Engineering
UPDATE©

MARINO ENGINEERING ASSOCIATES, INC. • Issue 1

From Research to Practice

In research, the funding provider must have trust in the researcher, otherwise the study can not be properly performed. In other words, there must be trust that funds are expended properly and that the tasks are proposed and performed from the most aware position.

This trust is needed when embarking on scientific research with a known objective because one is confronted with many unforeseen crossroads as the work progresses.

Therefore, choosing the researcher is the most important aspect and the decision should be made on the basis of the individual's valuable products and not to false standards such as academic or political authoritative titles. Valuable products in this area can be defined as those things that provide beneficial service to the industry in question.

In other words, even though the funding provider goes to great expense to achieve a worthwhile research objective, it can all be for naught if the selected researcher is not sufficiently competent. The results can be as extreme as complete failure that blocks further research to utter success with additional future potential. All researchers are not created equal. Further, just because a person has a Ph.D., 20 years of experience, and is an academician does not make him a good researcher.

Gennaro G. Marino Ph.D., P.E., D.GE

SUCCESSFUL DEEP MINE BACKFILLING TO MITIGATE MINE SUBSIDENCE

The purpose of this project was to significantly reduce or eliminate the mine subsidence potential beneath a number of Phase II structures at the Wabash Valley Correctional Institution (WVCI) in Carlisle, Indiana. From the study conducted by Gennaro G. Marino Engineering Consultants, the Indiana Department of Administration Public Works (DAPW) determined that mine backfilling was the most cost-effective solution for mine subsidence remediation of certain proposed structures.

As shown in Figure 1, existing Phase I structures were just north of the Phase II construction. Contrary to Phase I, many of the Phase II structures were undermined. Therefore, because of the approximately 300 ft. deep abandoned mine void, there was a significant potential for mine subsidence that could result at a number of the proposed Phase II structures. History shows that a structure ill prepared to handle mine subsidence performs very poorly with the associated damage resulting in abandonment of the structure. In order to limit the possible subsidence damage and to ensure safe operation of the structures, mine backfilling was performed in mine areas labeled Mine Areas 1, 2, and 3 which were subjacent to critical Phase II structures (see Figure 1).

Based on drilling information collected, Mine Area 1

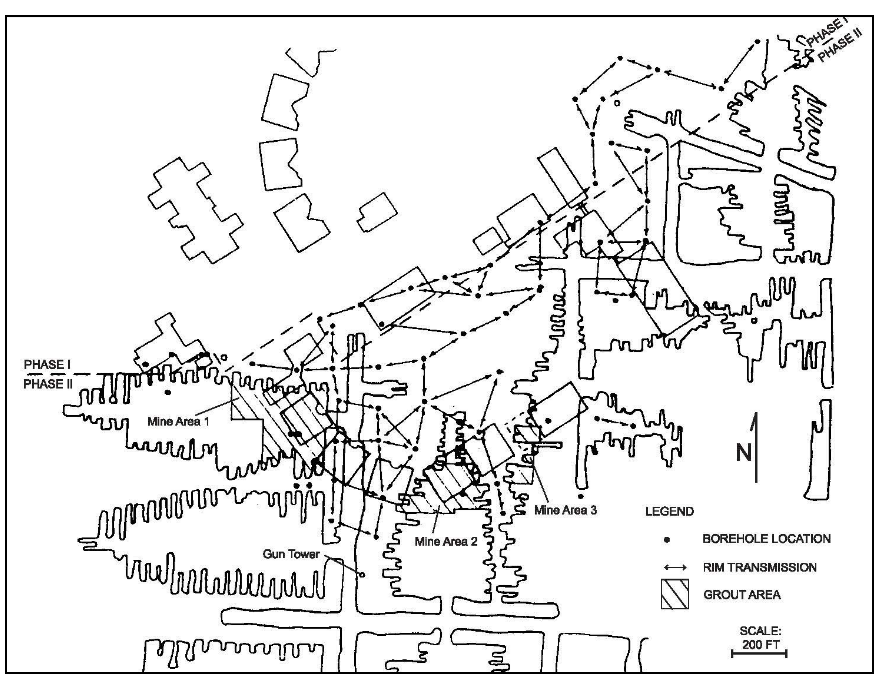

FIGURE 1 PLAN OF PHASE II CONSTRUCTION WITH OUTLINE OF MINING AND MINE AREAS THAT WERE GROUTED

contained more roof cave than Mine Area 2. Mine Area 3 appeared to have the most fall. This area, however, was small in comparison with the other two areas. The effect of the additional amount of rubble in the mine seemed nominal, as there was no substantial change in the grouting operation from Mine Areas 1, 2, and 3.

