

## Western Water and Power Solution Bulletin

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### New Developments in Terrestrial Photogrammetry

*Performs detailed 3-dimensional measurements that save time and money, and improve safety*

#### What Is The Problem?

Collecting accurate, detailed measurements of difficult to access locations such as dam faces and abutments, rock fall areas and landslides can be time consuming, expensive, and dangerous. These detailed measurements include dimensions, topography (landforms), areas, volumes and rock face joint (crack) orientations. Traditional methods for data collection on steep terrain typically include specialized rock climbing teams. These climbing methods can be very expensive and dangerous.

#### What Is The Solution?

Terrestrial (land based) photogrammetry is a rapidly evolving technology used in a wide variety of industries. Typical applications include forensic analysis, architecture, manufacturing and most recently, geotechnical engineering. Commercial photogrammetry software was recently developed to specifically meet Reclamation's geological or engineering needs.

Terrestrial photogrammetry analyzes digital photographs using commercially available computer software to measure objects in three-dimensional space. The process includes 1) taking two or more photographs from different locations, 2) surveying "control points" on the photographed surface, and 3) performing a computer analysis of the photographic and survey data. The resulting model is a combination of the 3D image and a terrain model that can produce accurate, detailed measurements. Advantages over traditional methods include: 1) rapidly collecting vast amounts of accurate data, 2) providing for infinite measurements using only photographs and limited survey data, 3) eliminating or reducing accessibility obstacles, and 4) improving safety.

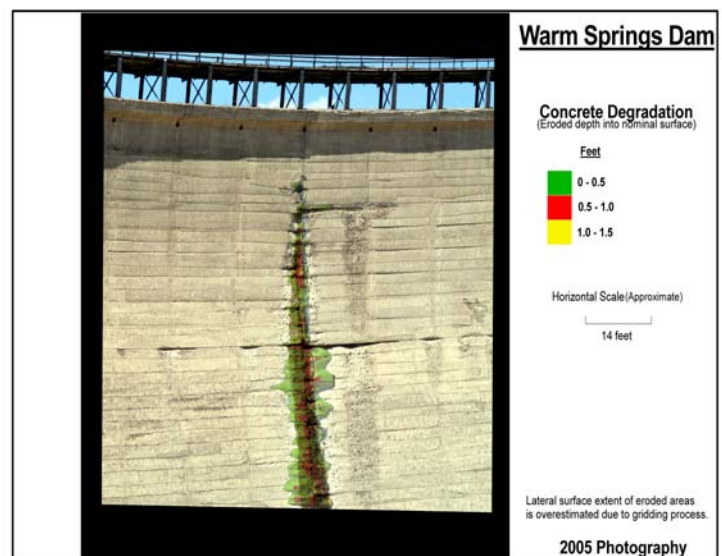
Reclamation is working directly with software engineers to steer the development of programs specific to its needs. Mapping of these features can now be accomplished quickly using low-cost equipment and specialized software. Obtaining accurate measurements of difficult to access rock faces can sometimes take weeks of field work, but terrestrial photogrammetry reduces field time to one or two days. Photogrammetry eliminates or reduces the use of rope access on steep slopes, and results in much more data of higher quality.

#### Who Can Benefit?

Terrestrial photogrammetry can be useful to anyone who performs surveys, measurements or mapping at any scale. It has been used to develop joint orientations, topography on steep rock faces, three-dimensional models of dams and spillways, document concrete deterioration on dams and river erosion, and many other potential applications.

#### Where Have We Applied This Solution?

Terrestrial photogrammetry has been applied at various sites including: East Canyon Dam, Arrowrock Dam, Crystal Dam, Hungry Horse Dam, Warm Springs Dam, Grand Coulee Powerhouse and work with the Colorado Department of Transportation. New projects are currently underway.



Example of 3D Image from Terrestrial Photogrammetry of Warm Springs Dam showing concrete degradation mapping

#### Future Development Plans

Reclamation will continue to work closely with the software developers to investigate new applications and improve data collection techniques. Research will transition to other infrastructure needs such as bridges and other structures.

#### More Information

Reclamation recently sponsored a Terrestrial Photogrammetry workshop and an associated report is available at: <http://www.usbr.gov/pmts/geology/goldenrocks.pdf>

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#### Collaborators

Reclamation's Science and Technology Program, Dam Safety Program, project-specific sponsors and software developers