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ROLE OF INSTITUTIONAL STRENGTHENING FOR SUSTAINED DAM SAFETY MANAGEMENT

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ABSTRACT

Institutional strengthening is one of the important pillars of dam safety management. It is important to nurture and enhance the institutional capacity on long term basis to operate the dam assets safely, effectively and efficiently all the time. Accordingly, in the conceptualisation of ongoing Dam Rehabilitation and Improvement Project (DRIP), dam safety institutional strengthening was planned to enable various Implementing Agencies to execute the project successfully. The institutional strengthening envisages equipping the dam operation and maintenance personnel with the required skills and knowledge as well as providing them with the infrastructure to carry out the job effectively thereby ensuring dam safety in a sustainable manner. Although, major component in the Project is related to rehabilitation of distressed dams, at the same time dam safety capacity building has been addressed holistically. The State partners needed the trainings as well as technical support right from the preparatory phase to closure of the Project on various aspects, which has been accomplished through various mechanisms. So far, about 170 trainings have been conducted, more than 5000 officials were trained in addition to capacity building of 8 academic institutions and two central agencies through laboratory facility upgradation as well as soft components. Other institutional strengthening efforts include: publication of technical guidelines and manuals to promote standardised dam safety practices; enabling the dam owners to publish and operationalise the much needed O&M Manuals and Emergency Actions Plans; development and implementation of web based asset management tool, Dam Health And Rehabilitation Monitoring Application (DHARMA), a foundation for application of Artificial Intelligence application; Seismic Hazard Mapping of Country; organization of annual Dam Safety Conferences; collaborations with leading national and global institutions for knowledge exchange etc. The Management Information System developed to manage voluminous information flowing within the Project system enables its analysis and retrieval thus contributing to a robust monitoring mechanism to complete the Project successfully.

1. INTRODUCTION

With 5334 large dams in operation and 411 under construction, India occupies the third position in terms of the large dams. About 80% of these dams are over 25 years old and some of them suffer from structural and hydrological deficiencies. Dam safety is of paramount importance not only to protect the downstream life and civilization, but also to ensure the sustained operational performance of the dam to provide the water security for meeting the needs for irrigation, domestic and industrial consumption and also for hydropower development. For improving the safety and operational performance of the distressed dams, Government of India with financial assistance from the World Bank is implementing the Dam Rehabilitation and Improvement Project (DRIP) to rehabilitate 198 dam projects in seven States. Considering the importance of institutional strengthening for sustained dam safety management, institutional strengthening was included as an important component of DRIP. The framework for institutional strengthening included capacity building in the DRIP Implementing Agencies, the Central Water Commission, and the selected premier academic institutes. Besides this, several enablers that will contribute to sustained dam safety management were identified and developed under DRIP. Institutional mechanisms were strengthened to carry forward the dam safety activities beyond the project.

2. TRAINING AND PROFESSIONAL DEVELOPMENT

People are an important resource in ensuring dam safety right through the design, construction, operation and maintenance of dams. To bridge the competence gaps among dam engineers for effective design, operation, maintenance and rehabilitation of dams, training programmes were specially designed and executed both within the country and outside by utilizing the expertise of national and international dam professionals as well as the senior faculty members of premier

academic institutes. About 170 training programmes spread over 500 training days were organized and over 5000 dam engineers belonging to the DRIP Implementing Agencies and the Central Water Commission were trained. Visits to dam facilities within the country were organized to provide an opportunity to physically experience the rehabilitation activities and the dam safety practices being implemented. Besides this, 8 international dam safety exposure visits were organized in which 62 policy makers in the water resources sector participated. These exposure visits provided an opportunity to observe and get first hand acquaintance with the dam safety practices being implemented in these developed countries and increased their involvement and support for the dam safety initiatives.

3. DAM SAFETY CONFERENCES

To provide a forum for exchange of expertise and experience among dam professional around the world, dam safety conferences were organized under DRIP, as annual feature. Three national dam safety conferences were organized in Chennai (2015), Bengaluru (2016), and Roorkee (2017). Considering the increasing trend of participation from outside India, it was decided during the third national dam safety conference held in Roorkee, that the next conferences should be international conferences to attract more international participation. International Dam Safety Conference - 2018 held in Thiruvananthapuram attracted several international experts and 140 technical papers and 54 overseas delegates. The International Dam Safety Conference - 2019 held in Bhubaneswar received 152 technical papers and 90 overseas delegates. Over the years, there was increasing interest in these conferences as evident from the number and level of participation. Due to logistic limitations, a total of about 2500 delegates were accommodated in these conferences. Again the number of technical papers selected for oral presentation was restricted, however, to provide for permanent reference to the vast amount of knowledge, expertise and experience documented in the technical papers, all the accepted technical papers received for each conference were published as a compendium and distributed to all major dam owning organizations and others concerned. Besides this, the compendiums were also published in the softcopy format in the DRIP website: www.damsafety.in with open access for all those interested. These conferences enhanced the dam safety awareness and culture in the country.

4. IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEMS IN CDSO

The standards for quality management systems (QMS) developed by the International Organization for Standardization (ISO) addresses the systematic improvement of the organization's overall performance. QMS employs the process approach, requiring understanding of the interactions between various processes and risk-based thinking to proactively determine the negative effects and to implement preventive controls to minimize them. Another important feature of the QMS was the understanding the evolving context to mould its processes for enhancing its sustained success. The Central Dam Safety Organisation (CDSO) took a strategic decision for adopting the quality management system conforming to ISO 9001, to provide a sound basis for sustainable improvement of its overall performance. QMS was developed, and implemented in the Central Dam Safety Organisation and certification obtained from the Bureau of Indian Standards. The framework developed for the CDSO could be adapted for developing QMS in other organisations of CWC as well as the State Dam Safety Organisations (SDSOs).

5. DAM SAFETY INSTITUTIONAL CAPACITY BUILDING IN PREMIER ACADEMIC AND RESEARCH INSTITUTES

There was inadequate interaction between the technical institutes and the dam owners. There was also a need for augmenting infrastructure facilities in the academic institutes to enable them for carrying out dam related investigations and for providing consultancy services to resolve dam related issues. It was therefore decided to provide assistance to selected premier academic institutes to equip themselves with required infrastructure facilities as well as for developing the competence of their faculty members through training and exposing them to dam related issues. Services of these institutes could later be utilized for providing consultancy and training to dam fraternity. Eight academic institutes and two central agencies were selected and provided with funds for equipping themselves with hardware and software facilities for carrying out dam related investigations and build competence of their faculty members through training and dam safety exposure visits. These institutes have committed to organize 70 short term training programmes on topics relevant to dam design, operation, maintenance, investigations, rehabilitation etc. during the project period. DRIP Implementing Agencies have also started engaging these institutes to solve their dam related issues. It is a win-win situation for the dam fraternity and the academic institutes where the academic institutes would get the exposure to the practical problems faced at the dams and dam owners get the expert services and at an economical cost.

6. DEVELOPING DAM SAFETY GUIDELINES, MANUALS, AND TECHNICAL SPECIFICATIONS

Dearth for comprehensive guidelines to address specific dam related jobs was felt by the dam community in India. Even though several books and other publications relating to dam safety practices are available around the world, they all specify the requirements relevant to their countries and they do not address comprehensively all aspects. To guide the dam fraternity in India, on various aspects of dam engineering and to standardize the dam safety practices appropriate for Indian conditions, the task of developing the dam safety guidelines, manuals, and technical specifications by pooling

the experience and expertise of several experts from across the world was taken up under DRIP. The topics covered under these guidelines, manuals and technical specifications include: (i) developing emergency action plans for dams; (ii) instrumentation of large dams, (iii) preparing operation and maintenance manuals for dams, (iv) mapping flood risks associated with dams, (v) safety inspection of dams; (vi) assessing and managing reservoir sedimentation; (vii) assessing and managing environmental impacts of dams, (viii) assessing and managing risks associated with dams; (ix) selecting and accommodating inflow design floods for dams, (x) classifying the hazard potential of dams and (xi) evaluating geological conditions and seismic hazards at dams; (xii) manuals for rehabilitating existing dams, (xiii) manual for assessing the structural safety of dams and (xiv) manual for assessing the hydraulic safety of dams. In addition, inspection manuals for dam field engineers after seismic event were developed with the assistance from the Japan Water Agency for (xv) Ichari dam and (xvi) Maithon dam and (xvii) technical specifications for instrumentation of large dams. 13 of the above documents have been published and the balance are in advanced stages of finalization. These documents are published on DRIP website providing free access to all those interested.

7 DEVELOPMENT AND OPERATIONALIZATION OF OPERATION AND MAINTENANCE (O&M) MANUALS

While analyzing the causes of distress in dams, it was observed that deferred maintenance was one of the prime causes. Several factors were responsible for the situation such as: lack of a defined system for O&M, lack of dedicated and competent manpower, inadequate infrastructure facilities, inadequate budgetary provision for operation and maintenance of dams, etc. Guidelines for the development of O&M manuals was published under the aegis of DRIP and dam owners were encouraged to develop the O&M manuals specific to their dams in conformity with these guidelines. The manuals developed for DRIP dams were reviewed by the Central Project Management Unit (CPMU) of DRIP for compliance with the guidelines and adequacy in addressing all the components of the dam projects. Dam owners later published the O&M manuals and operationalized them.

