HIGHWAYS DEPARTMENT

GUIDANCE NOTES
ON
APPLICATION OF SEMI-FLEXIBLE PAVEMENT

Research & Development Division

RD/GN/053
Aug 2026

Contents

1. Introduction

1.1 This set of Guidance Notes promulgates the application of semi-flexible pavement (SFP) as a surfacing material in bituminous carriageways in Hong Kong.

2. Background

2.1 SFP is a composite pavement structure formed by application of high-fluidity cement-based grout into a porous bituminous material skeleton. The adoption of SFP as an alternative paving material is increasing over the world. Successful applications in the Chinese Mainland and overseas in recent years have demonstrated its effectiveness in addressing pavement challenges, such as rutting and pre-mature distress under heavy traffic conditions. SFP offers better stability and higher strength compared to traditional bituminous surfacing materials, while maintaining good riding quality. Furthermore, it is easier to maintain than concrete pavement. Given these advantages, SFP is considered to have significant potential for application in Hong Kong, contributing to a more durable and sustainable road network.

2.2 The Research and Development (R&D) Division, in collaboration with the Hong Kong Polytechnic University, launched a study in March 2025 to evaluate the technical feasibility of using locally available highly modified friction course (HMFC) as the porous bituminous material skeleton for SFP. Laboratory tests confirmed that HMFC materials with a modified bitumen content of 4% provided sufficient connected air voids for effective grouting to produce SFP.

2.3 Furthermore, to evaluate the constructability of SFP in local environment in Hong Kong, depot trial and site trial were conducted in January and March 2026 respectively. Overall, the construction of SFP proceeded smoothly.

3. Design of Semi-flexible Pavement

3.1 SFP layer as a surfacing material on carriageway is typically 50 mm thick. The mix design of SFP comprises mix design of HMFC for SFP, design of cement-based grout and design of SFP, which are shown in Table 1, Table 2 and Table 3 respectively for reference. The relevant details may be subject to change when required. The up-to-date specifications for this material in the road maintenance term contract most recently awarded by Highways Department should always be referred to.

Table 1: Mix Design for Highly Modified Friction Course for Semi-flexible Pavement

Properties		Highly Modified Friction Course
Nominal maximum aggregate size		10 mm
Particle size distribution	BS test sieve	Percentage by mass passing
	14 mm	100
	10 mm	85 - 100
	5 mm	20 - 40
	2.36 mm	5 - 15
	75 µm	2 - 6
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	min.	4.0
	max.	5.5
No. of blows per side at Marshall compaction	50 nos.	
Air voids in mix as a percentage of total bulk volume	min.	20%
Connected air void content	min.	17%
	max.	25%

Table 2: Design for Cement-based Grout for Semi-flexible Pavement

Properties		Cement-based grout
Initial fluidity		10 -14 s
Fluidity (30 min)		10 -18 s
Bleeding	max.	1%
Compressive strength (3h)	min.	10 MPa
Compressive strength (1d)	min.	15 MPa
Compressive strength (28d)	min.	25 MPa
Bending strength (28d)	min.	2.5 MPa
Drying shrinkage (28d)	max.	0.3%

Table 3: Design for Semi-flexible Pavement

Properties		Semi-flexible pavement
Grouting plumpness	min.	85 %
Marshall stability	min.	10 kN

4. Areas of Application

4.1 Compared with conventional surfacing bituminous materials, like ordinary wearing course material or highly modified stone mastic asphalt with 10mm nominal maximum aggregate size (HMSMA10), SFP has higher rutting resistance and durability. SFP is therefore better suited for locations subject to high stress from vehicle movements, including frequent stop and go movement, deceleration, acceleration, and turning.

4.2 For **new road projects**, SFP should be adopted as the surfacing material for flexible pavements in high-stressed locations where heavy braking is common. These locations include:

- Bus stop zones;
- Roundabouts and associated approaches;
- Road junctions and associated approaches;
- Sharp bends; and
- Approaches to bus terminals and signalised junctions

Layout plans illustrating examples of SFP applications are provided in **Appendix A**.

