

AND THE RAINS CAME TUMBLING DOWN

A GEOSPATIAL ANALYSIS OF ROAD WASHOUTS IN ASHLAND CO. WI

On July 13, 2016 northern Wisconsin experienced a significant rainfall event. As much as 10 inches of rain fell over a 24-hour period resulting in widespread flooding and road closures*. Several of these roads sustained substantial damage, and in some cases were washed out completely. State Highway 13 in Ashland County was just such an example. Ayres Associates was on scene shortly after the event to fast-track design services in order to determine if it was necessary to replace washed-out culverts with bridges having greater capacity to pass floodwaters. As part of these services terrestrial LIDAR data was acquired from an HD Scanner to give a 3D representation of the damage.

In addition to the 2016 data collection, Ayres Associates acquired traditional airborne LIDAR data at 4 points per square meter and 6" imagery as part of the Wisconsin Regional Orthophotography Program (WROC) program in 2015. From this data a 1-foot digital elevation model (DEM) (figures 1 and 2), and 6" orthophotography were produced which were used in an analysis along with the terrestrial LIDAR data to compare the pre and post event surfaces. The DEM derived from the post-flooding data shows the dramatic washout on the part of State Highway 13 crossing Silver Creek (figures 3 and 4).

Routines also were run in which the pre-flood DEM and post-flood DEM were further analyzed for topographic change. The resultant surface displays areas where land was either lost or gained (figure 5). In some areas the washout resulted in an elevation change of almost 30 feet! This topographic change detection provides a quantitative way of analyzing how much material was lost and potentially where it was moved to.

The pre-flood and post-flood surfaces were also run through a cut/fill analysis which displays exactly how much material was lost or gained in specific areas (figure 6). This analysis provides particularly useful information in regards to the costs of potential reconstruction. Up to 20,000 cubic yards of material were washed downstream, some of which was deposited on higher ground just south of the highway. Considering a standard dump truck of fill contains roughly 13 cubic yards of material it can be surmised that roughly 1530 loads of material would need to be hauled in to rebuild this section of the road. This cost can be compared to the expense of building a bridge or perhaps taking other measures to re-open this important stretch of road.

The topographic data can also be used to visualize pre and post-flood scenarios. The representations on the right depict the 6" orthophotography acquired in 2015 draped on the elevation surface both pre (figure 2) and post flood (figure 4). These visualization tools give a "real world" perspective and help convey the impact of natural disasters such as this.

* <http://www.weather.gov/dh/fash-flooding-2016-07-11>

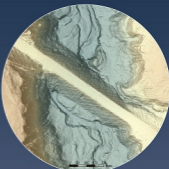


Figure 1 - Surface of Highway 13 before the flood. DEM from aerial LIDAR mission in 2015.

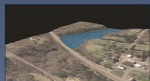


Figure 2 - 3 dimensional image drupe depicting the damming of floodwaters behind Highway 13 prior to the breaching (southeast facing)

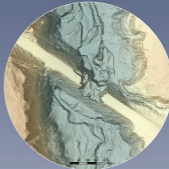


Figure 3 - Surface of Highway 13 after the flood. Hybrid DEM from aerial LIDAR mission in 2015 and terrestrial LIDAR survey on July 13, 2016.



Figure 4 - 3 dimensional image drupe depicting the breaching of Highway 13 by floodwaters (southeast facing)

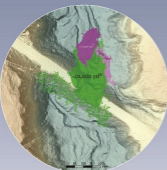


Figure 6 - Volumetric Analysis (Cut/Fill) depicting cubic yards of material lost or gained

Read more about the Road Damage and the Ayres response here -

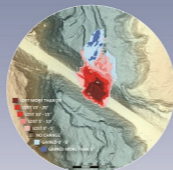


Figure 5 - Topographic Change Detection comparing pre and post flood surfaces

Read more about Topographic Change Detection here -



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A picture is worth a thousand words...
The extent of the damage to Highway 13 at Silver Creek