In India, the dams are, by and large, owned by State Agencies. The responsibility for the operation and maintenance of dams predominantly used for irrigation and water supply rest with the Irrigation or Public Works departments whereas in case of hydroelectric projects, the dams are operated and maintained by State Electricity Boards or other public sector agencies. Most often there is no dedicated budget or personnel for operation and maintenance of dams. To ensure systematic operation and maintenance of dams, all the dam owning agencies are encouraged to adequately provide funds in their annual budgets and post dedicated and competent staff for operation and maintenance of dams.

8. DEVELOPMENT AND DISSEMINATION OF EMERGENCY ACTIONS PLANS

Even though dams are safe structures, the consequences of an unlikely dam incident are quite catastrophic. A few of dam failures that have occurred in India resulted in loss of lives besides devastation of the flora and fauna and damage to the property. Emergency Actions Plans (EAPs) have an important role to play to improve the emergency preparedness of all concerned, namely the dam owners and operating personnel, affected persons mainly those living in the downstream developments and different agencies associated with providing the relief and rescue operations to prevent loss of life and reduce damage to the property and environment. Guidelines for the development of EAPs for dams was published under the aegis of DRIP. Tier 1 documents prepared after carrying out the dam break analysis of the DRIP dams and provided to dam owners to develop the EAPs for their dams. The EAPs prepared by dam owners are reviewed for adequacy and compliance with the guidelines by the CPMU before their publication. Dam owners later organize the stakeholder consultation meetings to inform the details of the EAP and their role to cope with any dam emergency.

9. DEVELOPMENT AND IMPLEMENTATION OF DAM HEALTH AND REHABILITATION MONITORING APPLICATION (DHARMA)

Basic information about the large dams is collected by CWC and published as the National Register of Large Dams (NRLD). In an effort to collect comprehensive and authentic dam and reservoir information including the dynamic data relating to the dam health from the results of various inspections, investigations as also the rehabilitation and improvements carried out at the large dams, DHARMA, a web-based asset management tool was developed under the aegis of DRIP. Individual dam owners are licenced to enter the authentic asset and health information pertaining to their dams in DHARMA. Different users at the Central and State levels are authorised to extract useful information for taking appropriate decisions relating to the operation and maintenance of dams as well as for rehabilitation and new investments; the application enables storing, analysing and retrieving information in an organized way. DHARMA is being implemented across the country and would eventually cover all the large dams in the country.

10. DISSEMINATION OF DAM SAFETY INFORMATION

An exclusive website: www.damsafety.in, was developed under the aegis of DRIP for dissemination of dam safety information. The website is a repository of the knowledge generated and acquired during the implementation of DRIP. Course material of all the training programmes, compendiums of technical papers received for national and international dam safety conferences, all published dam safety guidelines, quality management system documentation of CDSO, DRIP information bulletins are among the documents published on the DRIP website and the information is available

for free viewing and downloading by all those interested. To generate greater awareness, several publicity measure have been implemented. They include publication of DRIP information bulletins on quarterly basis, publication of event specific brochures, publications on social media like Twitter, Facebook, LinkedIn, production of documentary films and video spots, programmes in electronic media, release of press notes, etc.

11. SEISMIC HAZARD MAPPING OF INDIAN SUBCONTINENT

Specific investigations are being carried out to determine the seismic potential before any new dams or their rehabilitations are designed. To facilitate the designers in getting the authentic seismic potential at the dam sites instantaneously, seismic hazard mapping of the entire Indian subcontinent is being developed under the aegis of DRIP. Already mapping of peninsular India is completed with the assistance of IIT Roorkee and for rest of the country, CWPRS is carrying out the study. When completely developed and integrated, seismic hazard information system will be an online tool where the user will be able to obtain the seismic potential at any location by entering the lat-long coordinates of the particular dam site.

12. DAM SAFETY BILL, 2019

To provide for a legal frame work for proper operation and maintenance of the dams and for ensuring their safety, Dam Safety Bill, 2019 was passed in Lok Sabha. The Bill provides for institutional mechanisms for evolving dam safety policies and for implementing the policy, guidelines and standards for dam safety in the country for proper surveillance, inspection, operation and maintenance of all specified dams in the country to ensure their safe functioning. The Bill will also help all the States and Union Territories of India to adopt uniform dam safety procedures including for regular inspection of dams, preparation of Emergency Action Plans for dams, conducting comprehensive dam safety reviews, adequate provision of repair and maintenance funds for dam safety, etc. Dam Safety Bill, 2019 is an important milestone for ensuring safety of all the large dams in the country.

13. CONCLUSION

There is a popular adage that prevention is better than cure. While rehabilitation efforts implemented under DRIP have removed the deficiencies in the existing dams, the institutional strengthening initiatives implemented will go a long way in maintaining the safety and health of the dams in a sustainable manner through systematic operation and maintenance.

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REFERENCES

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