Joint Transportation Research Program

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Seal Coat Productivity

Introduction

The Indiana Department of Transportation is divided into six districts with district offices located in LaPorte, Fort Wayne, Crawfordsville, Greenfield, Vincennes, and Seymour.

The total statewide, annual cost for the chip seal operations in Fiscal Year 2013 was $11,854,882.66. This figure includes $9,720,347.60 for material (stone and oil), $1,251,672.13 for equipment (no fuel), and $882,862.93 for 59,940 hours of labor.

The aggregate spreaders (chippers) in the Vincennes and Seymour districts have a 12' fixed box and are the oldest chippers among the six districts. The chippers in the other four districts are variable width, with some having a maximum span of 20'.

In an effort to reduce the cost of the chip seal operation, this project was launched to find ways to improve the efficiency of the chip seal process by identifying and sharing best practices across the districts. The goal is to reduce the number of labor hours per lane mile for the operation. This project was not intended as a “head count reduction” project, but rather as a way to boost the efficiency of the overall operation and increase the number of lane miles that can be chip sealed per day so as to minimize the inconvenience to the driving public.

Another advantage of this project is related to the temperature and moisture sensitivity of the chip seal operation. The chip seal “season” varies by geography within the state with the southern districts being able to start chip sealing typically four to six weeks earlier in the year than the northern districts. Because the chip seal operation is sensitive to moisture, the road must be dry for the emulsion (oil) to properly adhere to the road and the aggregate. Ideally, the road would stay dry for two days between the time the aggregate is spread on the road and the time the fog seal is applied over the aggregate. Currently, some districts struggle to complete their planned lane miles of chip seal during particularly rainy summers. By increasing the number of miles that can be chip sealed per day, the districts should be better able to complete their planned lane miles even in years with unusually frequent rain fall.

Findings

Based on the 10 days of observation, the average chip seal operation is only adding value (the chipper is spreading stone) 41.9% of the time. While there are numerous reasons for the 58.1% of downtime, 74% of that downtime is caused by just three factors (switching trucks, waiting for trucks, and waiting for a distributor).

By taking steps to reduce the downtime, it should be possible to increase the uptime of the chipper from 41.9% to possibly 50% or 55%. An increase from 41.9% to 55% would yield an increase of approximately 31% more lane miles covered in the same amount of time.

While it is impossible to eliminate the time spent changing trucks, the 18.8% of downtime today should be able to be reduced by standardizing the connector bar height and maximizing the amount of stone delivered to the safe and legal limit. Today the trucks are typically loaded with 11 to 12 tons of stone but could be delivering 15 tons or more. By maximizing the stone delivery, the 18.8% of downtime could be reduced by approximately 20%, which would increase the chipper uptime to approximately 45%.

In addition, by closing roads to minimize the delays in getting trucks in and out of the chip seal operation and

finding better locations for stone stock piles, the 13.1% of downtime caused by waiting for trucks could be virtually eliminated. If the downtime associated with waiting for trucks was reduced by 75%, it would improve the chipper uptime by about an additional 9%, which would bring the overall uptime to about 54%.

Implementation

In FY 2013, INDOT spent $882,862.93 for 59,940 hours of labor. This equates to an average of $14.73 per hour. Based upon the 10 days of observation, the average chipper uptime across the state is currently 41.9%. The labor savings will be a function of how much the chipper uptime is increased. The table below is an estimate of how much money could be saved by increasing the chipper uptime assuming the total lane miles to be chipped are similar to the FY 2013 total miles.

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Potential savings based on chipper uptime

Chipper uptime	Hours of labor	Labor cost	Cost savings
42%	59,940	882,862	**0**
44%	57,215	842,784	**40,078**
46%	54,728	806,141	**76,721**
48%	52,448	772,552	**110,310**
50%	50,350	741,650	**141,212**
52%	48,413	713,125	**169,737**
54%	46,620	686,713	**196,149**
56%	44,955	662,187	**220,675**
58%	43,405	639,353	**243,509**
60%	41,958	618,041	**264,821**
62%	40,605	598,105	**284,757**
64%	39,336	579,414	**303,448**
66%	38,144	561,856	**321,006**