

# EVALUATION OF LIQUEFACTION POTENTIAL OF SOILS – A REVIEW

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**Abstract:** Liquefaction of soil during earthquakes results in catastrophic damages to life and property. The deformations of soil during earthquakes pose a serious risk to the stability of structures. Niigata earthquake in Japan and the Bhuj earthquake in India incurred large scale damage to the buildings and dams. It is essential to evaluate the resistance of soils to liquefaction. This paper deals with understanding the process of liquefaction and estimating the liquefaction potential of soils by various laboratory tests and empirical approaches. The undrained behaviour of soils in cyclic shearing is explained with the help of cyclic triaxial testing and cyclic direct simple shear test. The results of the cyclic direct simple shear test conducted on loose Fraser river sand in Vancouver, Canada are discussed in this paper. The empirical approach developed in 1996 NCEER and 1998 NCEER/NSF workshops to determine the liquefaction potential of soils is presented. This empirical approach is a simplified procedure based on field tests which can be used in practice to evaluate the liquefaction potential of soils.

## I. INTRODUCTION

The phenomena of liquefaction received attention mainly after the disastrous earthquake in Niigata, Japan on 16 June 1964. In India, the Bhuj earthquake on 26 January 2001 instigated the research on liquefaction. Fig 1 and Fig 2 show damage to the structures due to liquefaction in Niigata and Bhuj earthquakes respectively[1]. In simple terms, liquefaction can be comprehended as a phenomenon in which soil loses its shear strength due to the generation of excess pore water pressure in undrained loading conditions. Liquefaction is defined as the process of conversion of coarse material from a solid to a liquefied state as a result of rise in the pore water pressure and decrease in the effective stress[2]. It usually takes place in granular soils, since they are frictionless and do not possess significant cementation.

The liquefaction potential of soils is estimated by carrying out various laboratory and field tests. In this paper, the Cyclic Triaxial Test and Cyclic Direct Simple Shear Test will be discussed followed by a simplified procedure to determine the liquefaction resistance of soils developed in 1996 NCEER and 1998 NCEER/NSF workshops[3]. The simplified procedure is an empirical approach based on field tests mentioned above.



fig 1: tilting of apartment buildings at  
(courtesy of usgs)[1]



fig 2: failure of upstream crest of fategadh  
niigata, dam, (courtesy of iit kanpur)[1]