



Acoustic retroreflection in Indian stepwells: Field measurements in Bundi

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ABSTRACT

This study examines retroreflection – sound reflections directed back towards the source – in three historic stepwells in Bundi (India) using field measurements. Originally built for diverse purposes such as water storage, bathing grounds, and religious rituals, these subterranean stepwells represent significant examples of architectural heritage of the Indian subcontinent (Livingston 2002). The stepwells were selected for their potential in terms of retroreflection due to a relatively dense collection of simultaneously visible concave trihedral corners. Previous studies of stepwell retroreflection were based only on computational models, without real world verification (Cabrera et al. 2022). On-site measurements were conducted at Dhabhai Kund, Nagar Kund, and Baba Meer Kund using sinusoidal sweeps reproduced from a loudspeaker collocated with the microphone. Numerous source-receiver positions were selected in each stepwell. The derived impulse responses show evidence of retroreflection from the cascade of steps at high frequencies. However, the retroreflected energy level is weak relative to retroreflective building facades previously studied. Nevertheless, these results suggest that retroreflection may have plausibly contributed to anecdotal reports of unusual acoustic experiences in stepwells. These fascinating buildings provide some of the most extensive exemplars of acoustic retroreflector arrays.

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