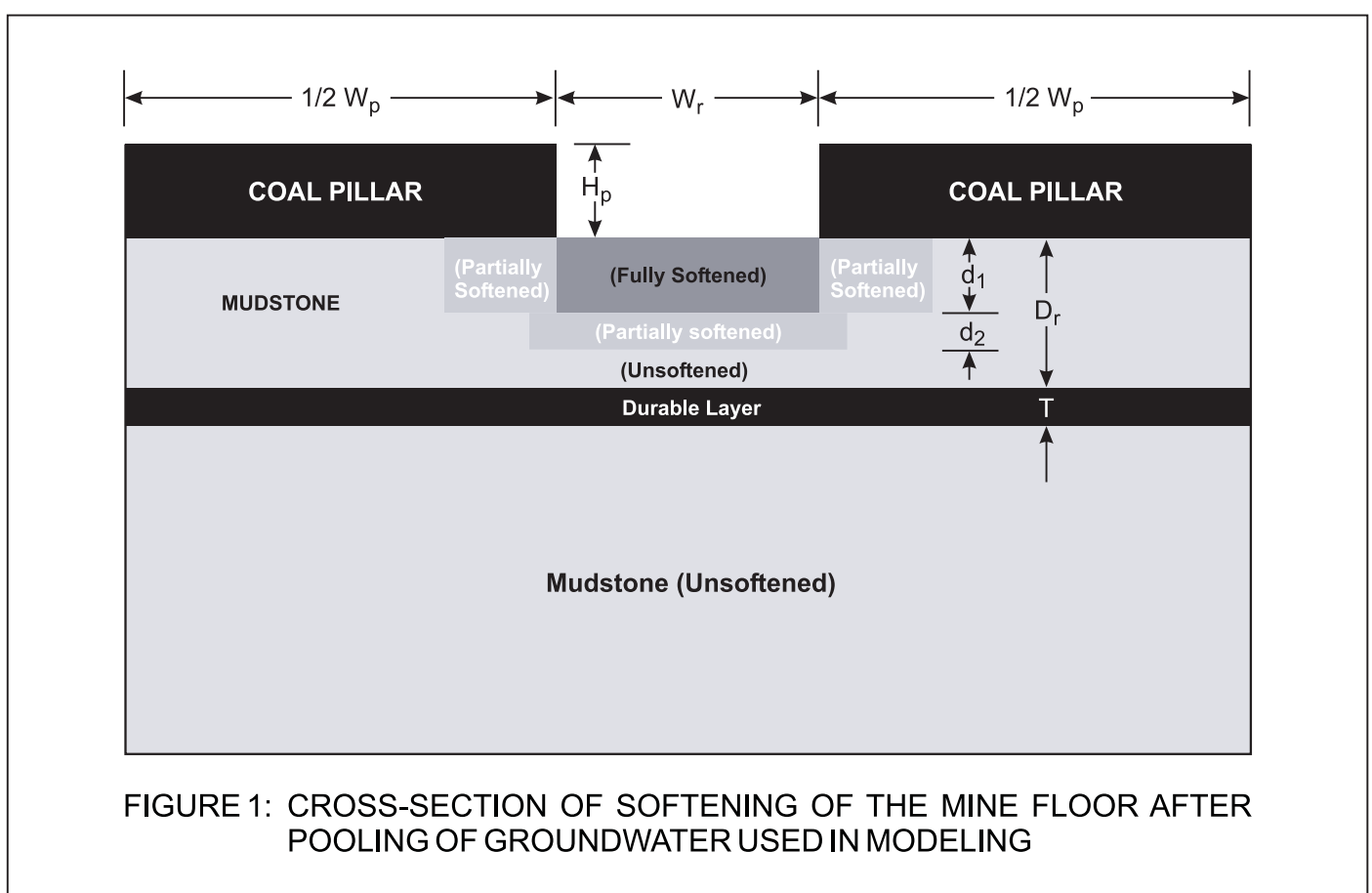


## SMART COAL EXTRACTION WITH VARYING SOFT FLOOR CONDITIONS

Conventional methodology that is used in mining of coal determines an overall extraction ratio for the mining of a coal reserve. The use of a uniform production extraction ratio creates inefficient removal of coal. Inevitably, because of variations in mine depth and mine geology, some areas of the mine will be over-designed, and some may be under-designed which may result in failure leading to surface subsidence.

When coal seam conditions remain relatively consistent throughout the coal reserve, mine stability and thus the variability in allowable extraction depend upon the soft floor conditions. Based on our experience, there can be significant variation in floor conditions across a reserve resulting in variations in the allowable coal extraction rate. It should be noted that room roof failures are of no concern because such failures are not expected to express themselves on the ground surface when the room-and-pillar mine is greater than about 165 ft deep.

