4. APPLICATION OF NOISE MITIGATION MEASURES TO EXISTING ROADS IN HONG KONG

4.1 Considerations in Application to Existing Roads

The feasibility of implementing suitable direct technical remedies on existing roads is largely controlled by the existing road-receiver configuration and the road design. Conventional plain barriers are the simplest noise abatement structure to use. Among the basic forms of mitigation measures identified, this noise screening method requires minimal space. However, the applicability of plain barriers may be fairly limited. Their uses are very often confined to where low-rise buildings are to be protected, or where there is an adequate set back of sensitive receivers. Besides, the effectiveness of plain barriers should be assessed on individual merit as the successful application of barriers will depend on many factors such as traffic flow, topographic conditions and source-receiver separation distance.

Generally, semi-enclosures provide a more effective noise protection to affected receivers than that offered by plain barriers. Subject to the availability of space and compliance with the safety requirements such as sightline distance, semi-enclosures could be built against the edge of road. Should existing infrastructure permit, a properly located semi-enclosure may protect high-rise buildings close to a road.

In terms of acoustical performance, complete enclosures can reduce road traffic noise by a substantial amount. Without the safety constraints imposed by existing road conditions (e.g. sightline problem), they are one of the most effective means in shielding traffic noise from reaching high-rise receivers in the vicinity of noisy roads. Despite their effectiveness on noise reduction, factors such as road structure, visual impacts, maintenance problems and ventilation requirements should be considered carefully when conducting the detailed design.

Among the many factors,which may influence the determination of form, location and material of noise abatement structure, safety, structural consideration, ventilation and sunlight, maintenance, public disturbance and visual impact stand out as the critical determinants for providing noise mitigation measures on existing roads. With the exception of safety, problems brought about by other factors could very often be overcome by careful design, according to previous implementation experience. While safety constraint could often render the erection of noise mitigation measures on existing roads impractical, recent EIA studies such as Route 5 Extension in Tsuen Wan provide workable solutions to incorporate this concern into the noise barrier/enclosure design.

Safety

From a safety standpoint, noise barriers and enclosures should not be installed where they will present a hazard to road safety. Wherever existing conditions allow, it is desirable to locate a noise barrier beyond the recovery zone of a carriageway, though the actual placement will vary with the width of verge, marginal strip and/or hard shoulder. Set back requirements of noise reduction measures should be evaluated for traffic safety with special emphasis on road alignment, sight distance and line-of-sight, which in turn are functions of vehicle speed, deceleration rate, radius of road/ramp curvature and driver reaction time. Due considerations should be given to situations like on- and off-ramps, ramp intersections, and intersecting roadways.

In densely developed areas, maintenance of adequate emergency access becomes a crucial safety factor. The noise screening structure should not obstruct the egress of public in crisis situations, and operation of fire engines, ambulances, police vehicles, cranes and other emergency vehicles, equipment or plant. In this respect, restrictions on the setting out and dimensions of noise barriers or enclosures should be observed to minimize the safety

implications. On the other hand, obstruction to pedestrian flows and creation of criminal black spots should also be prevented as far as possible.

Proper selection of barrier and enclosure materials constitutes another important safety aspect. Metallic and transparent materials can produce head-light glare at certain incident angles. Materials that have low fire rating or produce toxic fumes in a fire should be avoided. Additionally, the screening structure should be carefully designed such that it will not be easily broken into splinters in a crash situation. Under certain circumstances, addition of a safety barrier may be desirable.

Structural Considerations

As noise screening structures are to be erected on existing roads, the structural integrity of noise barriers and enclosures should be assessed in relation to the infrastructure setting. For situations involving elevated roads, embankments, retaining walls, steep slopes, services mains and/or foundations, structural impacts should be thoroughly investigated, and appropriate installation restrictions, design standards and guidelines should be strictly followed. For instance, HyD advise that installation of barriers or enclosures would be impractical on existing roads and flyovers because of the additional loading. To reduce the extra loading imposed on the infrastructure, self-supported noise screening structures with independent foundation should be employed where adequate space is available.

Other structural considerations such as wind loading should also be taken into account when evaluating the potential of erecting direct technical remedies on existing roads.

Ventilation and Sunlight

To prevent accumulation of vehicle exhaust gases, adequate natural or forced ventilation should be provided for full noise enclosures. Special circumstances such as where extremely high traffic volume and negligible road-receiver separation occur may warrant the verification of ventilation requirements even in the case of semi-enclosures. Enclosure headroom and length are important considerations when it comes to ventilation needs.

A high noise barrier or enclosure placed close to residents or other sensitive receivers may block the incoming sunlight, reduce the amount of natural ventilation and create turbulence, which would alter the micro-climate ultimately. The noise screening structure shall therefore be erected in such a way to minimize these adverse effects on buildings.

