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# Airfield flexible pavement using waste foundry sand and water-based VAE copolymer binder – studies on mechanical, thermal and weathering effect

Technical Paper Published: 11 July 2024

Volume 9, article number 305, (2024) Cite this article

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## Abstract

Airfield runways, taxiways, and aprons were primarily comprised of asphalt bituminous flexible pavement. Although, asphalt bituminous pavement possesses critical aspects such as abrasion, spalling, thermal degradation as well as UV radiation effects. In this aspect, the asphalt bitumen has been completely replaced by water-based polymeric binder vinyl acetate ethylene (VAE) copolymer emulsion to get better properties over the above concern. In addition, disposal of spent foundry sand (SFS) causes environmental contamination such as land and soil pollution via the leaching of metallic oxides, alternatively, it can be used as a raw material in the field of construction. Compared to conventional filler material, the spent foundry sand possesses higher surface area and thus improves the performance of the pavement by enhancing the binding of the fillers. The top layer of

the polymeric pavement has been tested for mechanical, thermal, ultraviolet irradiation and microstructural properties in laboratory scale. The spent foundry sand was mixed with varying weight percentages, i.e., 10, 15, 20 and 25 wt % of VAE emulsion (SC10-SC25) and compressed, then allowed to polymerize at room temperature for 48 h. Out of various mixes, SC-25 exhibits better performance by enhancing the compressive stress triple times over the conventional asphalt bitumen pavement and it showed good resistance towards moisture adsorption (water contact angle $118^{o}$). VAE possesses UV protection with zero transmittance rates due to the presence of an aliphatic compound in it. The abrasion resistance in terms of weight loss was found to be 1.08%. The outcome of the research paves an avenue for alternate binders as well as utilizing spent foundry sand as filler for the effective laying of flexible pavement over conventional materials.


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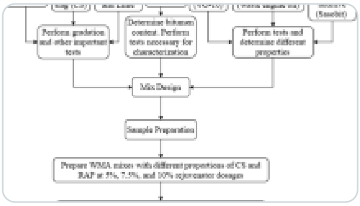

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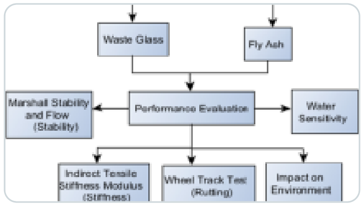

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## Introduction

Operating airfield pavement at the apron, taxiway, and runway was mostly constructed of asphalt flexible pavement. Airfield flexible pavement offers driving comfort, vibration damping, leveling, and anti-slip in addition to fast construction with minimal maintenance [1,2,3]. However, the surface of the pavement has become quite critical in terms of safe operation due to increasing operating time, heavier aircraft, etc., resulting in pavement distress thereby demanding a better surface pavement [4, 5]. Generally, flexible pavement comprises sub-grade, sub-base, base course and surface course. The surface course is the last layer of construction as it endures direct contact with the aircraft. Therefore, careful consideration is required in laying of surface course, as it should possess stability, durability, abrasive resistance, skid resistance, withstanding heavier loads, resilience, safety, etc.