HIGHWAYS DEPARTMENT

GUIDANCE NOTES
ON
LOW NOISE ROAD SURFACING ON LOCAL ROADS

Research & Development Division

RD/GN/011E
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Contents

1. Introduction

1.1 This set of Guidance Notes supersedes Guidance Notes No. RD/GN/011D. The binder of the polymer modified stone mastic asphalt with 6mm nominal maximum aggregate size (PMSMA6) has been upgraded with highly modified bitumen. With this upgrade, the highly modified stone mastic asphalt with 6mm nominal maximum aggregate size (HMSMA6) becomes the new generation of low noise road surfacing (LNRS) on local roads in Hong Kong.

1.2 The requirements for retrofitting or resurfacing of existing local roads laid with LNRS shall refer to the latest version of Guidance Notes No. RD/GN/039.

1.3 The technical guidelines on the application of highly modified friction course (HMFC) as LNRS on expressways and high speed roads in new road projects, as well as the requirements for retrofitting or resurfacing of existing expressways and high speed roads laid with HMFC shall refer to the latest version of Guidance Notes No. RD/GN/032. As HMFC is not designed for general use on local roads, this set of Guidance Notes does not cover its application.

2. Background

2.1 In 2000s, a trial programme on the use of polymer modified friction course (PMFC) as LNRS on local roads was jointly conducted by Highways Department (HyD) and Environmental Protection Department (EPD). Based on the findings in the trial programme, the technical application criteria of using PMFC as LNRS on local roads were recommended in Guidance Notes No. RD/GN/011C which was issued in November 2016, updating the technical guidelines on application of PMFC as LNRS and introducing the development of "thin surfacing" as LNRS.

2.2 However, both overseas and local experiences revealed that PMFC, attributed to its porous nature, is susceptible to wear and tear making it not sufficiently durable as LNRS for many situations to sustain the local road conditions.

2.3 To overcome these limitations, HyD commissioned the Hong Kong Polytechnic University (PolyU) to undertake a collaboration study on evaluating the performance of "thin surfacing", i.e. PMSMA6, as LNRS on local roads in 2016. With the positive findings in the study and subsequent trial programme, HyD updated the Guidance Notes No. RD/GN/011 from version C to D in 2023 for the application of PMSMA6 as LNRS on local roads.

2.4 To further enhance the durability of asphalt materials, HyD collaborated again with PolyU commencing a study to upgrade the binder of PMSMA6 from polymer modified bitumen to highly modified one in 2021. With the positive findings in the study, HyD conducted an about 1-year site trial programme covering 18 trial road sections laid with HMSMA6. Based on the findings from the study and the successful site trials, HMSMA6 is recommended by HyD and EPD as a new generation of LNRS for local roads.

3. Noise Generated from Traffic

3.1 Noise from road traffic has become a very contentious environmental issue. Reducing traffic noise is a subject of understanding the tyre/road/vehicle/noise generation mechanisms and is of an inter-disciplinary nature. The quality of the road surface, tyre design, vehicle system and speeds all have an effect on traffic noise.

3.2 Where traffic speeds are lower than 50 km/h, traffic noise is mainly attributable to engine, transmission and exhaust noise, especially from lorries and buses. Where speeds are higher, the major component of traffic noise comes from the tyre/road interaction. This noise comes from, amongst other things, vibration of the tyre wall, compression of air within the contact area of the tyre with the road surface, and the snapping out of the tread blocks as they leave the road surface.

3.3 It is worth noting that application of LNRS is just one form of noise mitigation measures and different types of LNRS would have their respective limitations. A holistic approach should be adopted while exploring and designing suitable measures for tackling road traffic noise issues for new road projects. The primary objective of road maintenance is to maintain the integrity of the road network with particular emphasis on safety and serviceability. Normally, HyD is not required to carry out any maintenance works solely for restoring the noise reducing performance of LNRS. The project proponent/designer shall take this into consideration in the proposed application of LNRS to address traffic noise issues under the concerned project.

3.4 In considering LNRS in a project, the project proponent should, as early as the planning stage, carefully review the road characteristics and the application of LNRS as detailed in Section 4.3. Early liaison with the concerned Regional Office of HyD is essential to identify the extent of road sections suitable for LNRS. The project proponent should also secure sufficient annual recurrent costs for the proposed LNRS.

