岩石力学与工程学报　2007 26 (12): 2466　ISSN: 1000-6915　CN: 42-1397/O3

青藏铁路沿线冻土场地地震动特征研究

吴志坚1，2，孙军杰1，3，王兰民1，程国栋2，徐舜华1，3

(1. 中国地震局 兰州地震研究所，甘肃 兰州 730000；2. 中国地震局 地震预测研究所兰州科技创新基地，甘肃 兰州 730000；
3. 兰州大学 土木工程与力学学院，甘肃 兰州 730000)

收稿日期 2007-5-18 修回日期 2007-7-18 网络版发布日期 2008-1-2 接受日期 2007-5-18

摘要　基于对青藏铁路沿线多年冻土区的现场地质考察、14个典型钻孔的地质编录以及现场测试，获取了青藏铁路沿线多年冻土区土层波速的基本特征。而后结合室内动三轴有关冻土动强度的试验结果，使用该地区50 a超越概率为62.5%，10.0%和2.0%的人造基岩地震波输入，通过土层地震反应计算，分析研究青藏铁路沿线冻土区10个冻土场地的地震动加速度时程与加速度反应谱的基本特征及其影响因素，同时，统计研究地温对场地的地震动加速度反应谱的影响。结果表明，青藏铁路沿线多年冻土区土层波速及横波与纵波之波速比值较非冻土区大，地震强度对冻土区场地的地震动加速度幅值具有决定性影响，冻土区典型地震动加速度反应谱的中、短周期成分所占比例较大，冻土场地的地震动加速度反应谱的幅值随地温的降低而普遍减小。

关键词　土力学；青藏铁路；多年冻土；波速；地震动；地温

分类号

STUDY ON CHARACTERISTICS OF GROUND MOTION AT PERMAFROST SITES ALONG QINGHAI—TIBET RAILWAY

WU Zhijian1，2，SUN Junjie1，3，WANG Lanmin1，CHENG Guodong2，XU Shunhua1，3

(1. Lanzhou Institute of Seismology，China Earthquake Administration，Lanzhou，Gansu 730000，China；
2. Lanzhou Creative Base of Institute of Earthquake Prediction，China Earthquake Administration，Lanzhou，Gansu 730000，China；
3. School of Civil Engineering and Mechanics，Lanzhou University，Lanzhou，Gansu 730000，China)

Abstract

Based on the field geological investigation at permafrost regions，geological description and field test of waves velocities at 14 typical boreholes distributing in permafrost areas along the Qinghai—Tibet Railway，elementary characteristics of wave velocities of soils at the permafrost regions are presented. And then，combining the results of dynamic triaxial test，using three time histories of ground motion acceleration with the exceedance probabilities 62.5%，10.0% and 2.0% in 50 years related to the research area，the characteristics of ground motion are analyzed for the 10 permafrost profiles by an equivalent linearization method to estimate the seismic response of frozen soil ground. Moreover，the influence of earth temperature on seismic acceleration response spectrum for permafrost sites is studied. Consequently，the following conclusions can be drawn. (1) Under the similar conditions，the wave velocities of frozen soils along the Qinghai—Tibet Railway are greater than those of other non-frozen soils areas；and the velocity ratio between the shear wave and compression wave does the same. (2) Earthquake intensity is a critical factor to influence the acceleration amplitude of ground motion at permafrost regions，e.g. with the decrease of earthquake intensity，the acceleration amplitude of the ground motion reduces gradually. (3) The proportion of the moderate and the short periods

of seismic acceleration response spectrum in permafrost regions is primary. (4) The amplitude of acceleration response spectrum of ground motion decreases distinctly while earth temperature of frozen soils reduces. The research should contribute to earthquake disaster prevention of engineering structures in permafrost areas on Qinghai—Tibet Plateau.

Key words soil mechanics；Qinghai—Tibet Railway；permafrost；wave velocity；ground motion；earth temperature

DOI:

通讯作者