DESIGN OFFICE APPROACH FOR THE ASEISMIC DESIGN OF CONCRETE GRAVITY DAMS

by

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SYNOPSIS

A simplified procedure has been proposed for the aseismic design of concrete gravity dams subjected to horizontal earthquakes. The procedure permits a quick estimate of the dynamic forces acting on the dam and is handy for use in the design offices for preliminary design of dams.

INTRODUCTION AND OUTLINE OF PROPOSED PROCEDURE

Several methods of analysis such as beam analysis and finite element analysis are available for the dynamic analysis of dams. However, these methods are very sophisticated and invariably require the use of digital computers. Such techniques and facilities are not readily available to most of the design offices engaged in the design of dams and thus a field designer feels handicapped in carrying out the earthquake resistant design of the dam. The necessity of a simpler procedure giving reasonably accurate results and amenable for easy computations in the field design offices is keenly felt at present.

The proposed method is based on the well known Rayleigh method in which an assumption is made of the dynamic configuration of a vibrating system by the static deflection consideration. The dynamic deflection shape and the natural period of vibration are derived therefrom, from which the evaluation of the dynamic displacements, forces, moments and shears is made using response spectra of the earthquake. The procedure has been applied for the analysis of four existing dams subjected to Koyna earthquake of Dec. 11, 1967 and a brief summary of the results is presented in Table 1.

TABLE 1*

Comparison of Results by Proposed Procedure and Dynamic Analysis

S. No.	Dam	Height	Proposed Procedure			Dynamic Analysis		
			T	M_b	V_b	T	M_b	V_b
1	Kolkewadi	64.1m	0.138	0.228 WH	0.425 W	0.142	0.211 WH	0.400 W
2	Sholayar	93.0m	0.223	0.119 WH	0.212 W	0.232	0.112 WH	0.260 W
3	Koyna	103.0m	0.330	0.129 WH	0.203 W	0.340	0.123 WH	0.249 W
4	Pine Flat	129.0m	0.357	0.289 WH	0.533 W	0.370	0.270 WH	0.560 W

* T – natural period of vibration in sec; M_b – base moment; V_b – base shear; W – weight of dam; H – height of dam.

It is concluded that the proposed procedure gives reasonably accurate results in comparison to dynamic analysis and thus can be used for preliminary design of dams in seismic zones. The proposed procedure should be quite acceptable for practical application and prove to be handy for design offices.

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