4. Low Noise Road Surfacing Materials on Local Roads

4.1 The mix design for HMSMA6 is shown in Table 1 for reference. However, the mix design and specification for HMSMA6 may be subject to change as technologies evolve. The up-to-date specification for HMSMA6 in the most recently awarded HyD road maintenance term contract should always be referred to.

Table 1: Mix Design for HMSMA6

Properties		
Nominal maximum aggregate size		6 mm
Particle size distribution	BS test sieve	Percentage by mass passing
	14 mm	100
	10 mm	98 – 100
	5 mm	76 – 90
	2.36 mm	22 – 30
Particle size distribution	BS test sieve	Percentage by mass passing
	1.18 mm	12 – 20
	600 μm	–
	300 μm	–
	150 μm	–
	75 μm	6 – 12
Bitumen type		Pre-blended type polymer modified bitumen having performance grade not lower than PG82 of the Performance-Graded Asphalt Binder Specification and viscosity at 60°C not lower than 70,000 Pa.s
Bitumen content as percentage of total mass of material		6.0 % min.
Fibre content as percentage of total mass of material		0.3 % min.
Draindown percentage as determined from binder draindown test		0.3 % max.
No. of blows per side at Marshall compaction		75 nos.
Marshall stability		6 kN min.
Air voids in mix (VIM) as a percentage of total bulk volume		7 % - 9 %
Voids in mineral aggregate (VMA) as a percentage of total bulk volume		17.0 % min.

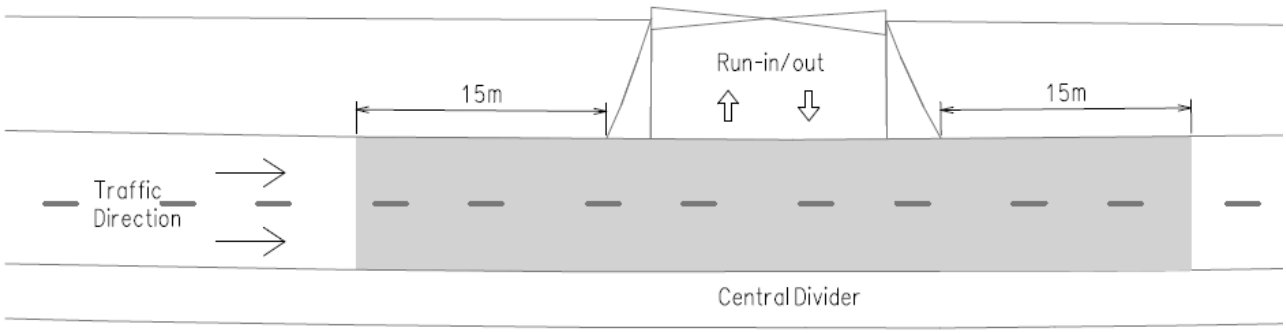
4.2 To evaluate the applicability of HMSMA6 on local roads in Hong Kong, 18 road sections were selected for site trial that commenced in November 2023 as mentioned in paragraph 2.4 above. Similar to PMSMA6, HMSMA6 is a thin layer of non-porous bituminous surfacing (typically 30mm thick), made of relatively fine and gap-graded aggregates (nominal maximum aggregate size of 6mm), which can provide an optimized surface texture for reducing road-tyre noise. The site trial results reveal that the average noise reduction level of HMSMA6 is approximately 2.5dB(A) and its noise reduction ability would only be materially reduced when substantial surface defects, like raveling and potholes, are developed.

4.3 Since the laboratory tests conducted under the collaborative study with PolyU show that the performance of HMSMA6 is superior to that of PMSMA6, it can be reasonably inferred that the road characteristics suitable for laying PMSMA6 should also be suitable for HMSMA6. Detailed information is provided in Table 2.