4.3 The above guidance is not applicable to new roads which are classified as Local Distributors or Feeder Roads under the Transport Planning and Design Manual published by the Transport Department and their traffic level of commercial vehicles per lane per day is not greater than 1500[Notes]. In addition, if a new road project involves localized roadworks on existing roads (such as junction widening), where a strict application of the recommendation according to paragraph 4.2 may not be appropriate after assessment, the designer may propose not to adopt SFP at a particular location. This proposal should be justified based on a thorough consideration of various factors. These may include, but not limited to:

- The existing road surface at the concerned location already adopts low noise road surfacing material.
- The location has no obvious rutting defects previously.
- There are significant practical difficulties in implementing the necessary temporary traffic arrangement for SFP works.

Designers shall submit the proposal with justifications to the relevant Regional Office of Highways Department for consent.

4.4 For avoidance of doubt, HMFC should be used on high speed roads to improve skid resistance and reduce the risk of aquaplaning as stipulated in the latest version of Guidance Notes No. RD/GN/032. The locations considered as high-stressed in paragraph 4.2 are not relevant to high speed roads.

Notes:

1. Commercial vehicles include all medium/heavy goods vehicles and buses classified in the Annual Traffic Census issued by the Transport Department.
2. Annual average daily traffic and percentage of commercial vehicles at appropriate stations listed in the Annual Traffic Census should be referred to in determining the no. of commercial vehicles per lane per day of a road section. For the procedure of calculating the traffic level, reference can be made to the latest version of Guidance Notes No. RD/GN/042, Pavement Design for Carriageway Construction. If there are no core or counting stations in the road section, the relevant data of adjacent roads in the areas should be referred to. Manual traffic counting may be required if necessary.

4.5 For **existing roads**, if severe rutting and pre-mature distress are observed in the flexible pavement, the maintenance officer could review the site condition and take into account paragraphs 4.2 to 4.4 to consider using SFP for rehabilitation or preservation works to address the defect issues.

5. Supplementary Notes for Semi-flexible Pavement Construction

5.1 Proper mixing and grouting of cement-based grout are crucial to the performance of SFP. A method statement for mixing and grouting, together with equipment to be used and a range of temperature suitable for grouting, should be prepared, taking into account recommendation of the manufacturer of the cement-based grout.

5.2 Throughout the whole site operation and before grouting, suitable protection measures should be taken to prevent leakage of cement-based grout to the adjacent kerb joint, gullies, etc., and to avoid contamination to the adjacent areas.

5.3 Mixing and grouting operations shall not be carried out during rainy conditions as the grout properties and the long-term performance of SFP are sensitive to its water content.

5.4 When implementing SFP on road sections with a steep gradient, the grouting of cement-based grout should be commenced from the low point and proceeded upwards. Moreover, SFP applied at road sections with longitudinal gradients of 5% or greater is generally not recommended. Under circumstances where the use of SFP on such gradients is necessary, a detailed method statement should be submitted for acceptance by the Engineer, and if considered necessary by the Engineer, a site trial should be conducted to confirm its constructability and compliance with the relevant requirements such as grouting plumpness and texture depth.

5.5 During the application of cement-based grout, the surface temperature of the newly compacted highly modified friction course shall not exceed 50^{o}C.

