

Facility Management of Reclamation's Dams – The Unified Intelligent Model

Facility-wide 3D modeling to advance comprehensive understanding and knowledge of Reclamation's dams and powerplants

Research Bulletin Science and Technology Program 9748

Reclamation set out to create a unified intelligent model of Glen Canyon dam and powerplant with BIM, laser scanning, photogrammetry and sonar. The prototype 3D model was created from the data collected in partnership with and using software from Autodesk.

Mission Issue

The unified intelligent model and collected data will be used to enhance facility knowledge and understanding for design, O&M, security, outreach and facility management. This project serves as a prototype to develop expertise, best practices, guidelines and procedures with applicability throughout Reclamation.

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Problem

Constructed in an age of slide rules and hand drafting, Reclamation's dams and powerplants were each created from thousands of individual engineering drawings. With current software and equipment and in partnership with Autodesk, Reclamation set out to create a unified intelligent model of a large infrastructure project – Glen Canyon Dam and Powerplant – to replace the 10,000 drawings currently used to manage the facility.

The project used Lidar and sonar scanning, CAD, BIM and photogrammetry to create a Building Information Modeling (BIM) model. When fully complete, this model will be utilized for design, O&M, outreach, safety, security, facility and asset management.

This project emphasized exploration and pushing the limits of technology to provide better information to facility managers and personnel to effectively manage, operate and maintain the facility into the future for the benefit of the nation.

Solution

To foster accurate point data and models, over 700 Lidar scans and 2000 photographs were collected. Lidar scanned locations included the dam exterior, powerplant interior and exterior, canyon walls, spillway intake structures, transformer deck and outlet works. Generating unit 6 was partially disassembled permitting scanning of most of the unit interior. After merging the scans, the overall accuracy from the top of the dam to the lowest powerplant level is approximately ± 1 inch. The Lidar point cloud containing hundreds of millions of data points provides a historical milestone which can be used as a near photo quality comprehensive as-built survey.

Photogrammetry and photos were collected by helicopter, by hand and a UAS flown inside the main generating room. A 3D photo model was created from these images. Sonar data for the reservoir between the buoy line and upstream face of the dam was also collected and a point cloud created.

The BIM model of the powerplant was partially completed. The standard component libraries were built as the basis for present and future model work. The main generating room and machine shop level, piping gallery and unwatering gallery base models were created. The models are connected to the Lidar point cloud to permit utilization for creating the existing components and systems.

“We are trying to understand how we can best supply water for the future of the nation – not only for the rest of this century, but beyond. The unified intelligent model is a tool that can be used by many different disciplines to help us better manage the facility into the future.”

David Winslow
Civil Engineer
Reclamation

Collaborators

Autodesk, Inc.

More Information

<https://www.usbr.gov/research/projects/detail.cfm?id=9748>

<https://www.usbr.gov/research/projects/researcher.cfm?id=609>

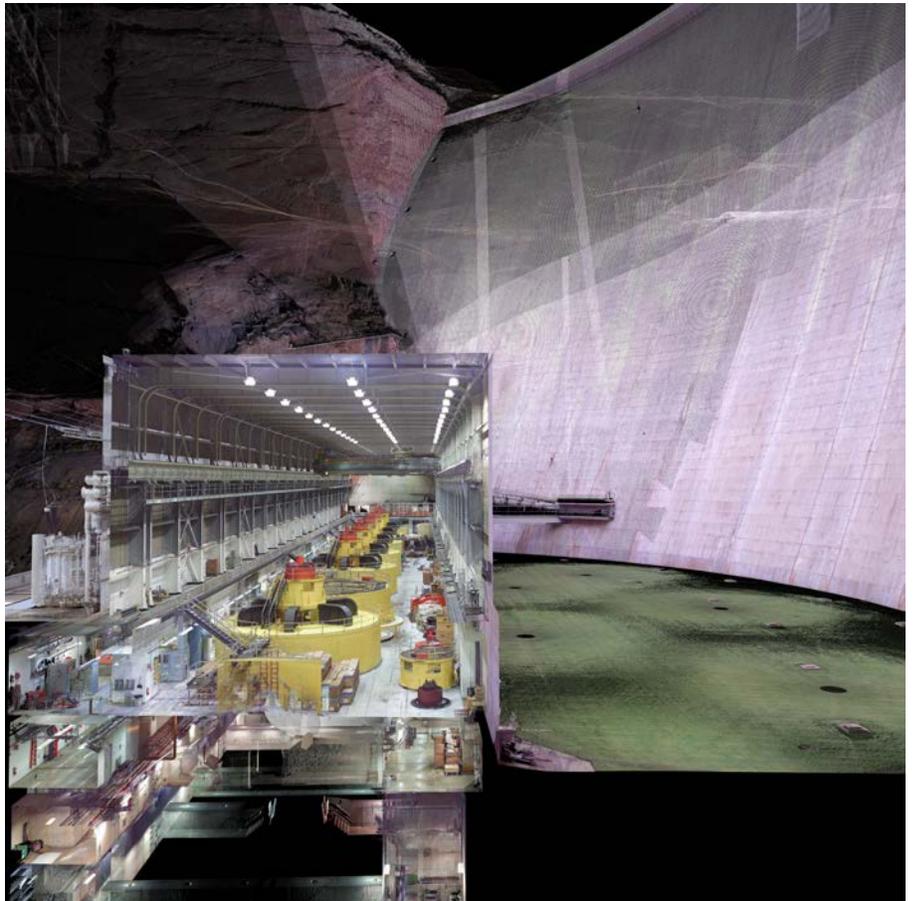
Application and Results

The research focused on Glen Canyon dam and powerplant where data was collected and merged to create several models:

- Lidar and sonar data was merged to create point clouds containing millions of data points.
- The photos collected were used to create a photorealistic model with associated wireframe mesh.
- Powerplant BIM model created from the merged point cloud which models all main powerplant levels.
- Renditions and videos of the data to increase the knowledge and understanding of Reclamation personnel.

Future Plans

The existing mechanical and piping systems will be added to the base BIM model. Electrical systems will be added as new designs are completed. The BIM model will be connected to CARMA and eDRAWS. When complete, the BIM model will be added to a user friendly, tablet application will to allow use of the data and additional digital information by facility management and personnel.



Section view rendition of Glen Canyon Dam and Powerplant.