Case Study 2 – Noise Mitigation through Innovative Designs and Measures

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Noise is a common source of nuisance in every large city around the world. As one of the major metropolitan cities, Hong Kong is characterised by its dense population and living environment. Many residential buildings in Hong Kong are unavoidably developed close to carriageways and exposed to excessive traffic noise. It is estimated that over one million people in Hong Kong are affected by traffic noise.

Conventional Approaches to Mitigate Noise Level

In general, there are three generic types of conventional noise mitigation measures to tackle traffic noise impact. These include: (1) mitigation measures at source, (2) mitigation measures at path of propagation, and (3) mitigation measures at receivers. Examples are shown as follows:

Type of Noise Mitigation	Noise Mitigation Measure
Mitigation measures at source	• Low noise road surfacing; • Noise enclosure;
Mitigation measures at path of propagation	• Noise barrier; • Non-noise sensitive building as a noise barrier;
Mitigation measures at receivers	• Building setback; and • Block configuration and disposition.

Low noise road surfacing to reduce noise at source

Noise barrier to reduce noise at propagation path

Building setback to reduce noise at receiver end

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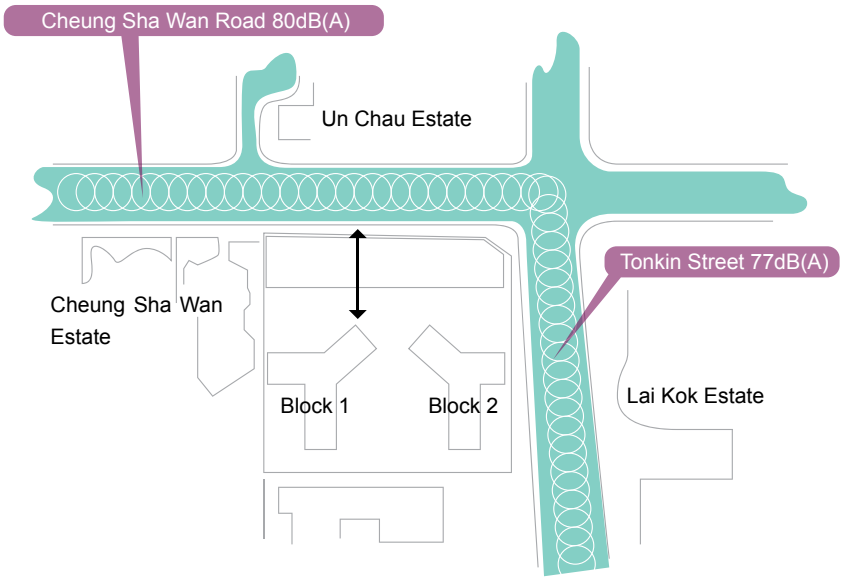
Our Innovative Approaches to Mitigate Noise Level

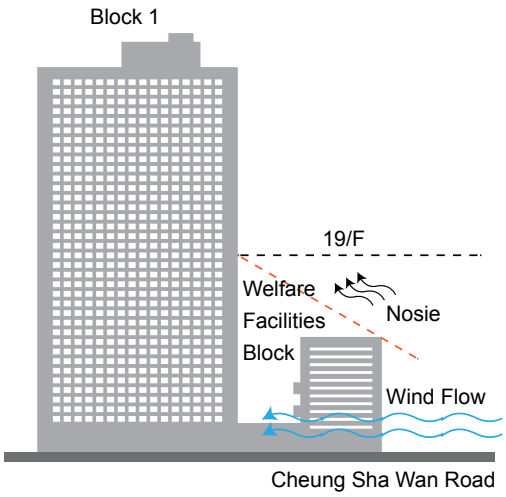
To protect public housing residents from noise nuisance, the Housing Authority (HA) strives to identify every opportunity to reduce noise impact by applying a host of noise abatement measures. The following three projects illustrate how we adopted the innovative approaches to minimise noise impacts for our residents.

Site Specific Modular Flats - Cheung Sha Wan Estate

Cheung Sha Wan Estate is located adjacent to two main roads, Cheung Sha Wan Road and Tokin Street, where the noise level reaches 80 dB(A) and 77 dB(A) respectively. Conventional noise mitigation measures including setback from Cheung Sha Wan Road, arranging welfare facilities block as a non-noise sensitive building against the road and using architectural fins have been considered in the first place to attenuate the noise level. Even with these measures in place, the noise level for flats above 19/F still exceeded the road traffic noise standard in Hong Kong Planning Standards and Guidelines at 70 dB(A).

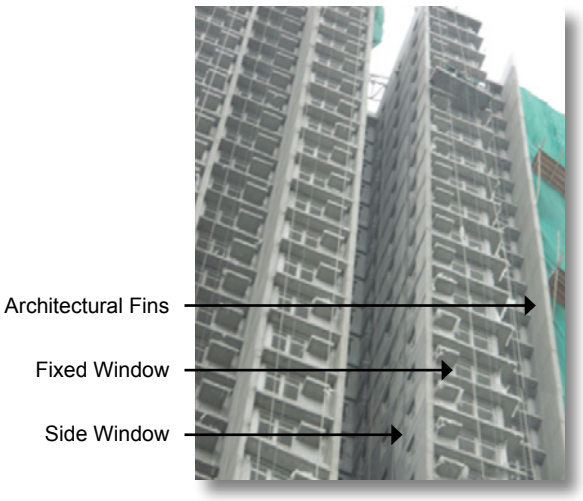


Cheung Sha Wan Estate located adjacent to two main roads with high noise levels



Welfare facilities block as a non-noise sensitive building to mitigate noise impact on the lower floors of the residential block

In view of the residual noise exceedance, we carefully looked into site specific flat layout to further mitigate the noise impact. In the site specific flat design, fixed windows are positioned at protruded rooms facing major traffic noise source while openable side windows for ventilation are installed at location with lower noise levels. These protruded rooms could also serve as barrier to abate the noise impact on the adjacent recessed rooms. By adopting this innovative design of site specific modular flats, we successfully further reduced noise level of 2-3 dB(A). Together with other conventional measures, a total noise reduction of 10 dB(A) was achieved.



