Ground-borne Noise & Vibration Results from recent Tunnelling & Construction Projects in Sydney

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SUMMARY
In recent years, Sydney has experienced unprecedented levels of infrastructure and building construction activities. Tunnel boring machines, roadheaders, rockbreakers, drilling rigs and vibratory rollers are commonly used plant on underground tunnelling projects and major construction projects which cause significant vibration and groundborne noise.

While theory surrounding airborne noise propagation is well established worldwide due to the consistent propagation medium of air, ground-borne noise and vibration (GBNV) is not as well defined. Although current theoretical models exist which can predict GBNV levels, such models do not cater to the unique geology of each area and often they provide relatively inaccurate results in comparison to empirical models. Accordingly, GBNV levels are often measured on site from which site-laws and empirical models are established.

Ground-borne vibration measurements were undertaken at different distances from construction machinery and outside and inside buildings surrounding construction activities from a range of recent Sydney projects. Undertaking vibration measurements at buildings allows for the consideration of how these vibrations may affect a building's inhabitants and how ground-borne vibration transforms into regenerated or ground-borne noise inside buildings. The data is presented via regression analyses to produce GBNV versus distance propagation curves, which can assist to describe the extent of areas potentially impacted for various types and sizes of construction machinery.

Vibration measurements were conducted at a range of distances from the source and where the opportunity existed measurements were conducted on the exterior and interior of buildings. Additionally, noise measurements were conducted concurrently, inside subject buildings, to consider the noise produced by the intrusive vibration. The majority of interior vibration and noise measurements were taken inside rooms at basement or ground levels, shielded from external intruding airborne noise.

1 INTRODUCTION

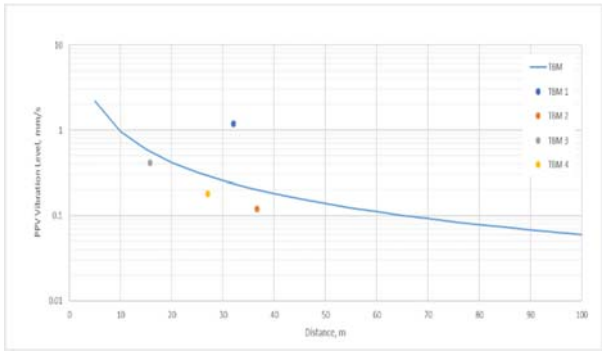
Multiple GBNV measurements conducted recently by Renzo Tonin & Associates on Sydney infrastructure and construction projects, were used to validate propagation curves which are well established and used on many past environmental impact assessments and studies. GBNV measurements were undertaken at different distances from construction machinery and outside and inside buildings surrounding construction activities. The data is presented as single levels and compared to the industry established GBNV versus distance propagation curves created using regression analyses. Additionally, ground-borne noise measurements were conducted concurrently, inside subject buildings at basement or ground levels, shielded from external intruding airborne noise.

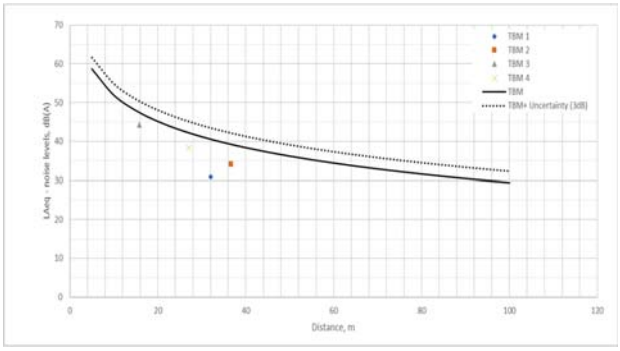
2 METHODOLOGY

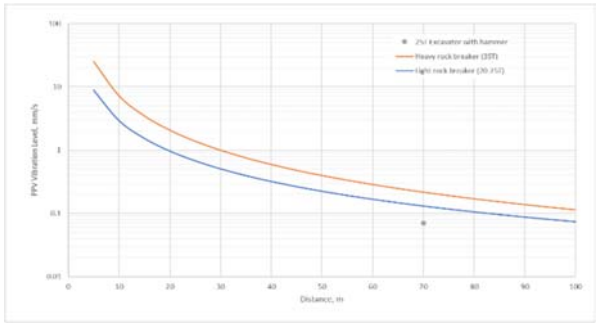
Multiple GBNV measurements were conducted at 17 different sites (approx. 5 measurement samples taken at each site) with geology mainly sandstone and a little siltstone and shale. Vibration measurements indoors and outdoors were conducted using PCB accelerometers triaxially feeding into a Soundbook and sound level measurements using B&K 2250 sound level meters.

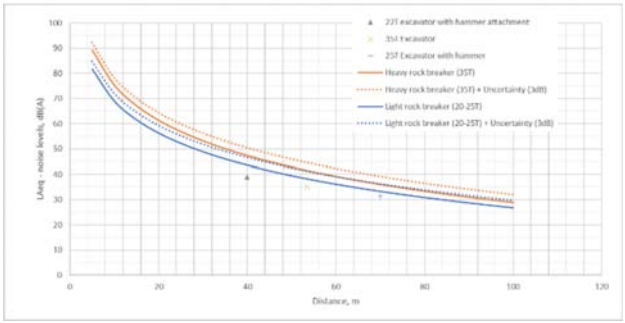
3 RESULTS

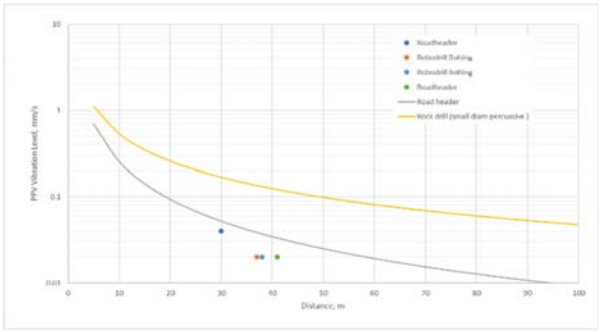
The graphs below show the average of several measurements of external vibration [PPV in mm/s] and internal noise [dB(A)] samples of TBMs, rockbreakers / rock hammers (light and heavy), roadheaders and rockdrills (rock-bolting) taken at each site as single points for comparison to the previously established empirical curves. These generally show most measurements fall slightly below the established empirical curves, with some exceptions for roadheader GBN levels.

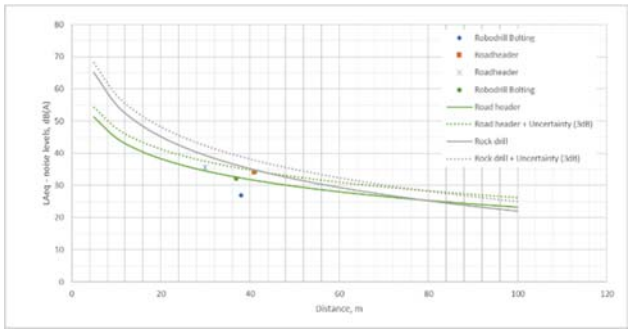












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