Grandview and Last Chance Mines - Bat Gating Project
Grand Canyon National Park

Located 3,000 feet below the South Rim of the Grand Canyon are the historic copper mines named the Grandview Mine and the Last Chance Mine. The upper part of the photo shows the Grandview mines, and the lower right hand corner of the photo shows the waste rock dump of the Last Chance mine. These mines were first staked in 1890 by prospector Pete Berry. The ore from these mines was hauled out of the canyon daily by a string of mules up the Grandview Trail. Note the mule team in the upper left hand corner of the photo. The ore from these mines was very high quality with some samples exceding 70% pure copper. But due to the high cost of moving this ore from such a remote location, the mine ultimately closed by 1907.

Grandview & Last Chance Mines, circa 1900

Today there are only ruins and scattered debris of this hundred year old mining works. The trail from Grandview point down to Horseshoe Mesa is the first historic feature that you will notice. It was built by the miners for the mule teams to haul bags of copper ore attached to the backs of each mule. Steep section of the trail were paved with rocks so that the mules would have good purchase on the trails. Down on the mesa are the ruins of buildings that the miners lived in. Most of these ruins are not much more than rock footers for tent and wooden structures, but one stone building along the main trail still stands roofless with it's fireplace chimney staking claim over this historic mine site.

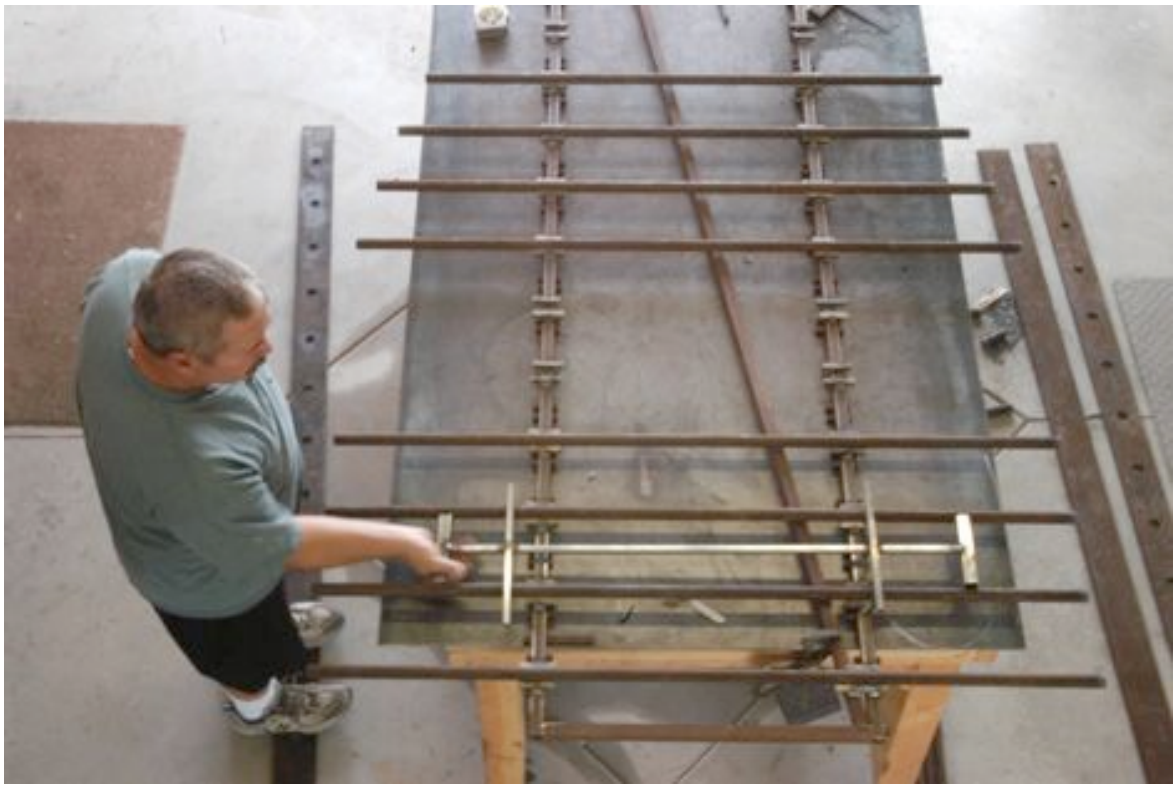
After 100 years, many of the mine tunnels and shafts have collapsed or have become quite unstable. Notice in the photo that the right tunnel is clear, but the left tunnel has dumped a large section of rock and dirt into the tunnel. The miners would install wooden shoring in mine tunnels at locations where they found loose rock. Over time this shoring rots, detiorates, and collapses sealing the tunnels.