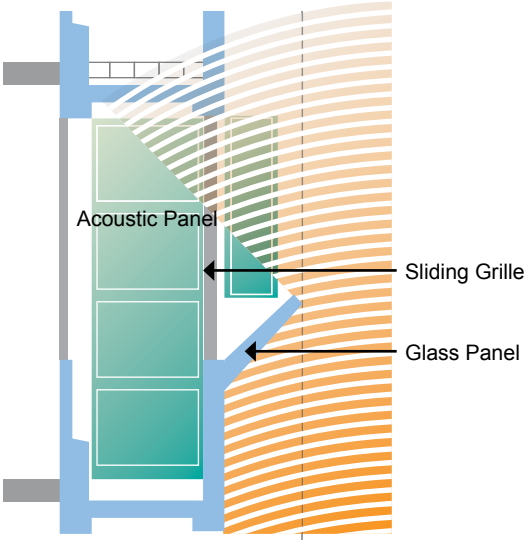
Fixed window facing major noise source and side window for ventilation

Acoustic Balconies - Wing Cheong Estate

Located at 30 metres away from the West Kowloon Corridor with severe road noise, Wing Cheong Estate development has first been explored with architectural fins and other conventional noise mitigation measures including low noise road surfacing, building set back and block orientation. However, with these measures in place, the noise level still exceeded 6 dB(A) compared to the noise standards.

To further alleviate the noise problem, project team came up with an innovative design of an arc-screen in front of the window. To verify its effectiveness, we constructed a full scale mock-up in Dongguan and carried out in-situ noise measurements using prototype installation. We tested various scenarios of different arc-screen set-ups and materials to prove the effectiveness of the design. Through consultations with other stakeholders, the arc-screen was further refined to a design of acoustic balcony with due consideration of its use and maintenance. Incorporating inclined glass panels at the parapet as noise barrier and noise absorption panels at the sidewalls and ceiling, the innovative acoustic balcony could achieve a noise attenuation up to about 6 dB(A).

Full scale mock-up at Dongguan

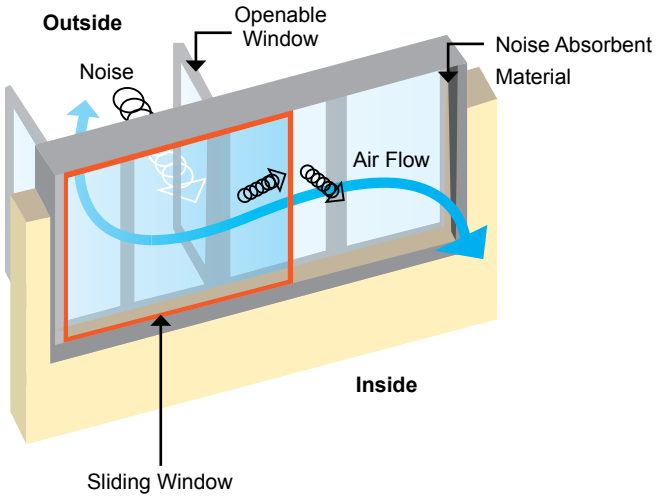


Refined design layout of the acoustic balcony

Acoustic balcony

Acoustic Windows - San Po Kong Public Housing Development

San Po Kong Public Housing Development site is located within 10 metres from the heavily trafficked Prince Edward Road East with noise level at 85 dB(A). Practicable conventional mitigation measures could only provide a noise reduction of 7 dB(A) and the project team faced a challenge to work out some innovative measures to further attenuate 8 dB(A) in order to enable the project to be viable. In collaboration with other experts and academics, we looked into the design of acoustic window which functions as a modified double-glazed window with offset openings to allow natural ventilation. Subsequent to conducting laboratory tests on this window design concept which gave very promising results, full scale mock-up flats installed with prototype acoustic window was set up on site for in-situ acoustic measurements. Upon testing for different flat and window scenarios, it was established that the acoustic window could achieve noise attenuation up to 8 dB(A). This innovative window design was adopted in the San Po Kong project and other public housing developments with similar severe traffic noise problem.



Acoustic windows to mitigate noise and allow natural ventilation

Acoustic windows

In-situ testing at San Po Kong site

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Looking Ahead

In view of the specific spatial environment in Hong Kong, we endeavour to explore innovative noise mitigation designs and measures to alleviate traffic noise impact at affected premises, in particular to those suffering from severe noise impact that cannot be adequately attenuated by conventional noise mitigation measures. These innovative measures have been proven effective to address the traffic noise issue in our public housing development without sacrificing the view of the housing blocks nor diminishing their efficiency of flat production. We strive to provide sustainable living environment for our public housing residents, and will continue to introduce and adopt innovative noise mitigation initiatives in our public housing development to offer a better living environment for them.

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