

土木工程

透水性混凝土桩减压减震耦合抗震机理研究

崔新壮^{1,2},王聪^{1,2},周亚旭^{1,2},张娜^{1,2},高智珺^{1,2}

1. 山东大学土建与水利学院, 山东 济南 250061;
2. 山东大学黄河冲淤积土工程技术研究中心, 山东 济南 250061

摘要:

透水性混凝土桩兼具散体桩和刚性桩的优点,特别适用于地基抗震。为研究其抗震机理,对地震过程中地基的加速度响应和超静孔隙水压力的长消规律等进行了数值模拟,并与碎石桩、素混凝土桩等的动力行为进行了比较分析。研究发现:透水性混凝土桩复合地基表面加速度放大系数明显小于碎石桩和素混凝土桩复合地基,而且其卓越周期仅为碎石桩和素混凝土桩复合地基的1/2,更有利于抑制上部建筑共振的发生;透水性混凝土桩除具有显著的减震效应外,还具有明显的减压效应,其高透水性使地震引起的超静孔隙水压力能快速消散,抑制了地基液化的发生。透水性混凝土桩的减压减震耦合效应还能有效协调地震期间土体的变形。

关键词: 透水性混凝土桩 复合地基 液化 抗震

Anti-earthquake mechanism of pervious concrete pile composite foundation

CUI Xin-zhuang^{1,2}, WANG Cong^{1,2}, ZHOU Ya-xu^{1,2}, ZHANG Na^{1,2}, GAO Zhi-jun^{1,2}

1. School of Civil Engineering, Shandong University, Jinan 250061, China;
2. Engineering Research Center for Yellow River Alluvial Soil, Shandong University, Jinan 250061, China

Abstract:

With the advantages of both granular piles and rigid piles, pervious concrete piles were especially suitable for earthquake-resistance foundation. To study the anti earthquake mechanism of pervious concrete pile composite foundation, the acceleration response and the development and dissipation of excess pore water pressure during the earthquake were numerically simulated. The dynamic behaviors of pervious concrete pile were compared with those of gravel pile and plain concrete pile. The surface acceleration amplification coefficient of pervious concrete pile foundation was obviously smaller than two other pile foundations. Meanwhile, pervious concrete pile predominant period was only half of gravel pile and plain concrete pile foundation, which demonstrated that pervious concrete pile foundation was more effective to avoid the upper building resonance. Besides significant damping effect, the pervious concrete pile foundation also had obvious pressure-reduction effect. The excess pore water pressure induced by an earthquake dissipated quickly because of the high permeability of pervious concrete piles, and the foundation liquefaction was effectively inhibited. Consequently, the draining-damping coupling effect of pervious concrete piles could improve the deformation compatibility of soil during the earthquake.

Keywords: pervious concrete pile composite foundation liquefaction anti-earthquake

收稿日期 2012-06-05 修回日期 网络版发布日期

DOI:

基金项目:

国家自然科学基金资助项目(51078222,50708056,50978207);山东省自然科学基金资助项目(ZR2011EEM012);山东大学自主创新基金杰出青年培养项目(2010JQ001)

通讯作者:

作者简介:崔新壮(1974-),男,山东寿光人,教授,博士,主要研究方向为岩土力学方面. E-mail: cuixz@sdu.edu.cn

作者Email:

PDF Preview

参考文献:

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(2434KB)
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 透水性混凝土桩
- ▶ 复合地基
- ▶ 液化
- ▶ 抗震

本文作者相关文章

PubMed

本刊中的类似文章

1. 贾超,赵建宇,徐帮树,岳长城,李树忱.清水隧道围岩软土振动液化研究[J].山东大学学报(工学版),2008,38(1):83-87
2. 董玉平,王理鹏,邓波,陆萍,申树云.国内外生物质能源开发利用技术[J].山东大学学报(工学版),2007,37(3):64-69
3. 黄增彦,王广月,李倩,赵明.基于可拓学的砂土液化等级评价研究[J].山东大学学报(工学版),2008,38(5):31-35

Copyright by 山东大学学报(工学版)