Evan Dorks

Southern Illinois University Edwardsville

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Illinois Asphalt and Paving Association Scholarship Report

The Cost and Environmental Benefits of Infrared Heat Repair of Asphalt

Introduction:

Hot in place asphalt repair is a method of rehabbing deteriorated asphalt surfaces by use of infrared heat. This process has surprising economic and environmental benefits and can be used for simple patch work in a parking lot to entire roadway repairs. Departments of Transportation nationwide are becoming more and more acceptant of this process because it involves recycling the current asphalt surface, saving costs on new material and demolition. In addition to being cost and environmentally effective, hot in place repair also takes less time than traditional replacement methods. This makes this repair even more favorable because traffic closure will be minimized. In order to understand these benefits one must first understand the overall process of hot in place repair.

Asphalt Heating and Repair Process:

1. First, an engineer from the decided asphalt company must inspect the areas where repair is needed. It is important to analyze the current shape of the surface. Identifying the different types of deterioration is crucial to having a quality repair.
2. After a variety of tests are performed to determine the current shape of the roadway, the engineer can start calculating the following:
    a. Heating temperature
    b. Required heat penetration depth
    c. Number of passes needed to achieve the desired depth
    d. Amount of virgin asphalt (if required) to be added

3. Once a plan is set, the company can start preparing this intended repair area. This involves a very thorough cleaning of the work space. Anything left of the pavement other than existing asphalt can interfere with the reheating process. All debris must be swept away.
4. Begin to heat infrared panels. In most cases, some sort of trailer is used to hold panels that are held directly above the existing surface. A propane flame is usually used to heat the top side of a series of panels. From there, heat is absorbed by the panels and then radiated downward to the asphalt surface.
5. Often times, multiple passes are needed to reach the desired penetration depth. Asphalt companies that are experienced with this method usually have several heating trailers in a row to ensure the proper heating depth without scorching the pavement.
6. After the required depth is met, the hot asphalt is broken up by a variety of equipment. This step is extremely important because this reworks the current asphalt until it appears to be a nice new layer. All unwanted aggregate like rocks must be removed to ensure that the asphalt re-bonds properly.
7. Once the existing asphalt is reworked, additional asphalt can be added if necessary. Some roadways are bad enough that some asphalt must be incorporated.
8. Next, a rejuvenating chemical is added to the broken up asphalt to replace any oil that was burned out during heating. This chemical is crucial in making sure the asphalt maintains plasticity.
9. Finally the asphalt can be rolled down to the finish product.

Cost Benefits:

As mentioned before, hot in place repair is a huge financial savings. It is estimated that the overall savings is usually around 30%. This savings mostly comes from not having to purchase new asphalt. Asphalt prices are determined by the cost of crude oil which is always changing. Not having to worry about this huge expense drives the overall cost of the project down. Other costs savings from hot in place repair compared to traditional resurfacing include not having to hire a demolition crew to remove the existing asphalt. This is another large expense because in requires additional labor and equipment to demolish and haul away the old asphalt. Not to mention needing a place to dump the original paving. Table #1 below illustrates these costs savings. This estimate is based on an average roadway repair for a stretch of road a few miles long. As you can see, a cost savings of over $330,000 was incurred. Companies that can provide this method have a huge advantage over companies that stick to traditional resurfacing.

Table 1 - HIP Repair Costs V.S. Traditional Replacement				
Description	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Office Overhead	1	OH	$22,000.00	$22,000.00
Equipment	200,000	SY	$2.50	$500,000.00
Equipment Fuel	45,000	Gal	$2.00	$90,000.00
Crew Labor	19	Lbr	$16,000.00	$304,000.00
Equipment Setup/Transport	1	Ea	$35,000.00	$35,000.00
Rejuvenating Addative	20000	Gal	$6.50	$130,000.00
Total HIP Repair Cost				$1,081,000.00
Profit			3.50%	$37,835.00
Grand Total (HIP Repair)				**$1,118,835.00**
Added 30% for Material/Demolition			**30.00%**	**$1,454,485.50**
Cost Savings				**$335,650.50**

Environmental Benefits:

In addition to being a more affordable option, hot in place recycling is a much more sustainable method for roadway repair. Since the materials are being reused, new natural resources do not have to be used for the new road. Reusing material also takes away the need for having to dump the old asphalt somewhere. Since the old asphalt does not get hauled away somewhere, the number of truck trips is greatly reduced. It is estimated that this method requires 50% less trucking. This reduces the amount of fuel used as well as reducing the air pollution given off by trucks. These environmental benefits make hot in place asphalt recycling an even better option.

Potential Issues with Infrared Heat Repair:

One might ask, if there is a cheaper, more environmentally friendly way to repair our roads, then why isn't every asphalt company doing this? The fact of the matter is, hot in place asphalt recycling is a process that takes years of experience to perfect. There is a very small margin of error. If the asphalt is heated too little, then it will not properly break apart and rejoin again. Even worse, if the asphalt is overheated, then the binding chemical is completely burned out. This makes the asphalt unusable. Excess smoke when heating indicates that this plasticizing oil is getting burned out of the pavement. Most asphalt is scorched, or at its flashpoint, at 430^{o} F. This high of temperature must be avoided for proper recycling. The optimum temperature the asphalt should be heated to is around 320^{o} F. However, the asphalt cannot be heated to this temperature immediately or else it will be ruined. Sometimes it is necessary to make multiple passes with the heater to meet the desired heat penetration.

Conclusion:

Hot in place asphalt recycling by use of infrared heat rehabilitates damaged asphalt while using minimal materials. Although it may be a difficult process, companies performing hot in place repairs can save upwards of 30% of total cost. In addition, this process takes less of a toll on the environment by reducing the use of natural resources and by reducing emissions with half the truck loads.

Acknowledgement:

I would like to thank the Illinois Asphalt Pavement Association for this great opportunity. I got the chance to research a topic that was extremely intriguing to me. I now understand the process of hot in place asphalt repair and am aware of the tremendous benefits this method has. Aside from this gained knowledge, I am very grateful for the money I have received through this scholarship. As a college student, this amount of money went and will go a long way. I greatly appreciate it.

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