

论文

高填方路堤强夯效果的现场检测及三维有限元模拟

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摘要:

针对河南某岩石碎渣高填方路堤,提出了夯击能1000kN·m、虚铺厚度1.5m的强夯施工工艺,对试验段进行了现场检测:地质雷达波形较好地反映强夯后虚铺层厚度的减小幅度,并可判断强夯水平有效加固范围为4m,瑞利波速沿深度变化比较均匀,平均值达到了310m·s⁻¹,重型动力触探结果表明试验段达到中密程度,灌水法测得的固体体积率都达到了83%以上,上述检测结果说明强夯的加固效果比较理想。采用ABAQUS有限元分析软件,将夯锤简化为刚性体,通过施加竖向初速度的方式模拟了强夯作用,结合雷达测试结果,认为夯沉量20mm可作为强夯的有效加固范围,最后模拟了存在涵洞结构物的路堤的强夯作用,指出涵洞上方路堤厚度必须达到8m以上,才能保证强夯安全作业。

关键词: 强夯 高填方路堤 现场检测 有效加固范围 涵洞 有限元模拟

IN-SITU TEST AND THREE-DIMENSIONAL FEM ANALYSIS OF DYNAMIC COMPACTION EFFECT OF THICK FILL EMBANKMENT

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Abstract:

One Thick fill embankment was composed of broken rocks in Henan province. It was taken as an engineering example in this paper. A construction technology of dynamic compaction with energy of 1000 kN·m and loose layer of 1.5m depth was put forward. In-situ tests were done at some segments. The loose layers turn dense after having been compacted and the horizontal efficient compaction range was 4m and was displayed from the ground radar wave shape. Rayleigh waves change little in the depth and the averaged value is 310m·s⁻¹. The segments have middle density judged with the heavy dynamic penetration tests results. The solid volume ratios tested with water replacement method were all above 83%. So, an important conclusion was obtained that the segments after having been dynamically compacted can have better compaction effect. The FEM software of ABAQUS was adopted. The dynamic compaction was simulated by taking the poulder as a rigid body and assigning the poulder with a vertical initial velocity. The efficient compaction range can be judged by the settlement of 20mm according to the conclusion from ground radar. Finally, dynamic compaction on the embankment with a buried culvert was simulated, which reveals that the depth of embankment upper culvert must be larger than 8 m for safe dynamic compaction.

Keywords: Dynamic compaction, Thick fill embankment, In-situ test, Culvert, FEM simulation, Radar wave, Rayleigh wave

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