

ABSTRACT

The Analysis of the Stability of I-196 Interstate over the Domtar Gypsum Mine, Grand Rapids, Michigan

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Gypsum mining started in Grand Rapids, Michigan in the 1850's primarily through shallow underground mines. As the city of Grand Rapids grew a number of buildings as wells as roads and other lifeline structures have been constructed over these mines. As with new mining regions smaller mines eventually consolidated into larger mines. This occurred in Grand Rapids where two eventually emerged; the Butterworth Mine, which closed in the 1970's and the Domtar Mine, which closed in 1998. A nearby mine, the Kentwood gypsum mine adjacent to Grand Rapids in the city of Kentwood Michigan, started in the mid-1970 but closed in 2000. All three of these mines have road overlying these mines. The most important road system overlying the mines is I-196, a major part of the interstate system for Grand Rapids. I-196 crosses over approximately one half mile of the Domtar mine, which is at a depth of between 90 and 120 feet (27 to 36 m) below I-196.

The Domtar Mine was in operation for 146 years prior to closing in 1998. In 1976 the mine, then known as the Grand Rapids Gypsum Mine, closed but was later reopened in 1984 as the Domtar Mine. Unfortunately, many of the mine records were lost during that time. It was determined, though, that the section of the mine in which I-196 is located over was mined prior to 1945, while I-196 was constructed later in 1963. Inspection of the Michigan Highway Departments records concerning I-196 found no records addressing the long-term stability of the section of I-196 over the mine. The records that were found, however, indicate that both the mining company and Michigan State highway personnel were concerned about possible instability of I-196 due to the mine. In fact, inspections of the mine in 1962 below the proposed interstate route found significant roof collapse and general mine instability. However, the interstate was still constructed over the mine with no apparent remediation to the mine. Since construction of the interstate through the present, though, no distresses have been observed to I-196.

In 2003, Kent County, where Grand Rapids is located, proposed that the County Zoo be moved from property adjacent to I-196 on the east side to the west side of I-196, which is over the Domtar Mine. A bridge was proposed that would connect the existing Zoo with the proposed new Zoo location over I-196. An analysis of the Zoo site indicated a number of sinkhole had formed with some being very recent. Based on the formation of these sinkholes as well as the underground mining methods used under the proposed Zoo, the site was abandoned. However, this study raised the question concerning the long-term stability of I-196. The purpose of this paper will be to present the current analysis of the long-term stability of I-196 over the Domtar Mine. This assessment will include an analysis of the stability of the mine pillar and roof system and the potential for sinkhole development that might affect the stability of I-196.