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ASSESSMENT OF CRITICAL FACE TRAVEL BENEATH SURFACE STRUCTURES

As coal is extracted by longwall methods, a dynamic subsidence wave is created at the ground surface. The speed of the subsidence wave depends on the rate of face advance (see Figure 1).

Where surface structures exist over the longwall panel, one concern may be the face locations which could cause damaging movements. This was the case on one recent MEA project.

The critical length of face advance, which can cause damaging subsidence movements, was assessed by evaluating the allowable ground surface distortion levels relative to the face location. Of course, the level of tolerable subsidence movements depends on the sensitivity of the structure in question. Both the horizontal and vertical components of the subsidence movement can cause damage and different structures have different levels of sensitivity to each. Two important vertical distortion characteristics of the subsidence profile are the change in the slope and curvature of the ground. The induced curvature of the ground or a structure is typically measured in terms of either the angular distortion or deflection ratio (see Figure 2).

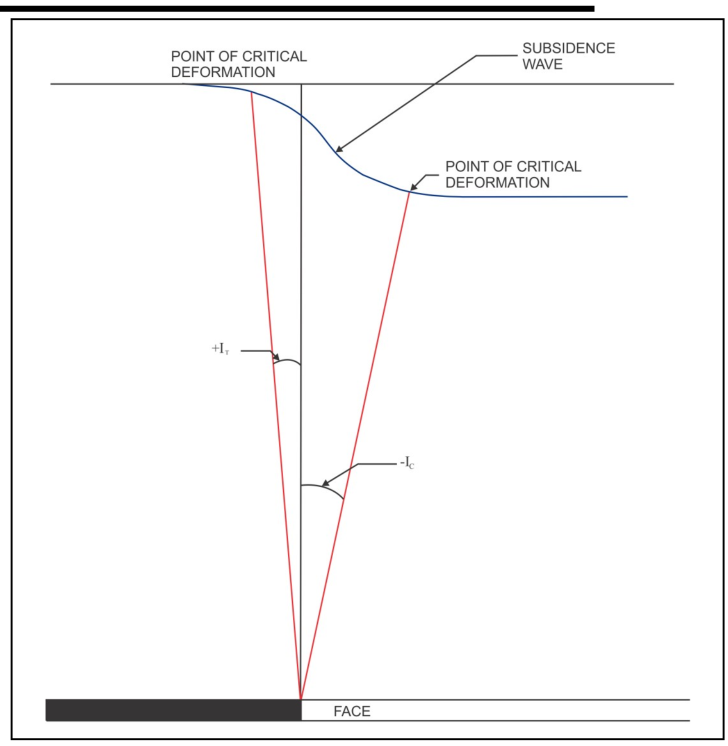

FIGURE 1 RELATIONSHIP OF LONGWALL FACE AND SUBSIDENCE WAVE

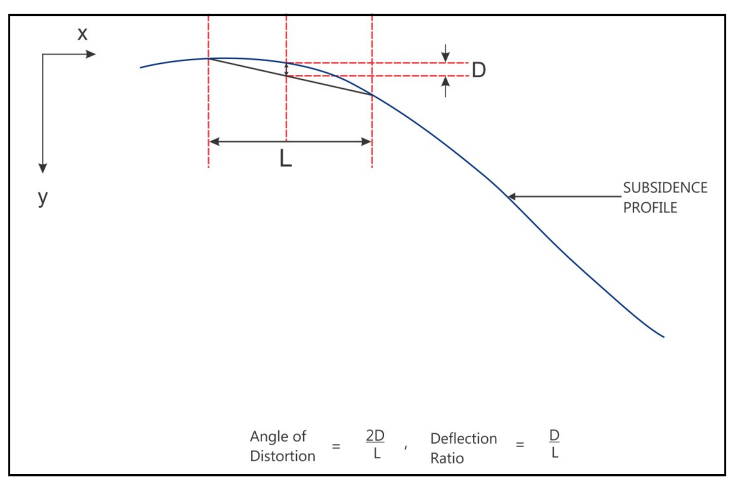

FIGURE 2 AVERAGE SLOPE AND ANGULAR DISTORTION (DEFLECTION RATIO) MEASUREMENTS ALONG A SUBSIDENCE PROFILE

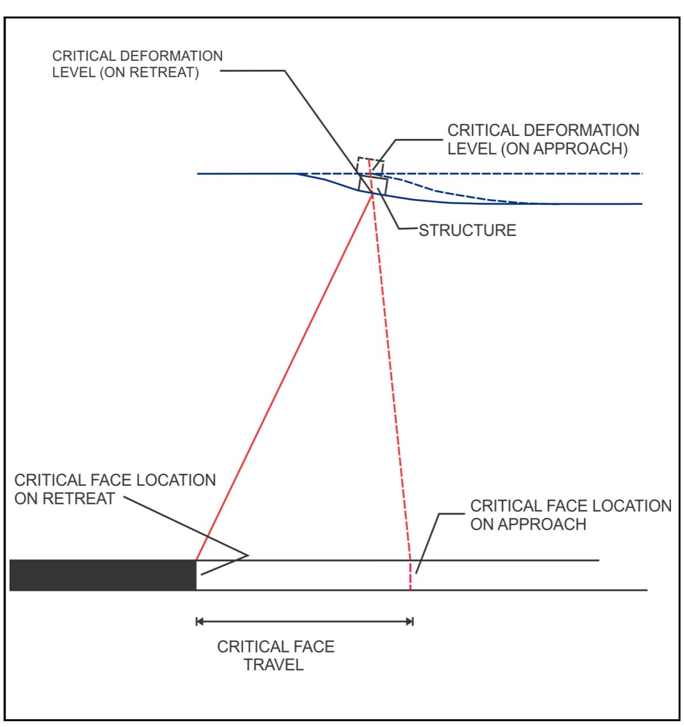

FIGURE 3 ASSESSMENT OF THE FACE TRAVEL UNDER A STRUCTURE WHICH RESULTS IN DAMAGE

