Proceedings of the Eighteenth (2008) International Offshore and Polar Engineering Conference
Vancouver, BC, Canada, July 6-11, 2008

ISBN 978-1-880653-70-8 (Set); ISBN 1-880653-68-0 (Set)

Damage of Houses and Residential Areas by Niigata Prefecture Earthquakes (Part 1)

Katsuya Matsushita
Misawa Homes Institute of Research and Development Co., Ltd.
Tokyo, Japan

Mamoru Fujii
Tokai University
Kanagawa, Japan

Toru Takata
Soil Design Inc
Tokyo,Japan

ABSTRACT

The earthquakes of Chuetsu (2004) and Chuetsu offshore (2007) in Niigata Prefecture caused frequent slope failures, landslides and ground liquefaction, and numerous instances of ground-induced damage to houses and residential areas were noted. In many cases, damage from liquefaction occurred not only on reclaimed land in coastal areas but also on residential areas where river channels had been filled.

This research investigates the characteristics and propensities of liquefaction damage to houses and residential areas. Case histories of damage are analyzed, and the current state of aseismic capacity evaluations of residential areas in Japan and future issues are reported.

KEY WORDS: Earthquake; damage; wooden building; foundation; ground; liquefaction; landslide

INTRODUCTION

Houses in Japan are typically made of wood, with the form of wooden building foundations being either continuous footing or raft foundation. The Swedish weight sounding test is employed widely for housing ground surveys. The allowable stress of ground is determined from the test results, and the form of the foundation decided.

Normally the bearing capacity is investigated, and buildings are designed with piles if the capacity is insufficient. For detached houses, however, cases where the bearing capacity is insufficient are extremely limited. When ground contact pressure is 20 to 30kN/m^2, a spread foundation can be used in the foundation design, with the foundation specifications determined approximately based on settlement.

While steps can be taken easily to address building inclination caused by settlement problems that make daily life difficult, implementing countermeasures against earthquakes that might occur without warning at any time is quite difficult. This is thought to become especially more difficult as the time passed since a major earthquake increases, or as the required countermeasure expense grows.

Although the fact ground hazards can occur more easily on new graded land and sloped land compared with existing residential land is widely recognized, and measures such as soil improvement or pile foundations are adopted in some cases in consideration of site safety when executing house designs, such hazards become more difficult to take into account for normal housing construction when, for example, the stability of surrounding sites including adjacent ground is considered.

Given such conditions, slope failures and liquefaction occurred in numerous instances on graded land during the earthquakes of Chuetsu (2004) and Chuetsu offshore (2007) in Niigata Prefecture, causing damage to residential areas and houses. In this report, case histories of damage are introduced, and the current state of aseismic capacity evaluations of residential areas in Japan and future issues are reported.

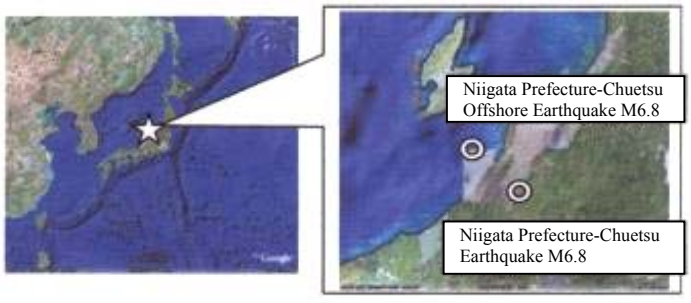

Fig.1 Epicenters of the two earthquakes