Appendix A

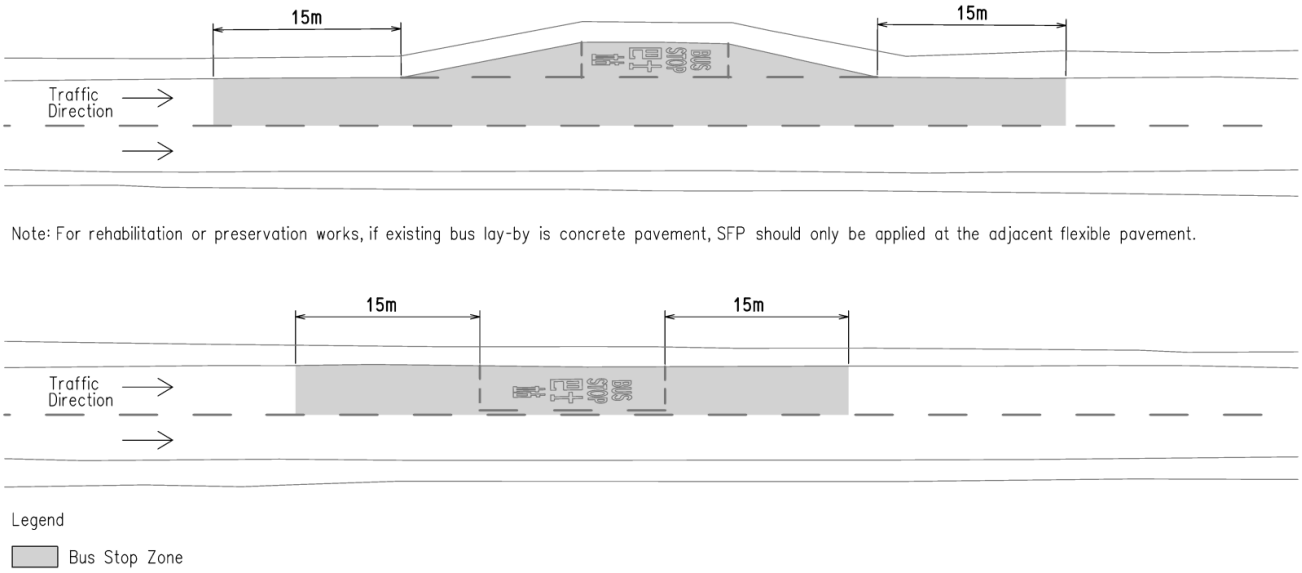

Figure 1 – Example of Bus Stop Zone with and without Layby

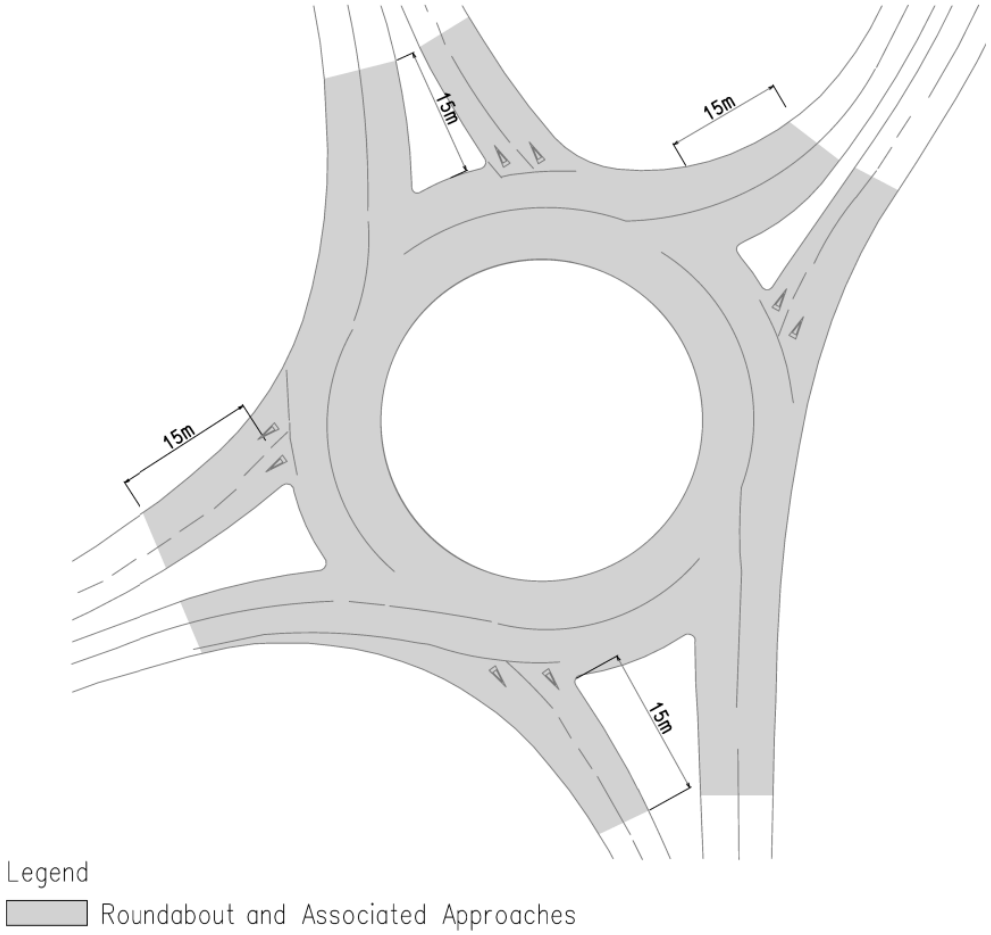

