

Progressive Mine Instability and Subsidence Response: A Case Study

Gennaro G. Marino, Ph.D., P.E., D.GE
Marino Engineering Associates
1101 E. Colorado Ave.
Urbana, IL 61801
(217) 384-2288
gmarino@meacorporation.com

Abstract:

In a fairly active area of mine subsidence in Illinois, an investigation was done to evaluate the condition of a care facility which had been subjected to ground surface subsidence. The investigation included assessing the subsidence activity in the area and historical mining data, drilling and sampling into the old underground coal mine, performing mine stability and subsidence-structure interaction analysis, assessing the existing subsidence and damage conditions, as well as the predicting of future subsidence and damage potential.

When this investigation began, it was found that the care facility was subjected to a subsidence sag event. With respect to this event, the structure was exposed to the tension zone ground movements. According to a rock mechanism analysis performed, the subjacent mine collapse induced subsidence was the result of a floor bearing failure which occurred over 60 years after the mining took place. The thickness of the weak mine floor material was found to be too large to support the pillars in the long-term.

After the onset of this first subsidence event, the progression of movements and structure damage had been monitored over a 10 year period. During the monitoring period, a second subsidence event was discovered to have begun affecting the structure, again with tension zone movements. The primary subsidence damage experienced by the structure consisted of severe cracking and separation of the exterior brick and floor slab/foundation, severe racking of doors and windows, and significant interior utility and ceiling damage. A relationship was found between angular distortion of the ground subsidence profile and the intensity of the building damage over time.