Collapsing Tunnel in Grandview Mine

Geologically, this mine site was formed in a formation called a Breccia Pipe. A Breccia pipe often starts out as a cave void that collapses to form a sinkhole

full of broken rock or "breccia". This sinkhole acts as a natural drain that collects minerals that are tranported by water to concentrate at the bottom of the pipe. This is where the miners find their highest concentration of ore. This formation will also sometimes collect radioactive minerals as it did at the Grandview mine.

The production part of the project only began after first hiking down to the mines and taking measurements of the adits. The site inspection was instrumentental in planning project logistics at such a remote and challenging site. Our goal was to install the gates quickly in a safe and secure manner, thus limiting our impact to the park. We chose to install the gates in September so that most of the roosting bats would not be present at the site. Our project also focused on making our gates designs blend into the historic feel of this unique site.



Designing Bat Gate in Workshop

Back at our shop in Tucson, we began production of the three gates. We started by building gate template tools to facilate quicker and more accurate construction of the gates. In this photo we are measuring bar gaps to ensure that they are 5 3/4 inches wide needed for easy bat flight passage. This is the optimum bat gate bar-gap size determined by BCI and other bat researchers.

Once the gate is framed up we weld the bars and braces into place. To increase gate security and strength we apply continuous welds to each intersecting piece. The gates for this project weighed around 350 pounds each, so we used chain hoists to move the gates around the shop. By building the gates in a shop instead of onsite, we were able to reduce the time in the field. This greatly reduced our impact in the park.

The entrance section of the gate is designed to have easy access when open, and allow enough space to pass a rescue litter through the gate entryway. On each gate we installed our secure P-Locking system, along with a heavy duty Medico high security lock. Final modifications to the gate are made onsite to fit the specific mounting location.

The upper adit of the Grandview mine required a culvert gate to help support the ceiling from further cave-ins. The culvert gate contains gating bars similar to the adit gates, but must be entered via crawling through the 30 inch diameter culvert.

Trimming Bat Gate

A project of this size required significant logistical planning. We would be working at a remote site where we would only have one chance to get this project done correctly. Since we would be working on three gates concurrently, we decided to have three workers at each gate, and two more team members for running materials and tools between the sites. This team size of 11 experienced workers proved just right for this project. We also brought duplicate tools in case something broke or did not work properly. This was most fortunate because one of our two cutting torches and fuel bottles got damaged during transport.

To prepare the tools, gear and gates for helicopter transport our group had to weigh and mark each specific item. Then the items were organized by the four different drops points, and then placed on cargo nets as shown. Each load must weigh less than 800 pounds for the helicopter to safely tranport. This project required seven placed loads, and five removed loads at the end of the project.

Organizing Gear into Helicopter Cargo Nets

GCNP provided Helicopter support for ferrying the gates, tools and equipment to this remote site. The expert skills of our helicopter pilot and the professionalism of the helicopter support crew greatly helped our group get this project completed ahead of schedule. Our helicopter pilot was able to deliver the camp load and the upper Grandview adit load easily.

The middle Grandview adit and the lower Last Chance adit were much more challenging. These adits were situated mid-cliff and only had flat target areas of about 8 feet wide trails right next to the cliff. The helicopter was able to hover very near the cliff wall and place these cargo nets and gates right on target. One or two feet off and our gear would be bouncing down the canyon, but the helicopter pilot is an expert and our gear arrived safely. This successful delivery also shortened our schedule as we had originally planned to drop all our gear and gates on top of the mesa and lower it over the edge by roped haul systems.

