

Supplementary Guidance
for
Preservation of Bituminous Carriageway

Purpose

1. This set of guidance is to :
 - i. Introduce a new maintenance practice for polymer modified friction course (PMFC); and
 - ii. Supplement HyD Guidance Notes RD/GN/039 by including a deep inlay practice for wearing course (WC) material suiting specific maintenance needs.

Resurfacing of PMFC without WC re-laid

2. With the belief that a rough milled surface can hardly provide a smooth running surface for effective drainage, it was the norm to rehabilitate defective PMFC by milling off and re-laying both the 30mm thick PMFC and its underlying WC (hereinafter referred to as “existing method”). Overseas maintenance practices on porous friction courses vary, and it is found not rare to only replace a failed friction course by a new one without its immediate sub-layer re-laid. To prudently review the existing local practice and evaluate the feasibility of resurfacing of PMFC without WC re-laid (hereinafter referred to as “new method”), Hong Kong Polytechnic University was engaged in 2011 for a collaboration research through theoretical analysis, computer modelling, site tests, laboratory tests and field trials. The findings and observations are summarized below.
3. The new method can fully satisfy the compliance criteria for texture depth and permeability as stipulated in Section 9 of the General Specifications, with the results very similar to those from the existing method.
4. Drainage efficiency is an important PMFC property, which describes the rate of surface runoff discharged through a porous surfacing layer. While no standard test was available, the change in moisture content inside PMFC layer against time was measured following a controlled pouring of fixed amount of

water (which simulates a heavy rain condition) in order to compare the drainage performance between the two resurfacing methods. Field measurements consistently showed that the new method resulted in a less increase in moisture content. It indicates that the existing method essentially produces a porous surfacing with a higher tendency of trapping seepage. Anyhow, field monitoring in the past two years over five trial sections using the new method found no noticeable difference in their on-site drainage performance during and after rainstorms when compared with their adjacent control sections laid by the existing method.

5. In-situ pull-out tests showed that the existing method provides a stronger PMFC/WC interlayer bond strength than the new method. In both methods, the interlayer bond strengths were found increasing with time, of an order more than doubled in two years. Further analysis and laboratory tests indicated that the shear strength at the interface between PMFC and milled WC (i.e. the new method), albeit reduced in magnitude, is well sufficient to stand for the anticipated maximum shear stress induced by traffic. Delamination failure would thus not be a concern.
6. The underlying reasons of the findings stated in the above two paragraphs can be further elaborated as follows. Under the existing method, while laying and compacting PMFC on a freshly laid and not yet fully cured WC, the coarse aggregates from the PMFC would somewhat be pressed into the WC layer, ending up with a better bonding. At the same time, aggregate interlocking and better fusion of two freshly laid PMFC and WC layers would hinder the free flow of water near the interlayer zone, which explains why the existing method in effect traps seepage. Moreover, it can be envisaged that, unlike the flow condition along a concrete step channel, certain amount of surface runoff would be retained or "trapped" inside the tiny and irregular voids of PMFC after raining regardless of the surface condition on which PMFC is laid. The "trapped" moisture could not be drained by gravity but gradually be evaporated or dried under the combined effect of sunshine, wind, and fast moving traffic.
7. Based on the above findings, there is a solid technical ground that PMFC can be laid directly on milled surface for resurfacing, except under any of the following circumstances:

- i. *Defective road sections with major cracking, depressions or rutting ---*
Unlike the predominant surface distresses normally encountered on PMFC (i.e. ravelling or void clogging), cracking and deformation are generally resulted from weak and deteriorated underlying materials, to which deeper inlay down to the WC or else has to be carried out to achieve more durable pavement rehabilitation.
 - ii. *Loose and weak underlying bituminous materials exposed from coring taken under project level investigation ---* The disintegrated layer(s), in particular the WC, should be replaced to achieve more durable pavement rehabilitation.
 - iii. *PMFC laid on cushion course as an overlay on concrete carriageway ---*
For rigid pavement composition, the remaining thin layer of cushion course after milling can hardly be maintained in good condition. Cold milling and resurfacing down to sound concrete surface should be considered instead.
8. Whilst the above provides a general guidance for resurfacing of PMFC, maintenance colleagues or project officers could exercise their judgment to carry out resurfacing of PMFC in conjunction with underlying layer(s) wherever necessary to suit specific site conditions or project needs.

Deep Inlay of WC in Single Paving Operation

9. Deteriorated bituminous pavements with severe cracking should have been experiencing a prolonged period of fatigue damage under repeated traffic loading and top-down deterioration through environmental attack. Condition of sub-layer material would likely be disintegrated to a certain degree. Deep inlay would be required to effectively restore the pavement structural condition. In case any particular site constraints hinder the implementation of rehabilitation works in the conventional layer-by-layer manner, as an alternative and pragmatic approach, defective WC and base course (BC) material can be resurfaced by ordinary WC20 up to a thickness of 105mm under a single laying and compaction process.
10. The above-mentioned deep inlay practice is not appropriate for road sections with major deformation, rutting or shoving kind of distresses as the rut

resistance provided by a layer of 105mm WC would be marginally lower than typical WC and BC pavement construction.

General Remarks

11. All the prevailing technical specifications for PMFC and WC materials, from handling, mixing, laying and compaction to compliance tests and acceptance criteria, shall still be followed.

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February 2015