



HIGHWAYS DEPARTMENT

**GUIDANCE NOTES
ON
LOW NOISE ROAD SURFACING ON LOCAL ROADS**

Research & Development Division

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1. Introduction

- 1.1 This set of Guidance Notes supersedes Guidance Notes No. RD/GN/011C and further updates the technical guidelines on the application of 6mm Polymer Modified Stone Mastic Asphalt (PMSMA6) as low noise road surfacing (LNRS) on local roads in new road projects.
- 1.2 The requirements of 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 of retrofitting or resurfacing of existing expressways and high speed roads laid with polymer modified friction course (PMFC) and HMFC shall refer to the latest version of Guidance Notes No. RD/GN/032.

2. Background

- 2.1 In 2000s, a trial programme on the use of 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 to undertake a collaboration study on evaluating the performance of “thin surfacing”, i.e. PMSMA6, as LNRS on local roads in 2016. With positive laboratory test results, HyD and EPD commenced a comprehensive site trial programme of PMSMA6 on local roads in 2019 with a view to establishing a set of criteria for general application of this new LNRS material. The noise reduction performance of PMSMA6 had continuously been measured and monitored by EPD during the trial programme.
- 2.4 On the other hand, HyD also commenced a site trial programme on HMFC on public roads since 2017 as another LNRS material with a view to addressing the durability problem of PMFC laid on expressways and high speed roads. In general, HMFC will not be used as LNRS for local roads and so the technical guidelines on the application of HMFC will not be covered by this set of Guidance Notes.

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 secure sufficient annual recurrent cost for the proposed LNRS.

4. Low Noise Road Surfacing Materials on Local Roads

- 4.1 From some overseas countries experience, “thin surfacing” is considered a better LNRS alternative for local roads. “Thin surfacing” refers to a thin layer of non-porous bituminous surfacing (typically 25mm to 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. Such noise reduction mechanism could be more sustainable than PMFC.
- 4.2 The mix design for PMSMA6 is shown in Table 1 for reference. However, the mix design and specification for PMSMA6 may be subject to change upon completion of further site trial as mentioned in paragraph 4.4 below. The up-to-date specification for PMSMA6 in the most recently awarded HyD road maintenance term contract should always be referred to.

Table 1: Mix Design for PMSMA6

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	75 – 90
	2.36 mm	20 – 30
	1.18 mm	10 – 20
	600 µm	–
	300 µm	–
	150 µm	–
	75 µm	6 – 12

Properties	
Bitumen type	Pre-blended type polymer modified bitumen having performance grade not lower than PG76 of the Performance-Graded Asphalt Binder Specification
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 % - 10 %
Voids in mineral aggregate (VMA) as a percentage of total bulk volume	17.0 % min.

4.3 To evaluate the applicability of “thin surfacing” on local roads in Hong Kong, about 50 trial sites were selected as agreed between HyD/EPD for laying with PMSMA6 under the site trial programme commenced in 2019 as mentioned in paragraph 2.3 above. The selected road sections covered various road characteristics such as stop lines, bus stops, inclined roads and sharp turnings. As gentle roads¹ with smooth traffic² should not be subjected to high shearing stress from traffic, laying PMSMA6 on bituminous base course or concrete with this road characteristic should not be a concern. The site trial results reveal that the average noise reduction level of PMSMA6 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. Its noise reduction mechanism is also found to be more sustainable than PMFC. Based on its technical properties and overseas experiences coupled with the site observations of the performance of PMSMA6 at different road characteristics of the trial road sections, the application criteria of PMSMA6 are summarized below:

4.3.1 Application of PMSMA6 on Bituminous Base Course

PMSMA6 is found suitable to be laid on bituminous local roads as LNRS except that the following locations/road characteristics shall be excluded:

- road sections where more durable materials (e.g. polymer modified stone mastic asphalt with 10mm nominal maximum aggregate size (PMSMA10)³ or highly modified stone mastic asphalt with 10mm nominal maximum aggregate size (HMSMA10)⁴) should be used according to Table 2 of the latest version of Guidance Notes No. RD/GN/038
- run in-out located at industrial buildings or heavy vehicle car parks
- bus stop zone⁵ on road section with gradient greater than 5%

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 “PMSMA10” is not considered as LNRS material

⁴ “HMSMA10” is not considered as LNRS material

⁵ “bus stop zone” means 15m approaching the bus stop and 15m following the bus stop

- stop line zone⁶ of bus lane
- sharp turn located at entrance/ exit of bus terminus

4.3.2 Application of PMSMA6 on Concrete Surface

The suitability of PMSMA6 for application on concrete surface at local road sections with different road characteristics is summarized below:

- (i) Not suitable
 - bus stop zone
 - run in-out located at industrial buildings or heavy vehicle car parks
- (ii) Suitable
 - parking area
 - run in-out except those not suitable as mentioned above
- (iii) Not conclusive
 - stop line zone
 - sharp turn location
 - inclined road⁷ with smooth traffic
 - concrete surface bridge structure

4.4 For the road characteristics categorized as “not conclusive” as listed under paragraph 4.3.2(iii) above, the project proponent/designer may still consider to use PMSMA6 on the proposed road sections for further site trial purpose subject to the agreement of both Research and Development (R&D) Division and the concerned Regional Office of HyD. It should be noted that if the performance of PMSMA6 was found unsatisfactory at these further trial road sections, the respective road sections should be resurfaced by a more durable material, for example, by PMSMA10 or HMSMA10 when early defect of the laid PMSMA6 is observed. Therefore, the above further trial arrangement is only suitable for use under non-designated projects, with a view to widening the potential application of PMSMA6 on concrete surface. However, for designated projects, laying PMSMA6 at the above “not conclusive” road characteristics is not recommended.

⁶ “stop line zone” means 15m before stop line

⁷ “inclined road” means road section with gradient greater than 5%