During the grouting operation, each mine area was first contained by strategically placing containment grout in certain entries and crosscuts. Once the mine areas were significantly contained, they were pumped with infill grout (which was lower in cost and more flowable than containment grout). Infill grouting generally proceeded across the mine with each injection hole grouted to refusal. In some highly rubblized areas, some retarder/plasticizer (calcium lignosulfonate) was used in the grout to increase penetration.

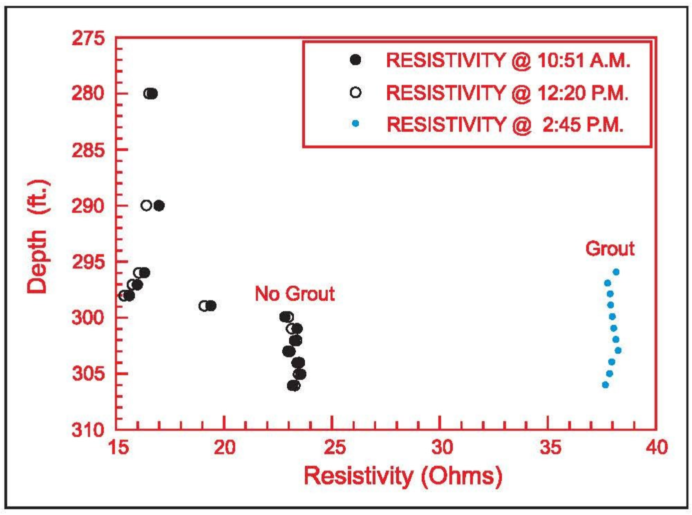

FIGURE 2 RESISTIVITY PROFILE USING ELECTRICAL PROBE (RESISTIVITY PROBE)

Once the grout operation began, the grout movement was monitored in adjacent holes by using electric resistivity probes (see Figure 2). Most of the holes were pumped to refusal. Refusal could not be achieved by only working the day shift despite pumping grout at typically 30-40 cy/hr., and so multiple shifts were necessary. Grout line refusal was taken at 600 psi or greater.

After the grouting operation was finished, core samples of the grouted zones were obtained for the verification. In-hole water pressure tests were conducted in grouted mine areas with low recovery. All tests were at refusal. The results obtained from the verification process showed the success of the operation.

At the completion, 9,559 cy of cement-flyash-sand grout was injected and 41,349 LF of drilling was performed. By implementing this backfill procedure, the potential subsidence at certain Phase II structures was suppressed at the prison site at Carlisle, Indiana. The backfilling was found to be significantly more cost-effective than designing each structure to be subsidence resistant.

Other Engineering UPDATES of Interest:

UPDATE 6: Subsidence Mitigation by Combining Foundation Treatment with Deep Mine Grouting

UPDATE 21: Mine Subsidence Damage During Construction of Medical Center and Remedial Measures Taken

UPDATE 24: Anatomy of Grouting Mine Voids

ABOUT MEA: Marino Engineering Associates, Inc. focuses on engineering research, practice and expert evaluations and is licensed in 24 states in the U.S. Our projects primarily have an emphasis on Geotechnical Engineering, however, we also have significant experience in projects involving transportation, subsidence engineering, laboratory testing, training, and geophysical exploration. Gennaro G. Marino, Ph.D., P.E., D.GE is president and principal engineer of Marino Engineering Associates, Inc., and has been a licensed professional engineer since 1984. To obtain additional information on MEA, one can also visit our website at www.meacorporation.com.

FOR MORE INFORMATION: There is a significant amount of additional information that is available on the above subject. For more information, please contact Dr. Marino at the address listed below.

1370 MCCAUSLAND AVENUE, ST. LOUIS, MISSOURI 63117
PH: 314.833.3189 FAX: 314.833.3448
http://www.meacorporation.com