Improve Material Inputs into Mechanistic Design Properties for Reclaimed HMA & Recycled Concrete Aggregate (RCA) Roadways

Executive Summary Report

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SUMMARY REPORT for Q3 for 2020

The research team has conducted pavement M-E analyses via use of minimum, maximum, and median value of each recycled asphalt pavement (RAP) and recycled concrete aggregate (RCA) material properties. Draft Task 3 report is almost ready to be submitted to the Technical Advisory Panel (TAP) for review. This report will cover summary of the results from AASHTOWare Pavement ME sensitivity analysis using inputs from the database collected in Task 2.

Sensitivity pavement ME analyses were conducted to investigate the impact of resilient modulus, gradation characteristics, and hydraulic conductivity on pavement distresses. It was observed that summary resilient modulus had the highest effect on pavement distresses when using RAP and RCA as base course materials.

The AASHTOWare Pavement ME Design program (version 2.6.0) was used for pavement distress analyses. The following sections give detailed information about (1) general inputs, (2) material inputs, and (3) performance evaluation.

(1) General inputs: Under this task, input parameters for asphalt layer characteristics (and subgrade layer characteristics were kept constant to be able to investigate the base layer impacts on pavement distresses. The weather station and analyses location were selected as MnROAD. Three different traffic volumes were considered for pavement design such as low, medium, and high traffic. Table 1 shows the traffic data used in Pavement ME analyses along with the AC and base layer thicknesses accordingly. This data was used per recommendation of Schwartz et al. (2011).

Table 1: Constant input data used for pavement ME analyses

Inputs	Low Traffic	Medium Traffic	High Traffic
AADTT	1,000	7,500	25,000
Number of Lanes in Design Direction	2	3	3
Percent of Trucks in Design Direction (%)	50	50	50
Percent of Trucks in Design Lane (%)	75	55	50
Operational Speed (mph)	50	50	50
Asphalt Thickness (in)	2	3	4
Base Thickness (in)	8	10	12

(2) Material inputs: In order to investigate the effects of RAP and RCA characteristics on pavement performance when used as unbound base materials, sensitivity analyses were conducted via use of the lowest, the highest and median values of summary resilient modulus, gradation properties, hydraulic conductivity, optimum moisture content and maximum dry unit weight of these materials collected in the database. The highest and the lowest values were collected from individual papers in the database, while the median values used originated from the median values resulting from the data across all papers in the database.

(3) Distresses: The international roughness index (IRI) and total rutting were the two distresses focused to investigate in this study since they are mainly influenced by the properties of base layers. IRI is a standard measure of pavement smoothness and riding quality (Akkari and Izevbekhai 2011). The terminal IRI value was defined to be 170 in/mile (Elbheiry et al. 2011). The initial international roughness index (IRI) value was determined to be 63 in/mile (Izevbekhai and Akkari 2011; Ceylan et al. 2015). Total rutting is the sum of calculated asphalt plastic strain and unbound plastic strain including the deformation of the base and subgrade layers.

It was observed that the majority of RAP and RCA inputs used in pavement ME design resulted in satisfactory performance and did not fail during design service life.