

# 地下轨道交通结构噪声与振动频率特性分析

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**摘要:**通过研究地下轨道交通现行国家标准与地方标准监测方法与评价量,探讨标准中存在的不足之处。并通过对受地下轨道交通运行过程影响的建筑物进行室内噪声与振动实地测试和数据分析,大胆提出了监测地下轨道交通排放的新思路。即采用1/3倍频程时间历程方法对列车通过全过程产生的结构传声排放与振动排放全时记录,借鉴声暴露级的方法,通过实测各频率数值变化截取列车通过时噪声事件的振动分频振级与结构传声1/3倍频程声压级。对此种方法的数据结果进行各频率噪声与振动相关性分析,得出地下轨道交通运行所产生结构传声污染排放的低频排放特性。通过研究和测量发现,轨道交通所引起的室内结构传声与振动污染能量主要集中于500 Hz以下低频部分,其峰值出现于40~60 Hz附近。将其与现行国家或地方标准进行比较,提出了采用特征频率作为事件判别的依据,并将各事件的最终测量结果以低频分频数据进行评价的方式,最终归纳总结了实际地下轨道交通排放频率特性并展望其测量方法。

**关键词:** 地下轨道交通;分频振级;结构传声;声暴露级

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## Structural Noise and Vibration Frequency Characteristics Caused by Underground Rail Transit

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**Abstract:** By studying the underground rail transit existing national standards and local standards monitoring method and evaluation, we explored the deficiencies existing in the standard. Through the indoor noise and vibration test of the buildings affected by the underground rail transportation operation process, we put forward new ideas of the monitoring of the underground rail transport emissions. The method used a third octave to record full discharge and vibration of train through the whole process of the structure of the microphone. By taking example of the measured method of sound exposure and testing levels of each frequency numerical change events, we intercepted train noise sound vibration frequency vibration level and structure and a third octave sound pressure level. Through various frequency correlation analysis of noise and vibration on the results, we came to a conclusion of low frequency sound transmission pollution feature caused by the underground rail transit operation structure. The tests showed that the sound and vibration pollution energy caused by underground rail transit operation mainly concentrated in 500 hz low frequency part and the peak appeared in 40~60 hz. We compared the results with the existing national or local standards, put forward the discrimination base of using characteristic frequency, evaluated the final measurement results in the form of low frequency data, and finally summarized the discharge frequency characteristic of actual underground rail transit and look forward to the measuring method.

**Key words:** Underground rail transit; Divide vibration level; Structure-borne sound; Sound exposure level

### 0 前言

国家城市化建设过程中,交通问题已越发受到重视,为了缓解地面交通压力,各大城市均开始大力发展轨道交通。但随之而来,由于城市空间利用的限制,许多地下轨道交通设施均沿道路铺设,致使周边居民或其他环境敏感受众群体常年受到地下轨道交通运行所产生的噪声污染影响。

在地面轨道环境噪声监测中,通常以测量噪声源所辐射的空气性噪声为主,但地下轨道交通所产生的空气声传播通常由于封闭的环境得到了较大程度的屏蔽。受影响的敏感建筑物内部噪声主要

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