Maintenance Considerations

Maintenance issues pertaining to the addition of a noise screening structure to an existing roadway consist of two major aspects: maintenance of the noise barrier or enclosure itself, and maintenance associated with the existing road and roadside facilities.

In general, maintenance of barriers or enclosures may be relatively less problematic, as the choice of materials and cleaning arrangement (and to a lesser extent, forms and layout of mitigation measures) are basically controllable. However, the proposed mitigation structure may obstruct the original maintenance access and cause inconvenience for the servicing of existing roads and related facilities. Potential maintenance difficulties may further limit the options of suitable mitigation measures to busy or heavily serviced roads.

For the maintenance of noise abatement structure, the following points should be considered:

- Noise screening structures made up of acrylic and polycarbonate panels may subject to discolouration, ultraviolet attack and/or dust buildup, which may lead to consequent loss of transparency.

- Accumulation of rubbish on the roof of noise enclosures could create significant maintenance and hygiene problems, particularly where the enclosures are located right adjacent to domestic premises. In addition, the cover of the enclosures could also be damaged by objects dropped from nearby high-rise buildings.

- Artificial lighting is usually required in both full enclosures and semi-enclosures. Special maintenance arrangement such as temporary closure of traffic lane may be required when servicing the luminaries. Nevertheless, this problem could be resolved if provision for maintenance access is made in the noise mitigation structure.

Public Disturbance

Potential disturbance to the public is another concern for the selection, design and construction of direct technical remedies on existing roads. For example, erecting noise reduction structures on major routes and in busy commercial areas could cause significant public inconvenience. As an extreme example, the installation of noise enclosures or barriers along Nathan Road will obviously bring about intolerable disruption or interruption to the roadside commercial activities, which in turn would not only limit the choice of mitigation measures, but also render the provision of practicable noise mitigation solution impracticable. Despite the potential impacts of erecting noise screening structures on adjacent shops, it is yet possible to build noise barriers/enclosures in urban areas (e.g. Road 3/2 in Tsuen Wan).

Visual Impacts

The noise screening structures should preferably be planned to match the visual characters of the transportational and adjoining environmental elements. However, the design and placement of direct technical remedies are often governed by the existing road-receiver conditions. Despite this, various visual concepts should be employed as far as possible to avoid excessive visual impacts such as shading and tunnel effects. These two effects will not only increase the visual dominance of the screening structure, but they will also impair the visual and psychological perception of the drivers. Adverse visual impacts of noise barriers/enclosures, however, could be ameliorated through careful design such as proper selection of materials and colours, and mindful layout planning and landscaping.

4.2 Examples of Successful Application of Noise Mitigation Measures in Hong Kong

Despite the considerable limitations in implementing direct technical remedies on existing roads in Hong Kong, there are successful examples where noise mitigation measures work. Table 3 illustrates examples of noise barriers and enclosures installed in Hong Kong.

Table 3 Noise Barriers and Enclosures in Hong Kong

Location	Barrier Form	Materials	Size (H x L, m)	NSR Protected
Fenwick Pier Street Flyover	Plain Barrier	Concrete	1.8 x 50	Hong Kong Academy for Performing Arts
Flyover at Hing Wah Estate	Plain Barrier	Acrylic Sheets	3 x 100	Rotary Club of Hong Kong Island West Morninghope School
Tolo Highway and Slip Road	Plain Barrier	Precast Concrete	1.8 x 140 1.8 x 309	Wan Tau Tong Estate
Shatin Road near Pok Hong Estate	Plain Barrier	Acrylic Sheets	4 x 185	Schools in Pok Hong Estate
Tate's Cairn Tunnel Approaches at Choi Hung Estate	Enclosure	GRC and Acrylic Panels	5.5 x 119	Choi Hung Estate
Tate's Cairn Tunnel Approaches at Richland Gardens	Enclosure	GRC and Acrylic Panels	5.5 x 166	Richland Gardens
Route 5 - Shatin Approach	Plain Barrier	Acrylic Sheets	1.5-4 x 991	Mei Lam Estate
Lei Yue Mun Road	Deck	Concrete Decking	261 L x 45.5 W	Sceneway Garden
Route 5- Tsuen Wan Approach Cheung Pei Shan Road	Plain Barrier	Crib Wall	2-3 x 340	Sam Tung Uk Village and Hoi Pa Resite Village
Yuen Long - Tuen Mun Eastern Corridor	Plain Barrier	Acrylic Sheets	3 x 32	To Yuen Wai
A Kung Kok Road	Plain Barrier	Concrete Wall with Transparent Panels	3 x 645	A Kung Kok Village
Smithfield Extension	Plain Barrier	**	**	Mei Wah House and Wah Fai Mansion
Road 3/2 in Tsuen Wan	Enclosure	**	**	Kam fung Garden, Tsuen Tak Gardens and Joyful Buildings

Notes: ** Subject to detailed design

Source: Noise Policy Group, EPD, "Application of Screening Structures to Abate Noise from Surface Transportation"