

斜坡稳定性与地质灾害

强震条件下双面坡变形破坏机理的振动台物理模拟试验研究

肖锐铨, 许强, 冯文凯, 陈建君, 左雅娅

地质灾害防治与地质环境保护国家重点实验室, 成都理工大学 成都 610059

摘要:

5-12汶川地震引发了数以万计的崩塌、滑坡、泥石流等地质灾害。为了研究双面坡在强震条件下的动力响应规律,本文在大量野外调查的基础上,采用振动台物理模拟试验手段,设计完成了四类11个模型试验,从改变模型的坡度和坡顶宽度、软岩硬岩结合、阶梯状坡形等角度,较系统地研究了双面坡在强震作用下的响应规律。试验结果显示:强震条件下地震水平惯性力是导致边坡破坏的主要原因;在地震情况下边坡变形破坏表现出明显的初动破坏效应;振动过程中双坡具有明显的共剪效应,坡面为阶梯状时其共剪效应更明显;坡体结构为上软下硬时下部硬岩对振动具有一定的放大效应,上硬下软时坡体易整体偏移产生变形破坏。试验结论与实际情况基本符合。

关键词: 强震区 双面坡 振动台 物理模拟

SHAKING TABLE SIMULATION EXPERIMENT ON DEFORMATION FAILURE MECHANISM OF DOUBLE SIDES SLOPE IN CONDITION OF INTENSE EARTHQUAKE

XIAO Ruihua, XU Qiang, FENG Wenkai, CHEN Jianjun, ZUO Yaya

National Key Laboratory of Geohazard Prevention and Geoenvironment Protection, Chengdu University of Technology, Chengdu 610059

Abstract:

5-12 Wenchuan earthquake triggered thousands of rock collapses, landslides, debris flows and other geological disasters. In order to study the response of the double sides slope to the earthquake, we designed a total of 11 models according to the field investigation. We took four factors into consideration to study the seismic response of the slope. The four factors are the slope degree, the top width of slope, structure combination and the shape of the double sides slope. The tests manifested that (a) seismic inertia force is the main factor that results in slope failure; (b) the deformation and failure of the slope has a relation to the initial seismic direction; (c) the double sides slope shows an conjugated shear phenomenon; (d) different structure combinations of slopes result in different failure modes; (e) the conjugated shear phenomenon is more obvious on the ladder shaped double sides slope. The test findings are well in line with the results of field investigation.

Keywords: Earthquake zone Double sides slope Shaking table Physical modeling Slope failure

收稿日期 2009-11-18 修回日期 2010-04-08 网络版发布日期

DOI:

基金项目:

国家重点基础研究发展计划课题(2008CB425801)、地质灾害防治与地质环境保护国家重点实验室“科技减灾、重建家园”专项基金(DZJK 0811)联合资助

通讯作者:

作者简介: 肖锐铨, 工程地质专业. Email: xiaoruihua0316@126.com

作者Email:

参考文献:

[1] 许强, 黄润秋. 5-12汶川大地震诱发大型崩滑灾害动力特征初探 [J]. 工程地质报, 2008, 16(6): 721~729. Xu Qiang, Huang Runqiu. Kinetics characteristics of large landslides triggered by May 12th Wenchuan earthquake. Journal of Engineering Geology, 2008, 16(6): 721~729.

[2] 冯文凯, 许强, 黄润秋. 斜坡震裂变形力学机制初探 [J]. 岩石力学与工程学报, 2009, 28(增1): 3124~3130. Feng Wenkai, Xu Qiang, Huang Runqiu. Preliminary study on mechanical mechanism of slope Earthquake induced deformation. Journal of Rock Mechanics and Engineering, 2009, 28(s1): 3124~3130.

[3] 徐光兴, 姚令侃, 高召宁, 等. 边坡动力特性与动力响应的大型振动台模型试验研究 [J]. 岩石力学与工程学报, 2008, 27(3): 624~632. Xu Guangxing, Yao Lingkan, Gao Zhaoning, et al. Large scale shaking table model test study on dynamic characteristics and dynamic responses of slope. Journal of Rock Mechanics and Engineering, 2008, 27(3): 624~632.

[4] 许向宁. 高地震烈度区山体变形破裂机制地质分析与地质力学模拟研究. (博士论文) [D]. 成都: 成都理工大学, 2006. Xu Xiangning. Geological Analysis and Geomechanics Analog Study of Mountain Deformation Failure Mechanism in High Earthquake Intensity Area. (Ph. D. Dissertation). Chengdu University of Technology, Chengdu, 2006.

[5] 张平, 吴德伦. 动荷载下边坡滑动的试验研究 [J]. 重庆建筑大学学报, 1997, 19(2): 80~86. Zhang Ping, Wu Delun. A Shaking-Table Test Research on Rock Slope. Journal of Chongqing J ianzhu University, 1997, 19(2): 80~86.

[6] 梁庆国, 韩文峰, 马润勇, 谌文武. 强地震动作用下层状岩体破坏的物理模拟研究 [J]. 岩土力学, 2005, 26(8): 1307~1311. Liang Qingguo, Han Wenfeng, Ma Runyong, Chen Wenwu. Physical simulation study on dynamic failures of layered rock masses under strong ground motion. Rock and Soil Mechanics, 2005, 26(8): 1307~1311.

[7] 张俦元, 王士天, 王兰生. 工程地质分析原理 [M]. 北京: 地质出版社, 1994. Zhang Zhuoyuan, Wang Shitian, Wang Lansheng. Principles of engineering geological analysis. Beijing: Geological Publishing House, 1994.

[8] 王运生, 罗永红, 吉峰, 等. 汶川大地震山地灾害发育的控制因素分析 [J]. 工程地质学报, 2008, 16(6): 759~763. Wang Yunsheng, Luo Yonghong, Ji Feng, et al. Analysis of the controlling factors on geohazards in mountainous epicenter zones of the Wenchuan earthquake. Journal of Engineering Geology, 2008, 16(6): 759~763.

[9] 黄润秋, 裴向军, 李天斌. 汶川地震触发大光包巨型滑坡基本特征及形成机理分析 [J]. 工程地质学报, 2008, 16(6): 730~741. Huang Runqiu, Pei Xiangjun, Li Tianbin. Basic characteristics and formation mechanism of the largest scale landslide at DAGUNGBAO occurred during the Wenchuan earthquake. Journal of Engineering Geology, 2008, 16(6): 730~741.

本刊中的类似文章

1. 陈德基. 汶川大地震后水坝建设中若干问题的思考 [J]. 工程地质学报, 2009, 17(3): 289-295

文章评论

- ▶ Supp
- ▶ PDF
- ▶ [HTM
- ▶ 参考
- ▶ 参考
- ▶ 把本
- ▶ 加入
- ▶ 加入
- ▶ 引用
- ▶ Ema
- ▶ 文章
- ▶ 浏览
- ▶ 强震
- ▶ 双面
- ▶ 振动
- ▶ 物理
- ▶ 肖锐
- ▶ 许强
- ▶ 冯文
- ▶ 陈建
- ▶ 左雅
- ▶ Artic
- ▶ Artic
- ▶ Artic
- ▶ Artic
- ▶ Artic

反馈人

邮箱地址

反馈标题

验证码

7237

Copyright by 工程地质学报