside the mine with a 6m long pushing arm to stow stone into the roof of the gallery entrance.



Primary Conveyor



Secondary belt with bridge belt



‘Slusher’ distributing infill stone



View through gallery at start of stone infilling