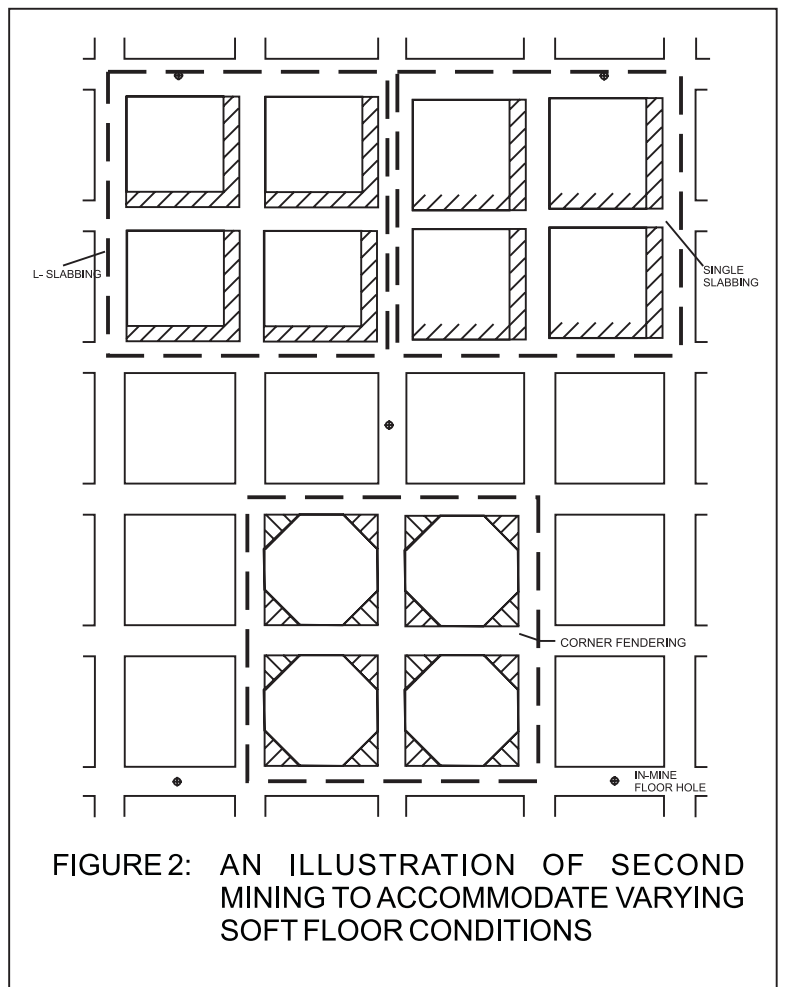
In assessing the floor bearing capacity, the softening of the most immediate fine grained rocks is considered because there will ultimately be groundwater pooling on the floor. The softening effect of the floor does not lend itself to conventional bearing capacity formulae, however. These formulae assume that the weak floor layer(s) are homogenous. With the soaking and softening of the fine grained floor from pooling of groundwater, the stiffness and strength of the floor will vary considerably from the room to under the pillar. Consequently, a fully softened condition will be present in the room, a partially softened condition around the periphery of the pillar, and an unsoftened condition under the core of the pillar if the pillar is sufficiently wide. An illustration of these states of softening is depicted in Figure 1.



Rock mechanics testing and numerical analysis for the various floor conditions present across the coal reserve are performed to determine the softened floor bearing capacity. By considering the weak floor conditions across the reserve, the allowable extraction ratio is then determined.

During one MEA project the softened floor conditions across the coal reserve resulted in allowable extraction ratios that ranged up to 1.6 of the minimum value. In other words, the mine could not be efficiently designed using only one production extraction rate. Therefore, because of the variable floor support conditions, mining at the minimum extraction ratio with secondary mining, executed after data is gathered by in-mine coring of the localized floor, was recommended. The extent of second mining is then determined by the localized floor conditions and mine depth.

An illustration of the proposed secondary mining is provided in Figure 2.



### Engineering UPDATE Issue 21 Correction

Due to a publication error, the complete text of the article titled "*Mine Subsidence Damage During Construction of Medical Center and Remedial Measures Taken*" was not included in Engineering UPDATE Issue 21. We regret this error and invite you to read the article in its entirety on our website: [www.meacorporation.com](http://www.meacorporation.com). Once you are on the site, choose "Updates" and then select Issue #21.

### ABOUT MARINO ENGINEERING ASSOCIATES, INC.

MEA is a leading expert in mine subsidence engineering. With 30 years of experience, MEA's staff has provided services across the full scope of mine subsidence engineering, including significant work in research, site subsidence studies, mine stability design and failure analyses, prediction of subsidence displacement and damage potential, subsidence damage evaluation, repair design, and mine grouting design and monitoring. Being foremost in this field, MEA staff have authored over 70 publications on related topics and have worked in coal fields across the U.S.

MEA has also been hired by coal mining companies and others to provide consulting services on active or new operations for both room-and-pillar and longwall mining. These services are included in those listed above. Because of the amount of coal mining related work MEA has done, it has designed and developed a cross-hole radar to detect mine voids for cases where mining may exist.

Located in the Midwest, MEA's clients include government, public agencies, private businesses, and insurance companies who have presented a variety of challenging and interesting projects that have included mine subsidence, complex foundation conditions, underground structures, specialized earthquake damage and evaluation training, damage investigations of pavement and structures, subsurface investigations, specialized laboratory testing, and construction difficulties.

Just minutes from the heart of the University of Illinois Engineering campus, Marino Engineering Associates utilizes the wealth of research resources and personnel available in an advanced technology environment. In addition, MEA maintains strong business relationships with professionals in related fields. Marino Engineering Associates, Inc. is also uniquely positioned to address the diverse Geotechnical and Pavement Engineering projects present in today's environment.

### FOR MORE INFORMATION

There is a significant amount of additional information available on the above project. For more information please contact Dr. Gennaro Marino at the address listed below.

### ADDITIONAL COPIES

If you know of someone who would like to receive a copy of Engineering Update, please contact us at 217-384-2288.

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