Millability of geosynthetic pavement interlayers

Tiago Souza[1], *Jorge G.* Zornberg[2], and *Natalia S.* Correia[1*]

[1]Federal University of Sao Carlos, Civil Engineering Department, Washington Luis Rd., km 235, 1356590 Sao Carlos, SP, Brazil
[2]University of Texas at Austin, Austin, Civil, Architectural and Environmental Engineering Department, TX-78712, USA

Abstract. Due to the increasing use of geosynthetic pavement interlayers, such as geogrids, paving geocomposites, and paving mats in asphalt rehabilitation works, asphalt milling projects involving milling the geosynthetic layers will significantly increase in the upcoming years. Thus, it is essential to understand how the milling process of conventional asphalt layers differ from milling paving interlayers. An experimental field section was constructed at the Salvador International Airport (Brazil) with different geosynthetic sections. Results showed that all geosynthetic pavement interlayers were "millable", but with certain differences in the milling efficiency, as well as in the physical characteristics of the RAPs.

Regardless of how structured and durable the flexible pavement is, the end of its service life is inevitable, and the need for a rehabilitation or reconstruction technique for the asphalt overlay becomes crucial. Rehabilitation programs that include milling the pre-existing asphalt layer will lead to the production of significant amounts of asphalt millings. Furthermore, due to the increasing use of geosynthetic pavement interlayers, such as geogrids, paving composites, and paving mats in asphalt rehabilitation works, projects involving milling the geosynthetic will significantly increase in the upcoming years. Simultaneously, asphalt millings, known as reclaimed asphalt pavement (RAP), has been extensively utilized in the construction of roadway base and surface courses due to its ability to offer economic and environmental advantages. Thus, while both the incorporation of paving interlayers and recycling the pre-existing asphalt layers have become very common sustainable practices, a new challenge may arise in the coming years with respect of the millability of geosynthetics withing asphalt layers. Therefore, it is essential to understand how the milling process of a geosynthetic-reinforced asphalt layer differ from a conventional asphalt layer. Literature presents very few studies on milling aspects of geosynthetic pavements, such Damisch and Kirschner (1994), Tran et al. (2012), Gu et al. (2021) and Saxena et al. (2023). In this regard, experimental programs need to be developed to assess the milling processes and characteristics of RAPs collected from geosynthetic-reinforced pavements, referred here as G-RAPs. This research addresses aspects of milling operations of five geosynthetics on an experimental full-scale section at the Salvador International Airport, Bahia-Brazil, marking the first experimental study conducted on milling

* Corresponding author: ncorreia@ufscar.br

geosynthetics using Airport pavement practices. Geosynthetics included: glassfiber grid (G1), glassfiber reinforcement composite with thick fabric backing (G2), glassfiber paving mat (G3), glassfiber reinforcement composite (G4) and polyester reinforcement composite (G5). The milling process was carried out by a Wirtgen W1000L milling machine. To promote an accurate comparison regarding the milling performance, standard productivity parameters were previously defined, such as the rotation speed of the milling drum, and a fixed the milling depth of 90 mm. Figure 1 presents the milling operation to collect G-RAP samples.

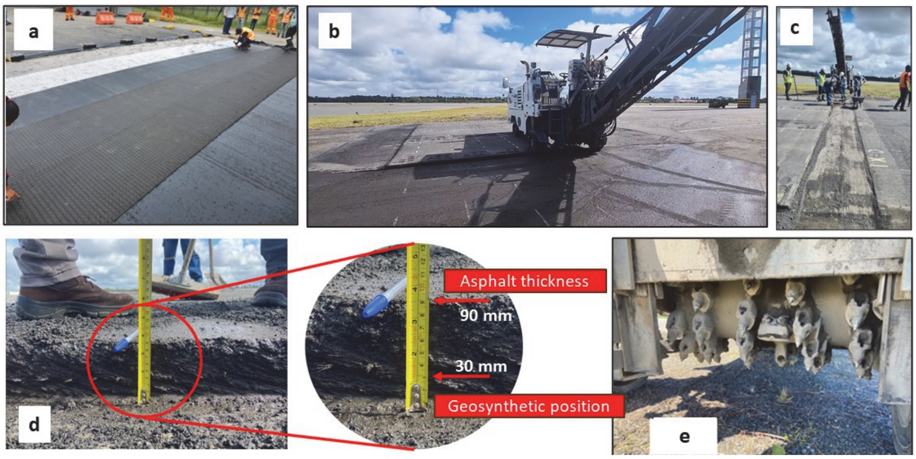

Fig. 1. Milling operation to collect G-RAP samples: (a) geosynthetics installation; (b) milling equipment; (c) milled section; (d) geosynthetic position; (b) closer view of the milling drum.

The milling speed, considering sections of 1.0 m width and 10.0 m length, were respectively 6.25 m/min for control section, 6.06 m/min for G1, 5.26 m/min for G3, 5,13 m/min for G2, 5.08 m/min for G4, and 4.14 m/min for G5. Overall, after milling operation, no traces of geosynthetic fragments were detected on the milling drum. The exception was the polyester composite (G5), which presented some trapped fragments that were removed from the drum and did not hinder the milling process. Fiberglass products presented facilitated milling process, although the size of fragments and percentage of fibres in G-RAP have altered considerably. Geosynthetic fragments lesser than 9.52 mm sieve aperture were present in the G-RAPs. Results showed 0.21 g/kg in the paving mat (G3), 0.31 g/kg for the thick fabric geocomposite (G2), 0.62 g/kg for the lightweight geocomposite (G4), 0.178 g/kg for the geogrid (G1), and 0.12 g/kg for the polyester geocomposite (G5). The fibers content can contribute to the production of high-quality asphalt mixtures and thus enabling the reuse of G-RAPs. Findings enhance valuable insights for optimizing efficiency in the milling process, as well as potential recycling practices with milled geosynthetic-reinforced asphalt layers.

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