Table 2 - Application of HMSMA6 on Road Pavement with Different Road Characteristics

	On Bituminous Pavement (Laid on Base Course)	On Concrete Pavement
Suitable	• parking area • run-in/out zone except those not suitable as mentioned below • gentle or inclined road with smooth traffic (with or without bus stops, except those not suitable as mentioned below) • bus stop zone on road section with gradient not greater than 5% (except those not suitable as mentioned below) • stop line zone (except those not suitable as mentioned below) • sharp turn (except those not suitable as mentioned below)	• parking area • run-in/out zone except those not suitable as mentioned below • gentle road[1] with smooth traffic[2]
Not Suitable	• road section where more durable materials (e.g. HMSMA10[3]) should be used according to Table 2 of HyD Guidance Notes No. RD/GN/038 • run-in/out zone located at industrial buildings or heavy vehicle car parks (see an example in Figure 1 for an illustration) • bus stop zone[4] on road sections with gradient greater than 5% • stop line zone[5] of bus lane • bus terminus zone with sharp turn located at its entrance/ exit (see an example in Figure 2 for an illustration)	• bus stop zone • run-in/out zone located at industrial buildings or heavy vehicle car parks
Not Conclusive	• road junction	• road junction • stop line zone • sharp turn location • inclined road[6] with smooth traffic • existing concrete surface bridge structure

[1] "gentle road" means road section with gradient not greater than 5%
[2] "smooth traffic" means road section without stop lines, bus stops, signalized junctions etc.
[3] "HMSMA10" is not considered as LNRS material
[4] "bus stop zone" means 15m approaching the bus stop and 15m following the bus stop, as illustrated in Figure 3
[5] "stop line zone" means 15m before stop line, as illustrated in Figure 4
[6] "inclined road" means road section with gradient greater than 5%

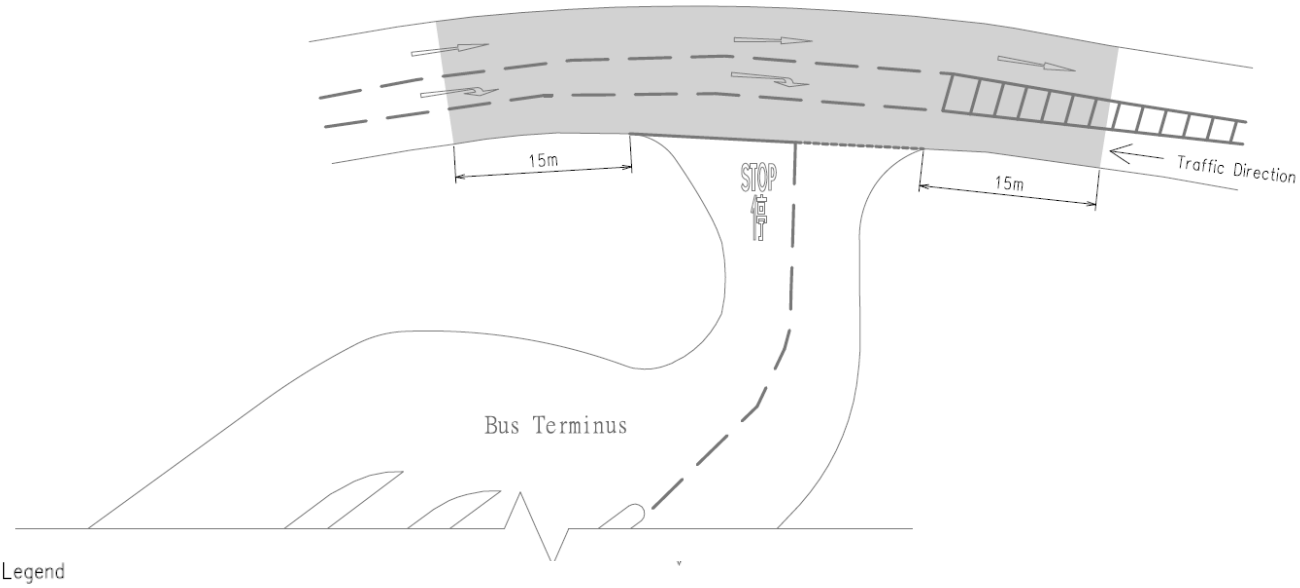


Legend

Not suitable for LNRS

Remark: The extent is unified across all traffic lanes with maintenance consideration.

Figure 1 – Example of run-in/out zone located at industrial buildings or heave vehicle carparks



Legend

Not suitable for LNRS

Remark: The extent is unified across all traffic lanes with maintenance consideration.