Helicopter Hauling Equipment to Last Chance Adit

Once the gates and tools are onsite, each team would fit the gate to it's specific location in the adit. Normally the gate would need to be trimmed or expanded depending on the adit walls. Trimming is done with the "portable" cutting torch as shown in the photo. When our middle Grandview mine adit torch broke, we had to shuttle this 70 pound "portable" cutting torch up from the lower Last Chance Adit. Fortunately, we planned ahead and brought along backup tools. Depending on the airflow of the adit, sometimes it is best to do torch trimming work outside of the tunnel.

Large gates such as this one require two to three workers to manuever the gate into place. The hammer drill used for drilling holes for the mounting pins, also acted as a chissel for widening spots along the adit walls. Large prybars and light sledehammers are also useful pursuading the gate into it's final position.

Trimming Bat Gate

After the gates are fitted at their specific location in the adit tunnel, the walls are marked for the mounting pins. In this picture we are drilling one inch holes that will hold the mounting pins for the gate. These 12 inch long pins are then pounded into the wall and later clamped and welded to the gate. Much longer pins are placed into the floor and are also welded to tabs on the base of the gate.

Note the safety gear worn by the driller. Any underground work requires the use of approved caving helmets with mounted lights. Safety glasses, respirator and high traction boots are standard gear for this project. Each of our team members are vertical cavers with Grand Canyon experience. Additional training included MSHA mine safety training, NCRC cave rescue, BCI mine gating training, and Bat Gate installation experience.

Drilling Holes for Steel Mounting Pins

Since this mine had a high amount of copper, many interesting copper based minerals have been found at this site such as Malachite and Azurite. As you walk around the mine workings watch the ground for blue rocks. This is Azurite which the miners would look for as an indicator of weathered copper sulfide ores. The green rock is Malachite and is another good clue for the miner on where to dig for copper ore.

This image shows the final mounting work of the middle adit of the Grandview mine.

Bat Gate Mounting.

Excess steel is trimmed off with the torch, and mounting pins are welded to the gate frame. The outside edge of the frame is checked for gaps along the adit wall, and extra steel braces are welded in place as needed. Any rough edges near the bat flyway gaps between the bars are ground smooth. Rough and sharp edges on a bat gate can tear bat wings as they fly through the portal.

This mine adit had a variety of historical artifacts in the tunnel. These included a functioning ore car that rolled freely along the narrow gauge rails. We moved this car foward out of the deep mine so that visitors could view the car from behind the locked gate. We also placed a historic digging pick and digging bar next to this mine car. During bat surveys we found the remnants of a burlap sack with the lettering "G V Hotel" stenciled on the side. This sack is from the Grandview Hotel that was located at Grandview Point above the mesa. In the early days of grand canyon visitation, this hotel was a very popular spot. Many tourists would stay at the Grandview Hotel and hike down to the mine workings of the Horseshoe Mesa. Many historic signatures from the turn of the century can be found on walls throughout the mesa.

The photo below is the final view of the upper adit of the Grandview mine. The original entrance shoring timbers of this mine have been rebuilt over the culvert entrance. The excess timbers are stacked outside as if ready for a 1900's shoring project.

Culvert Gate with Historic Shoring Timbers

The 30 inch culvert will provide stability for the collapsing entrance, and ensure a portal for the Townsend's Long-eared bat colony using this entrance to the mine. To avoid later infilling, the entry path leading up to this portal has been dug down in a sloping manner so that water drainage flows away from the entrance.

The view below is of the final gate in the middle adit of the Grandview Mine. Note the heavy lock box on the left side of the gate, and the customized outer frame contouring the tunnel walls. Installation of all three gates were completed in about a day and a half to minimize impact to the park.

Further reading about the history and geology of these mines can be found in these excellent books, “Quest for the Pillar of Gold”, Billingsly, 1997, and “Hiking the Grand Canyon's Geology”, Abbott, 2004.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