

## Monitoring Movement of Buildings Adjacent to an Excavation A Case Study

### BACKGROUND

Releases from an underground fuel storage tank contaminated soils and groundwater near the outlet of the Clam River into Torch Lake. The fuel storage tanks were removed years ago but the contaminated soils and groundwater remained at the site. Much of the contamination was beneath a county road.

Removal of the contamination was needed to protect the affected properties, the Clam River and nearby Torch Lake. However, the close proximity of homes, garages, and an active business (Butch's Tackle) prevented conventional dig and haul work to remove contaminated soils.



Site sketch showing proximity of the proposed pile walls to the buildings

A system of piles and building underpinning was proposed to support the buildings and isolate them from excavation activities to remove the contamination. Some of the piling was installed within 6 feet of the existing building and the excavation was planned to extend 20 feet below the existing ground surface.

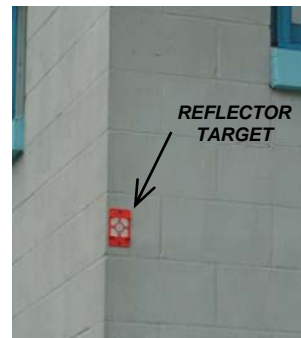
Because installation of the piling and excavation had the potential to damage the adjacent buildings, an accurate system was needed to monitor if construction activities were disturbing the buildings and their foundations.



Installation of underpinning system. Note targets attached to building siding.

### BUILDING MONITORING CONTROL NETWORK

Gosling Czubak established a detailed system to monitor any lateral or vertical movement of the buildings. Working as a subconsultant to Elmer's Crane and Dozer, Gosling Czubak's surveyors established a network of control points outside the active work area using centimeter level geodetic GPS receivers. The control network was referenced to the Michigan State Plane Coordinate System. Specialized reflector targets were placed on the Butch's Tackle building, a nearby house, and a garage. A total of 24 targets were installed (14 on the Butch's Tackle building and 5 each on the house and garage). These targets allowed



accurate measurements over the open excavations from the control network

Prior to the start of construction, two sets of angle and distance control measurements were made to each target. The specified accuracy

between measurement sets for the vertical and lateral movement monitoring points was  $\frac{1}{8}$ ". This accuracy was obtained by using a robotic total station and digital level for the measurements.

## LATERAL AND VERTICAL MONITORING

Measurements to each of the targets on the buildings were made and recorded daily during excavation. During pile installation near the buildings, measurements were made twice daily. After the excavation reached its planned depth, the measurements were made twice weekly.



Checking target on building for settlement with a digital level.

Initially, the only building movement observed by the monitoring has been a 1/4" increase in the building elevation caused by jacking the building columns against the underpinning system.



Ground vibration monitoring

In addition to the lateral and vertical movement, Gosling Czubak provided ground vibration monitoring during the pile installation and monitored cracks in the building masonry walls that existed prior to construction.



Monitoring existing wall crack



Pile wall installation

For more information about this project and construction surveys, contact David Gillette, P.S. at Gosling Czubak. (800) 968-1062.

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