Figure 2 – Example of bus terminus zone with sharp turn located at its entrance/exit

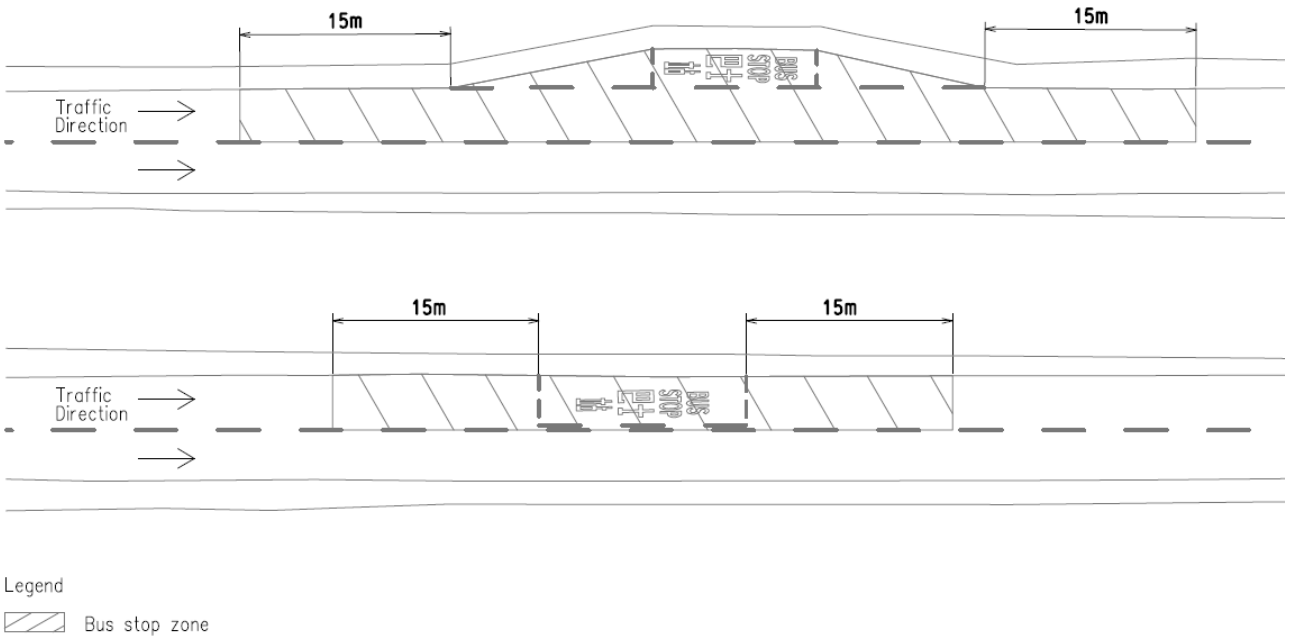


Figure 3 – Bus stop zone with and without layby

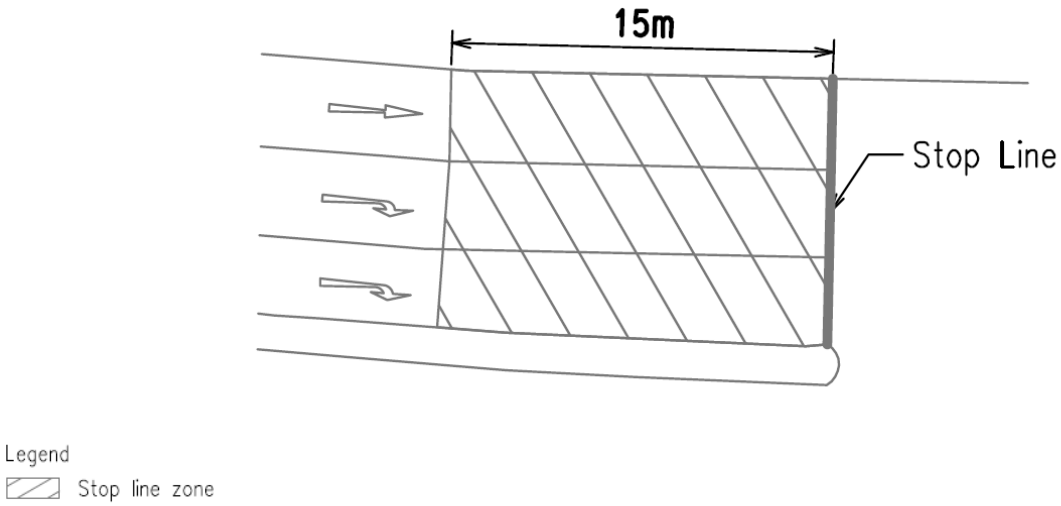


Figure 4 – Stop line zone