



Research Need Statement 542

Date:	7/25/2018
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Idea Originated from:	IdeaScale

Select Program:

MnDOT OR Local Road Research Board (LRRB)

Research OR Implementation

Need Statement Title:

Evaluation of Curing Effects on Cold In-Place Recycled (CIR) Materials

Need Statement: Describe the problem or the opportunity. Include background and objective.

CIR is a rapidly growing rehabilitation and maintenance technology that offers multiple environmental and economic advantages. For these reasons, more and more states and local agencies are applying it for rehabilitation of low-volume roads and interstates (i.e., TH110 in the Metro district, 2017). However, unlike traditional asphalt pavements, the CIR technology poses significant challenges most of which are strictly related to the on-site recycling of existing pavement and the varying length of curing period: time required for the cold recycled pavement to reach its optimal strength or to sustain traffic and surfacing equipment. Due to this complexities, the existing quality control and acceptance tools cannot be adequately used to assess the uniformity, curing behavior and the as-constructed performance of CIR pavements.

Provide a summary of the potential benefits:

The project will evaluate various field and laboratory test methods that can be used to assess the uniformity and to determine the minimum curing period before applying traffic or surfacing on newly constructed Cold In-Place Recycled (CIR) pavement. The project will identify critical performance characteristics of CIR materials and develop or repurpose exiting test methods that can be used to measure the identified critical characteristics. Laboratory and field test results generated from this study will then be used to develop performance prediction model(s) in function of time to predict and forecast the readiness of cold recycled pavements in the days after compaction. Ideally, these equations will make use of easily obtainable predictors (i.e., laboratory strength, resilient modulus, early field density readings, initial field strength, emulsion content, ratio of virgin to recycled aggregate, climatic conditions and characteristics



Research Need Statement 542

of the underlying structure) to predict the required curing period of the final product. Similar equations are used in the concrete industry to predict the strength achievable at various ages under normal or accelerated curing regimens (IS-9013 1978).

Furthermore, the project will assess the ability of Ground Penetration Radar (GPR) and Rolling Density Meter (RDM) technologies to evaluate the uniformity and quality of CIR pavements. Noting that these technologies are affected by the presence of moisture, they can be used to survey CIR pavements at regular intervals of time to determine how moisture evolves with time and when it ceases to affect the RDM and GPR readings.

Based on the performance equation(s) and tools identified in this study, the project will recommend a draft specification that highway agencies can implement for uniformity and quality checks, as well as to determine the proper amount of time required before CIR pavements are opened to traffic or surfaced.

How does this project build upon previous research (include title or reference to a completed research effort)?

The literature on this topic is limited. However, there is an ongoing NCHRP research study 09-62 that is driven by similar underlying objectives. Researchers involved in this study should follow closely available progress reports to minimize unnecessary redundancy in research efforts while focusing the research to typical pavement materials and practices used in the state of Minnesota, and with particular attention to existing and new technologies currently being developed at MNDOT (RDM, GPR). Other relevant literature/reference that should be considered during the literature review include:

- 1) Standardized survey of states districts to document their experiences and needs
- 2) Examination of Curing Criteria for Cold In-Place Recycling (Phase 1 to3):
Authors: Lee, Hosin David; Woods, Adam; Kim, Yongjoo Thomas
Source: Iowa DOT and University of Iowa (Dec. 2011)
- 3) A Non Destructive Gauge for Measurement of Density and Moisture of Recycled Materials
Authors: Gamache, Ronald; Pluta, Sarah
Source: 2005 International Symposium on Pavement Recycling
- 4) Non-Destructive Testing of Cold In-Place Recycled Materials at Very Young Age
Authors: Lecuru, Q; Carter, A; Ethier, Y
Source: Proceedings of the 61st Annual Conference of the Canadian Technical Asphalt Association (2016)
- 5) Investigation of the Curing Properties of Cold-In-Place Recycled Asphalt Pavements
Authors: Isgor, O Burkan; Halim, Abd El; Mostafa, Abdelzاهر
Source: Ontario Ministry of Transportation (June 2006)



Research Need Statement 542

Provide names to consider for a technical advisory panel:

County engineers, city engineers, State Aid, MnDOT Office of Materials and Road Research (Shongtao Dai, Terrence Beaudry, Dave Van Deusen, Tim Clyne, Tim Anderson)