

DEL047 - DAMSAFE Enhancing Dam safety and Reservoir Management in India

DAMSAFE project

Dams are critical components of the river basin infrastructure in India. There are 5187 large dams in India (4839 completed and 348 under construction). Many of these structures are old, maintained poorly and the knowledge on their actual safety and state of operation is limited. The dams are aging further, but are also facing different circumstances than when designed, often decades or more ago. The water reservoirs, created by these dams, are of vital importance to the rural and urban areas in India. They provide water for drinking, irrigation of the land (food production), are used to generate electricity (water and energy) and offer protection against flooding (safety).

The overarching goal of the pilot project is to enhance dam safety and water management in India, and at the same time, to strengthen the position of the Dutch water sector. This goal is achieved by deliverance of the following set of actions (summary):

- Pilot case of the Bhadra dam and reservoir to demonstrate risk-based dam safety analyses, online monitoring system, satellite deformation measurements and forecasting and early warning system (FEWS) by integrating Delft-FEWS software.
- Inviting local staff of KaWRD to the Netherlands for on-the-job training and capacity development.
- Organising sessions during the project execution with stakeholders, end-users and the wider water and dam safety community in order to demonstrate the participatory approach as well as to disseminate project results.
- Disseminate project results through scientific papers, conference presentations and a website
- Enhance cooperation between the consortium partners
- Identifying in-depth the potential for future application and upscaling.
- Reach out to new end-users (other dam owners and authorities) in India to generate business.

Project performance

The project started in December 2016, with the inception mission in May 2018. All project activities and deliverables have been finalized in April 2019. The government of Karnataka has been very helpful in realising the project tasks by providing data and information and with practical assistance such as local transport, meeting accommodation, assistance during installation of the monitoring system and deputation of two engineers to the Netherlands for 2 months of training and capacity development.

However, the schedule of the project could not be met due to the delays from our Indian collaborators (attributed to Indian bureaucracy). This fact was underestimated by the project team. All agreed activities by Karnataka were honoured but it took much more time, hence led to the extension of the project period by 7 months.

After installation, the in-situ monitoring system suffered severe damages due to vandalism, intense monsoon rains and the ongoing Bhadra dam rehabilitation works. Response of KaWRD to requests for inspection and repair were poorly followed up because of personnel changes. During the inspection visit of the monitoring system in December 2018, part of the data could be retrieved. However, approximately half of the system was not functioning correctly anymore^[1] and a significant amount of data was lost. This limited the validation of numerical models and making the system fully operational.

Regardless of these setbacks, the main goals of the project were realized as follows:

- An innovative approach to dam safety and water management has been demonstrated in the pilot case Bhadra dam and catchment.
- Results have been disseminated to the stakeholder, other end-users and wider community in India through various means such as papers, presentations, deputation, workshops and a website. This has strengthened the position of the Dutch water sector.

Innovation

Main innovation of this project was to integrate a number of observation technologies with numerical models and forecasting system. In the Bhadra pilot case, an online monitoring system was installed by Royal Eijkelpark to monitor the water levels in the reservoir and the dam failure mechanisms that were identified by iPresas. All measurement stations are equipped with a battery and solar panel for energy supply and a wireless connection for real time data transmission. Over a period of two years, the dam deformation was measured by partner SkyGeo using PS-InSAR satellite technology. All measurements were integrated in Deltares' Delft-FEWS platform. This platform for forecasting of reservoir inflow was extended with the Dam Analyses Module (DAM) to calculate dam stability in real time. Integration and application of these innovations were successfully realized in the Bhadra pilot case.

Results

<https://publicwiki.deltares.nl/display/TKIP/Uploads>