

Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2017-83
Project Title:	Smart noise barriers / enclosures for dual active and passive control of construction noise
Principal Investigator:	Dr LAI Siu Kai, Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University
Total Approved Grant:	\$837,080
Duration:	1/4/2018 to 30/6/2020
Project Status/Remarks:	Completed
Project Scope:	<p>The major objective of this project was to investigate a new smart noise barrier for both active and passive control of construction noise resulted from powered mechanical equipment. This hybrid sound absorbing barrier would be made of recycled composite materials (i.e., wood wastes and tyre rubbers) integrating with smart materials (e.g. piezoelectric thin-film, polyvinylidene fluoride (PVDF)). The recycled composite materials were used to produce high sound absorption at middle/high frequencies, while the low frequency sound absorption was resorted to an active cancellation mechanism by the smart materials. This would not only provide an effective mitigation measure for the design of noise barriers in particular, it would also reduce the impact of construction noise to achieve better environmental conservation in general.</p>
Summary of the Findings/Outcomes:	<p>Construction noise is mainly dominated by low-frequency sound components. A common practice to this severe noise problem for environmental protection is to block the acoustic transmission path between noise sources and sensitive receivers, in which noise barriers or acoustic enclosures can be used to surround construction sites or powered mechanical equipment, respectively. This research work aimed to develop a smart noise barrier design for both active and passive control of construction noise. This hybrid-based design was made of two layers, one thick layer was a recycled composite material (i.e., a mixture of wood pellets and rubber particles) and the other one was a polyvinylidene fluoride (PVDF) thin-film. The interaction of wood-rubber materials as a resilient layer could achieve good transmission loss at middle and high frequencies for passive noise control. In terms of active control, motivated by the high-quality piezo-actuator acoustic technology, PVDF thin-film materials were performed as a noise-cancellation speaker that could mitigate the low-frequency components of incident waves. It was expected that this study would bring new ideas for designing retractable and movable noise barriers/enclosures.</p>