3D Elevation Program and Pipeline Safety

High resolution lidar data are used in pipeline route siting, design, permitting, construction, and monitoring to promote public safety through reduction of risks. In particular, lidar data is used to identify safe routes for pipelines by analyzing terrain parameters and identifying and analyzing geological hazards (e.g., landslide and fault locations) and their potential public safety impact on the routing or design of pipelines. Increasingly, engineering companies and regulatory agencies are using lidar and other remote sensing techniques as an efficient method to collect accurate, comprehensive data along pipeline routes, while reducing risks to field personnel. The USGS 3D Elevation Program is collecting lidar data nationwide (IfSAR in Alaska) to support a wide range of applications, including infrastructure projects related to pipeline construction and safety.

Lidar uses to support pipeline safety include:

- **Pipeline route siting and permitting** – high resolution lidar-derived digital elevation models (DEMs) of proposed pipeline corridors are used in hydrologic and hydraulic modeling, floodplain mapping, identifying hazards to pipeline integrity such as erosion, landslide and fault locations, and permafrost thaw settlement impacts. Evaluation these factors are necessary to design the pipeline and meet the information needs of several required federal and local construction permits.
- **Spill impact analysis** – Lidar-based DEMs are used to model the extent of the damage caused by a pipeline leak, which is largely influenced by the surrounding terrain. Spill impact analyses can be completed for pipeline leak scenarios to predict the risks to sensitive ecosystems or populated areas.
- **Pipeline monitoring** – Lidar provides baseline terrain data for long-term monitoring after pipeline construction takes place. For example, lidar has been used to measure ground displacements from earthquakes or rainfall-induced landslides that are large enough to damage buried pipelines. Terrain characteristics and flood models derived from lidar can also be used to identify high-risk segments of a pipeline that merit more frequent monitoring.

Example Applications:

The Federal Energy Regulatory Commission (FERC) is an independent agency that regulates the interstate transmission of electricity, natural gas, and oil, and also reviews proposals to build interstate natural gas pipelines. In the 2012 National Enhanced Elevation Assessment (NEEA) study, FERC managers identified pipeline routing and National Environmental Policy Act (NEPA) compliance assessments as mission-critical requirements that utilize enhanced elevation data. In the NEEA study, FERC noted that the acquisition of high resolution lidar data by the USGS 3DEP initiative helps both FERC and applicants by providing accurate and consistent data for hazards analysis by both the permit applicant and FERC, accelerating the application and review process, and avoiding the much higher costs of acquiring elevation data specifically along proposed corridors.

In another example, the Alaska Department of Natural Resources is using lidar data to evaluate swaths of land that would likely be used if new natural gas pipelines were constructed in Alaska. The state is using the data to conduct analyses of the proposed pipeline routes to facilitate the design, permitting, and construction of the pipelines. The data are used to evaluate potential hazards such as faults, slope instability, thaw settlement, and erosion that could impact pipeline safety.

Reference Cited

Dewberry, 2012, Final report of the National Enhanced Elevation Assessment (revised 2012): Fairfax, Va., Dewberry, 84p. plus appendixes, http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment.

3D Elevation Program (3DEP)

3DEP is a national program managed by the U.S. Geological Survey (USGS) to acquire high-resolution elevation data. It produces point cloud, bare-earth digital elevation model, and other products.

3DEP is backed by a comprehensive assessment of requirements (Dewberry, 2011) and is in the early stages of implementation. The goal of this high-priority cooperative program is to have complete coverage of the United States by the end of 2022.

Reduced Acquisition Costs and Risks

A funded national program will provide:

- *Economy of scale* by acquiring data for larger areas and reducing acquisition costs by 25 percent.
- *Predictable, efficient, and flexible Federal investments* that reduce costs for and allow better planning by Federal, State, and local government partners, including the option of "buying up" to acquire higher quality data.
- *Consistent, high-quality data and national coverage* that provide data ready for applications that span project, State, and watershed boundaries, meet multiple needs, and increase benefits to citizens.
- *Simpler data acquisition* that provides contracts, published data acquisition specifications, and specialized quality assurance and information technology expertise. Partners reduce their risks and concentrate on their business activities.

3DEP can conservatively provide new benefits of $690 million/year and has the potential to generate $13 billion/year in new benefits through applications that span the economy (Dewberry, 2011). This shared, common elevation dataset would foster cooperation and improve decisionmaking among all levels of government and other stakeholders.

LEARN MORE about 3DEP
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