Figure 2 – Example of Roundabout and Associated Approaches

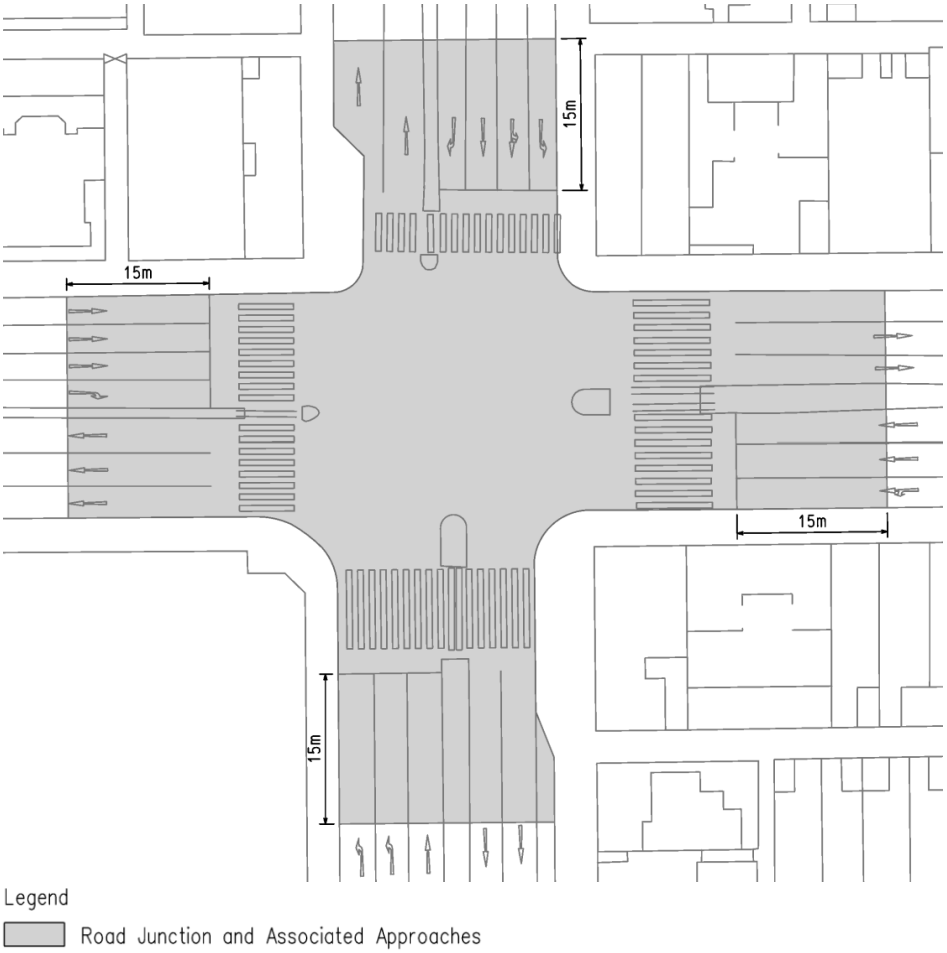

Figure 3 – Example of Road Junction