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Decision Support System in Thailand's Dam Safety With a Mobile Application for Public Relations:
DS-RMS (Dam Safety Remote Monitoring System)

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ABSTRACT

This paper describes the decision-making based on civil engineering expertise of the dam safety remote monitoring system (DS-RMS), which decides on action-based advice depending on everyday scenarios and special occurrences such as earthquakes and floods. The system has been in full operation since 2016 and automatically evaluates 35 failure modes for three major dam types 24 hours a day. Key benefits include quick and reliable access to current information about the dams and being a reliever to dam executives in critical situations. In further development, parts of the real-time dam information were selected and made available to the public together with dam safety evaluation results automatically and continuously via a mobile application.

KEYWORDS

Dam Safety, Decision Support System, Remote Monitoring

INTRODUCTION

The Electricity Generating Authority of Thailand (EGAT) is currently operating fourteen large dams constructed for irrigation, flood prevention, power generation and so forth. In order to ensure dam safety, EGAT has analyzed and monitored dam behavior through its dam safety program since 1982 and has been improving the processes according to international standards and guidelines, one of which was to initiate an automated Dam Safety Remote Monitoring System (DS-RMS) in 2013. The first objective is to automate the conventional acquisition of safety-related measurements by using remote-monitoring technology like dam safety management systems named KDSMS from Korea introduced by Jeon et al. (2009), MISTRAL Italy Lazzari and Salvaneschi (1923), ESMHS Egypt

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Abd-Elhamid et al. (2008), or PAEWEB Brazil Leone-Filho et al. (2014). Existing dam instruments were connected to reliable remote terminal units (RTUs), communication links and computer servers running advanced information software so that comprehensive information can be remotely obtained in real time.

SCADA (Supervisory Control And Data Acquisition) high functions: dam behavior visualization showed by Nuntawattanasirichai et al. (2019), earthquake monitoring, flood routing simulation, safety evaluation and warning system are the goals objectives. DS-RMS is designed to support three major dam types: concrete, embankment and impervious faced rockfill dams, with special requirements for the Bhumibol Dam and the Lamtakong Jolabha Vadhana Power Plant, presented in Figure 1 with detailed information in Table 1.

BACKGROUND

Sander-Kessels & Straßer (2016) have published experience of Uniper, the international operator of 185 hydropower plants and the associated 225 dams, in the implementation of Dam-Safety-Management-System (DSMS), whose principle of DSMS came from §2 ICOLD-Bulletins Nr. 154 published in 2010. The Dam Safety Policy is implemented in three steps according to the BowTie method as part of Standard IEC/ISO 31 010: risk management – Risk assessment techniques published in 2009. DSMS uses a risk management process named AERO (Asset Engineering Risk and Opportunities) with the Swedish hazard classification RIDAS (Hydropower Industry Dam Safety Guidelines) published in 2012. Early results showed that the transfer of proven, best practice (e.g. in thermal plant) BowTies procedures to dams is difficult: "This is mainly due to the fact that dams are unique in every way and that the different hazard potentials do not automatically derive from the dam parameters, but must be determined individually." (Freely translated from German into English).

Hence, EGAT in cooperation with Geotechnical Engineering Research and Development Center (GERD) – Kasetsart University (KU) has been endeavoring to define criteria for several dam instruments in order to identify the safety of the dams listed in Table 1. GERD (2014) reported the analysis of historical data for each dam individually. Examples of the results with evaluation flowchart are presented in the next section. Subsequently, the National Electronics and Computer Technology Center (NECTEC) – National Science and Technology Development Agency (NSTDA)

Figure 1. Locations of the fourteen large[1] dams operated with DS-RMS. Dams in Northeastern Thailand are outside of earthquake hazard. Adapted from (National Electronics and Computer Technology Center [NECTEC], 2019)