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ABSTRACT

The direct shear tests were conducted to study the shear performance of steel-asphalt interface by taking epoxy asphalt (EA) as waterproofing adhesive layer (WAL) material when considering temperature and relative humidity (RH) coupling. The temperatures of 30 and 60℃ and RH of 30, 50, 70 and 95% for each temperature were chosen and the steel-WAL interface, WAL-pavement interface and composite structure specimens were cured under specified temperature and RH. The research results show that the influence of RH on the shear strength of the steel-asphalt composite structure without considering the effects of temperature and RH on interfaces is negligible and the traditional shear test method should be updated. However, the interface shear strength decreases with increased RH when it exceeds 70% by considering the effects of temperature and RH on interfaces.

Keywords: Bridge deck pavement; Steel-asphalt interface; Epoxy asphalt binder; Temperature and relative humidity; Shear performance

1. Introduction

Asphalt concrete is commonly paved as a wearing course on steel bridge decks, and a waterproofing adhesive layer (WAL) is laid as an interlayer between pavement and steel deck to stop permeating of water and strengthen interfacial adhesive force [1-3]. Besides the vehicle loading, the influences of environmental temperature and humidity on the shear performance of steel-asphalt interface cannot be ignored.

Many scholars studied the effects of environmental factors on the shear performance of asphalt material. Huang and Qian [4-7] studied the effect of temperature on the interfacial shear strength of the WAL on steel bridges in China, and they found that the shear strength decreases with the increasing temperature. Xu et al. [8-10] obtained that the interfacial shear stress has minor changes with increasing temperature or decreasing asphalt concrete modulus. Xu [11], Qian [12] and Liu [13] discussed the influences of temperature and loading on the adhesive characteristics of WAL on bridges, and the safety factors (strength/stress) significantly decrease with increasing environmental temperatures. Yao et al. [14] evaluated the shear characteristics of two types of steel-asphalt interface by the steel-concrete interface shear (SCIS) test method at temperatures of 25℃ and 60℃, and the shear strength increases with decreasing temperature and increasing normal