Proselytize LIDAR, Please!

The United States Geological Survey (USGS) 3D Elevation Program (3DEP) is now in full swing. 3DEP is an expense sharing program with the goal of collecting high quality LIDAR data for the conterminous United States, Hawaii, and the U.S. territories with Alaska being covered by synthetic aperture radar (SAR) elevation data. The goal is to acquire these data over an eight year period and, one would assume, to repeat ad infinitum.

This is generally a cost sharing program where the direct beneficiaries (e.g. state and local government agencies) share the data acquisition cost with the USGS. The USGS states that about 50 million dollars will be expended by all public agencies on LIDAR data acquisition in FY-2015, a shortfall of about 96 million. This says that the estimate of expenditure needed to fully implement the 3DEP schedule is about 146 million (FY-2015 dollars) per annum.

Just last week I was visiting with one of our customers, the Tennessee Office of Information Resources (OIR), who is spearheading a 27 county 3DEP co-funded LIDAR acquisition that will provide Quality Level 2 (QL2) coverage of some 11,500 square miles. Among many specifications, QL2 data have a nominal point density of 2 points per square meter with a vertical Root Mean Square Error of 10 cm. The funding is being provided as 25% USGS, 50% Tennessee state agencies and 25% by a collection of 8 state and federal partners (such as the Tennessee Valley Authority). The data will be housed and managed by the OIR.

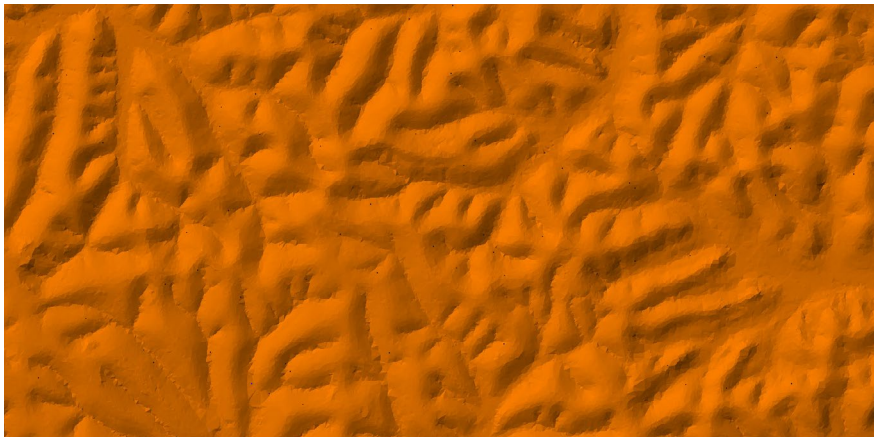

Figure 1: Bare Earth model of a section of Davidson County, TN

In discussions with our customer, I realized that they had to "sell" this program to enough potential "customers" to bring the funding to a level sufficient to warrant a program. I had not really thought very much of our government customers needing to be sales folks—I thought that was strictly a commercial necessary evil!

I was fascinated by this idea of selling a data collection concept and asked a lot of questions along the lines of return on investment for the contributing agencies. How do you convince a state agency, already strapped for resources, of the value of 3D data? This led to a discussion of the value of LIDAR point cloud data in general, as compared to simple gridded elevation models. This issue is of wide interest and, I believe, will be essential to answer if the 3DEP program is to receive sufficient local funding to remain viable.

Bare earth elevation data (with hydro enforcements) are the critical base data needed to perform flood plain modeling. An example of a section of a bare earth LIDAR model of Davidson County, TN is depicted in **Figure 1**. The problem with promoting bare earth models as the value proposition for LIDAR is that most agencies have been receiving moderate resolution (3 m) bare earth raster digital elevation models (DEM) for years. They see no advantage in having the classified LIDAR data. If these same agencies applied hydro breaklines to a LAS point cloud model of bare earth, they

would notice a transition from jagged, quantized DEM flow models to a much smoother triangulated irregular network (TIN) model. Therefore, there is great value in the point cloud version of bare earth; it just isn't realized.

Much better perhaps, is to move beyond simple ground models to some of the rich content inherent in point cloud data. Of course, the simplest use of the point cloud is data visualization (**Figure 2**). These sorts of views cannot be generated from either raster elevation models or digital ortho photos.

Finally, of course, is close-in planning and visualization. It is simply not possible to cut a cross-section through image data or even 3D Google Earth data and visualize at street level. The data provided in these views (e.g. **Figure 3**) provide a wealth of information that just cannot be obtained in any other manner save sending someone out to have a look. How do we develop convincing return on investment arguments centered on moving observations from the field to the office?