Given the allowable distortion level and knowing the face advance rate, the time that a structure will be exposed to damaging subsidence movements was estimated.
The more sensitive the structure, the greater the face advance and time when significant damage can result. The critical length of face positions is

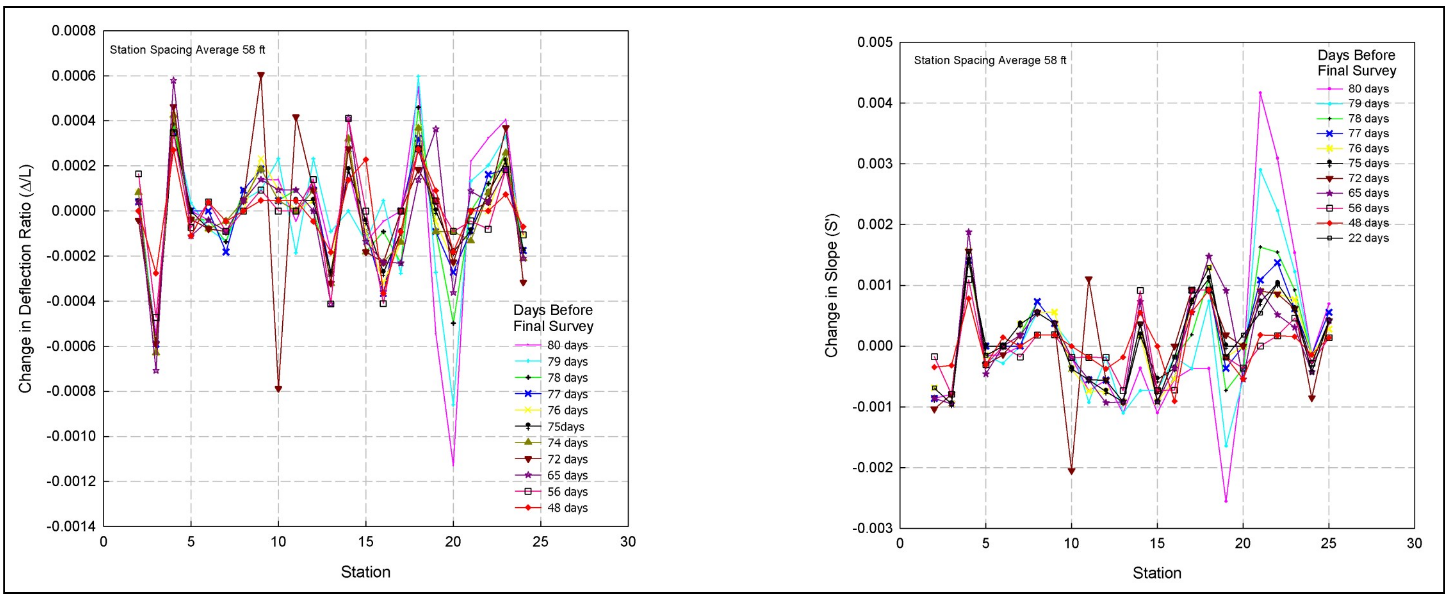

FIGURE 4 CUMULATIVE CHANGE IN DEFLECTION RATIO WITH TIME FROM FINAL SURVEY ACROSS A PANEL WITH FACE IN RETREAT POSITION

illustrated in Figure 3.

Example plots of assessing the change in slope and deflection ratio of the ground surface are shown in Figure 4. As can be seen in these plots, the greater the number of days before the final survey, the greater the distortion level and depending on the structural tolerances, the longer the wait before repairs can be effectively accomplished. From such plots, the critical face location and the associated angle of influence were then determined for prediction of the damaging face advance locations.

In summary, a method is presented above that has been used to estimate the location of the advance of a longwall face which can result in damage to an overlying structure. This methodology can be used to determine when mitigation measures would need to commence and when repairs can be made, as well as determining the duration of damaging subsidence movements.

Other Engineering UPDATES of Interest:

[UPDATE 22: Smart Coal Extraction with Varying Soft Floor Conditions]

[UPDATE 14: Establishing Mine Subsidence Risk]

[UPDATE 10: Borehole Radar Determines Solid Coal and Mined-Out Areas]

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

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