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Research on Rapid Construction Technology of Cold-Mix Epoxy Asphalt Concrete

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Abstract. Cold mixed epoxy asphalt concrete has attracted much attention in the field of road engineering for its normal temperature construction, rapid curing and excellent performance. In this study, the rapid construction technology of cold mixed epoxy asphalt concrete is discussed. Its characteristics of high cost performance, normal temperature construction, strong adaptability, deformation matching with steel plate, large stiffness and good durability are detailed. System combing, including raw materials procurement, mix design, mixture mixing, transportation, paving, rolling and maintenance, rapid construction process, clear each link key points and matters needing attention, such as raw materials, AB glue and aggregate precision ratio mixing, paving speed control, rolling temperature and times set, etc. The significant advantages of the process in construction conditions (low temperature, wide temperature domain, rapid traffic recovery) and material properties (high strength, fatigue resistance, high water stability, good compatibility and excellent weather resistance) are analyzed. Through this study, the aim is to provide a comprehensive theoretical basis and technical support for the efficient application of cold mixed epoxy asphalt concrete in road engineering, and promote its wider application in practical engineering and continuously optimize the construction process.

Keywords: cold mixing; Epoxy resin; Rapid construction process.

1. Introduction

Cold-mixed epoxy asphalt concrete, as a novel pavement material, has gained increasing attention in road construction. It offers advantages such as ambient-temperature construction, rapid curing, and excellent performance, presenting new possibilities for practical engineering applications. With the continuous advancement of transportation infrastructure development, requirements for pavement materials have become more stringent. Traditional hot-mixed epoxy asphalt concrete faces limitations in construction processes, such as the need for heated raw materials and specialized transportation/construction equipment, which not only increase maintenance costs but also pose environmental concerns. Cold-mixed epoxy asphalt concrete provides an effective solution to these challenges. With its low-viscosity epoxy resin that facilitates easy mixing with aggregates, ambient-temperature mixing/curing characteristics reduce equipment demands, significantly lowering construction difficulty and accelerating project timelines. This innovative material aligns with energy-saving and emission-reduction principles, offering high strength, heat resistance, fatigue resistance, waterproofing efficacy, and ease of construction, thereby demonstrating broad market potential.

2. Characteristics of Cold-Mixed Epoxy Asphalt Concrete

2.1 Ambient-Temperature Construction

Cold-mixed epoxy asphalt concrete cures at ambient temperatures, eliminating the high-temperature heating required for traditional hot-mixed asphalt. This feature reduces energy consumption and simplifies construction processes.

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2.2 High Adaptability

The thermosetting material formed after curing exhibits both flexibility and exceptional strength. Through chemical modification, epoxy resin and petroleum asphalt form a stable homogeneous liquid at ambient temperatures, which rapidly cures upon adding hardeners. Its Marshall stability (25–30kN) surpasses conventional asphalt concrete (8–12kN), enabling thin-layer paving that reduces material/energy consumption [1-2]. Uniform mixing of components A and B during production is critical to ensure performance consistency across diverse applications.

2.3 Compatibility with Steel Plate Deformation

Cold-mixed epoxy asphalt concrete bonds securely with steel bridge decks and adapts to their thermal deformation without delamination. This stems from its thermal expansion coefficient matching that of steel and its insensitivity to temperature fluctuations. The cured material's high strength and mechanical stability ensure durability under varying thermal conditions [3].

2.4 High Stiffness

Demonstrating superior strength and deformation resistance, cold-mixed epoxy asphalt concrete achieves Marshall stability comparable to hot-mixed variants (25–30kNvs.40–60kN). Wheel-tracking tests at 60°C and 70°C reveal dynamic stability values (5,500) eight times higher than AC-modified asphalt or SMA, highlighting exceptional high-temperature resistance [4]. Low-temperature bending tests (-15°C) show maintained ductility, reducing brittleness and cracking risks [5].

2.5 Enhanced Durability

Resistant to fuel erosion and water penetration, this material protects steel decks from corrosion. Its dense aggregate structure and strong adhesion create an effective moisture barrier, extending pavement lifespan.

3. Rapid Construction Process

3.1 Workflow

Material procurement → Target mix design → Production mix design → Mix validation → Mixing plant setup → Equipment calibration → Mixing → Transportation → Paving → Compaction → Curing.

3.2 Key Steps

Material Control: Verify asphalt quality at source; use hard, clean aggregates (e.g., basalt).Mixing: Uniformly blend components A/B with aggregates using forced-action mixers.Paving: Maintain consistent speed and smoothness; handle expansion joints per design.Compaction & Curing: Follow specified protocols to ensure density and strength [6-8].

3.3 Workflow

Material procurement → Target mix design → Production mix design → Mix validation → Mixing plant setup → Equipment calibration → Mixing → Transportation → Paving → Compaction → Curing.

4. Characteristics of Cold-Mixed Epoxy Asphalt Concrete

Control screed plate preheating temperature to avoid localized overheating. Strictly adhere to material delivery timelines to prevent segregation. Continuously monitor spiral conveyors to

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eliminate "dead material" accumulation. Promptly remove waste materials during paving. Halt operations during rain/snow and remove uncompacted mixtures.

5. Advantages

5.1 Construction Benefits

Energy savings and reduced environmental impact via low-temperature operations. Wide operational temperature range (-10°C to 50°C).Rapid traffic resumption (4–6 hours post-construction).

5.2 Material Performance

High strength (Marshall stability >25 kN). Superior fatigue resistance (2–3× lifespan of onventional asphalt).Excellent high-temperature stability and water resistance. Strong compatibility with existing pavements.

6. Summary

Cold-mixed epoxy asphalt concrete combines ambient-temperature construction, cost efficiency, and high adaptability with exceptional stiffness and durability. Its streamlined construction process and performance advantages position it as a transformative solution for pavement engineering. Ongoing process optimization will further enhance its applicability.

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