Of course, all of us readers of *LIDAR Magazine* are well aware of the value of these data and have been since the mid-1990s. However, the general use of 3D data by the ultimate consumers of GIS is still, unfortunately, in its infancy. I can still recall the resistance that the GIS community exhibited to digital image data. Objections such as "I cannot manage this much data", "I have great cartographic data that is a lot easier to interpret than image data", "my carto data is smart—this raster has no intelligence at all!" were quite common. Today it would be rare indeed to find a desktop user of GIS who did not constantly have a raster backdrop displayed.

Eventually point cloud data will form another layer of base mapping data that will be viewed as indispensable. I think it is incumbent on all of us "LIDAR folks" to continue to evangelize the value of true 3D data to the desktop GIS user. We keep pushing LIDAR data and still do not see a lot of "pull." Until we develop this pull demand from the desktop GIS analysis community, programs such as 3DEP will struggle to generate sufficient co-funding interest. Thus, go forth and proselytize LIDAR!

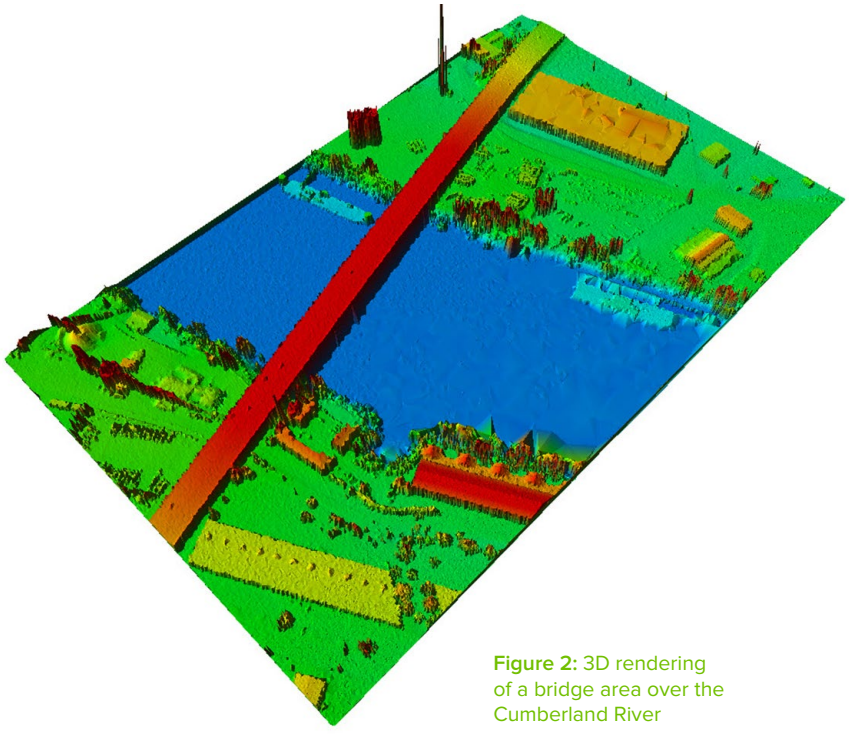

Figure 2: 3D rendering of a bridge area over the Cumberland River

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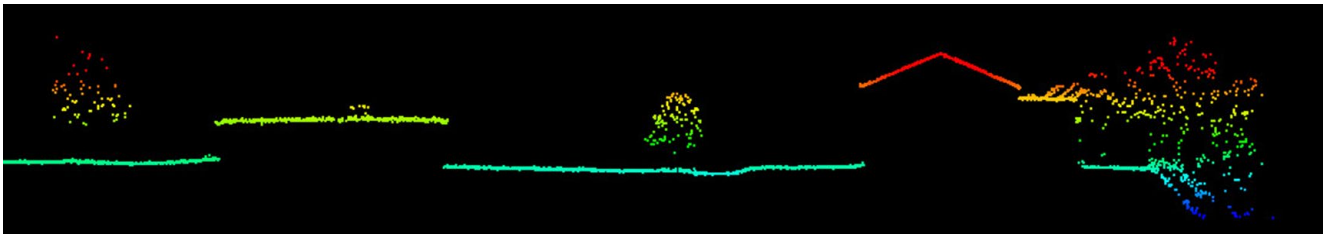

Figure 3: Cross section near the waterfront