and Associated Approaches

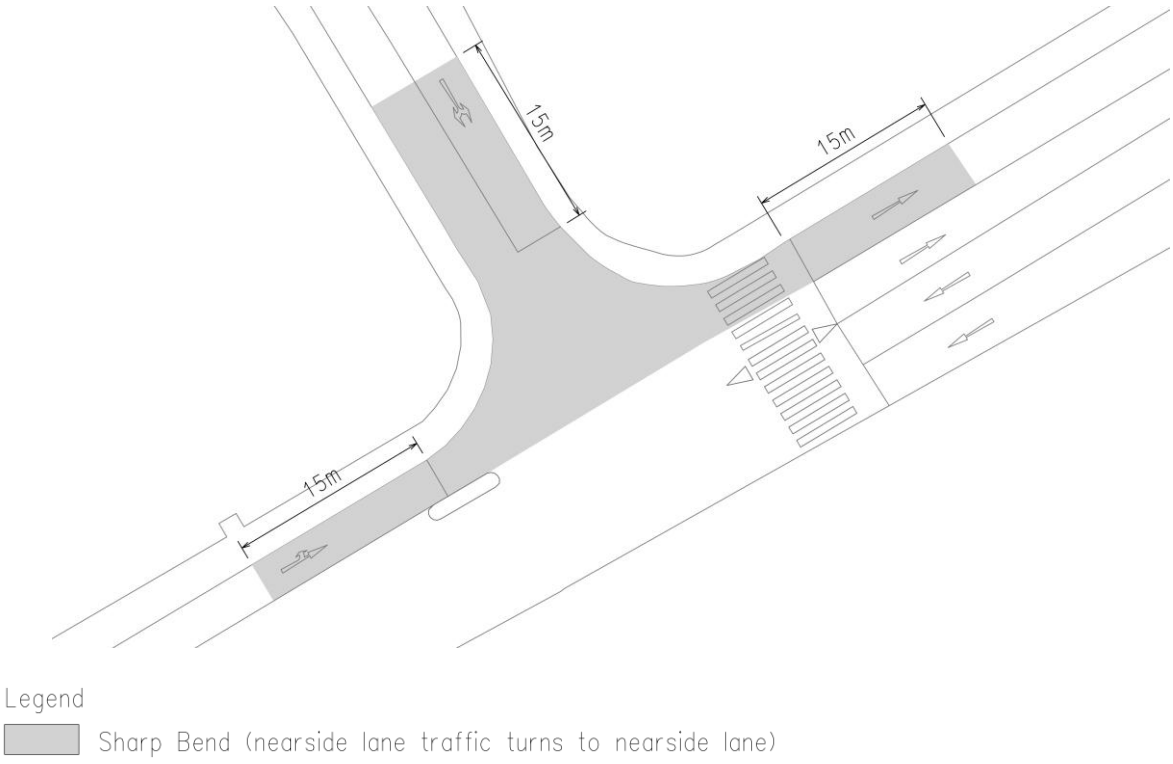

Figure 4 – Example of Sharp Bend

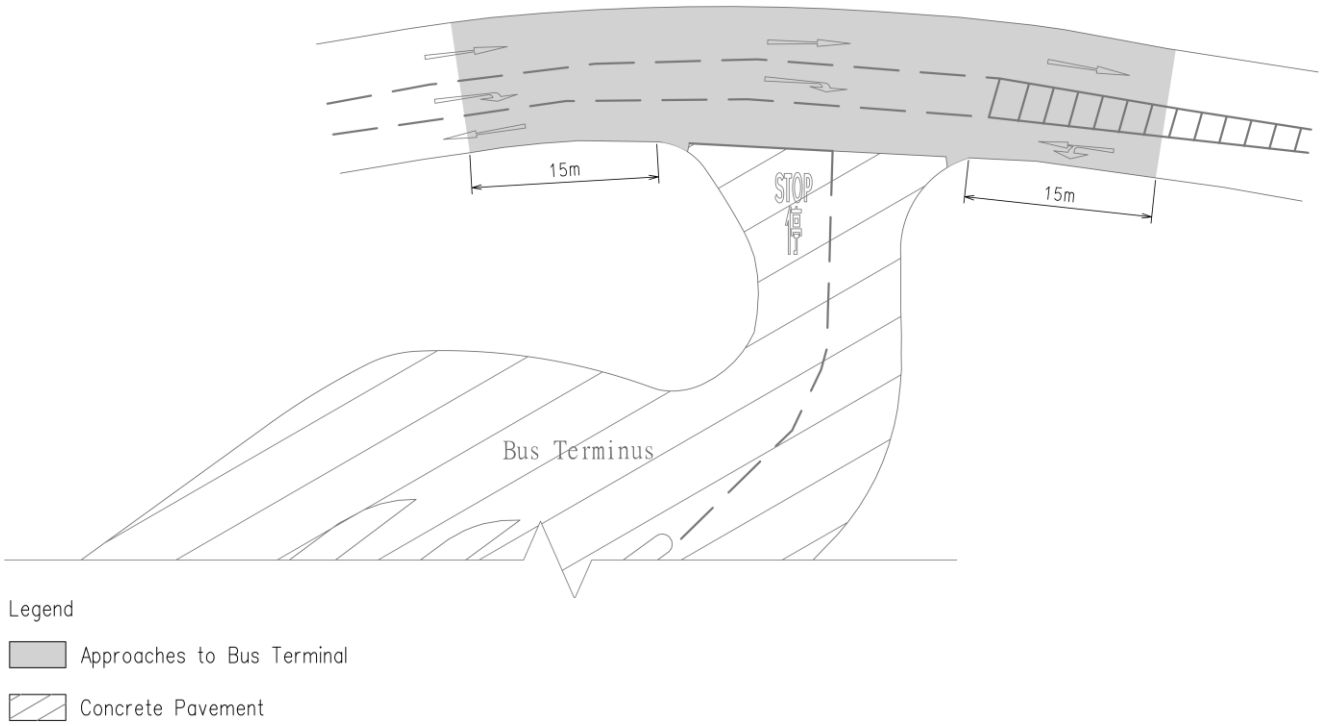

Figure 5a – Example of Approaches to Bus Terminal

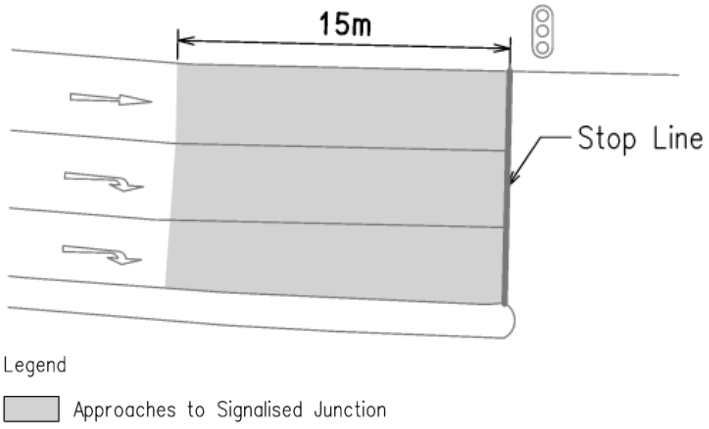

Figure 5b – Example of Approaches to Signalised Junction