



Damage Study of Dhamdum Bridge Concrete Pier by Flowing Rock Impact

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Abstract

Near Samtse Dzongkhag in Bhutan, the country terrain is flat and hence the river 'Dhamdum chu' is very wide and remains dry during most of the time of the year. But during monsoon, rain water with melted ice from mountain, it becomes mighty. The bridge proposed over Dhamdum chu connecting the community residence to Samtse Industrial Park is a multiple span concrete bridge supported by solid concrete piers placed on open foundation. A very large span bridge was possible but not considered practical from the view point of economy and social aspect.

This paper represents the output of non-linear analysis carried out during design of the bridge to ensure safety of the bridge Piers against damage by impact from flowing rock if any. Rock impact simulation of the bridge pier is done using Finite Element Code[1]. Continuous Surface Cap Model (CSCM) of concrete model is used to identify the possible damage of Pier concrete. Plastic kinematic model of steel is used to represent the reinforcing steel. Two-way automatic surface to surface contact algorithm is employed between the rock and the static Pier.

Keywords: impact simulation; concrete damage; CSCM model of concrete; cracking; failure criteria; LS DYNA.

1. Introduction

The river at the bridge location becomes dry during winter but during monsoon it flows between the banks full but with shallow depth. The water sometime carries large tree logs and boulder from the mountain area. The purpose of this study to

check the potential harms that the 'flowing boulder' may cause to the structural integrity of the Piers.

No data available about the size of the boulder that may carry by the water. Following assumptions are made for the boulder and its probable strike velocity in discussion with the local people:

- Boulder size – approximately 1.0m diameter