Hot In-place Recycling Summary report

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The Hot In-place Recycling (HIR) is a process by which rehabilitation of the existing Hot Mix Asphalt (HMA) pavements occurs on site in one operation. This process is used for pavement preservation and begins by heating the existing HMA pavement to a temperature high enough to allow equipment to mill or scarify the upper 1-3 inches of existing HMA pavement. HIR is a process of correcting HMA pavement surface distress by softening the existing surface with heat, mechanically removing the pavement surface, mixing with recycling agent, possibly adding virgin asphalt and/or aggregate, and replace it on the pavement without removing the recycled material from the original pavement site. HIR process can occur in one or multiple passes.

HIR has been used in Canada and Europe. HIR started to be implemented in the US during the oil shortage and rise in oil prices, but did not become a popular rehabilitation strategy for pavement preservation. Caltrans has used the HIR process in pilot projects since 2005. HIR process was attempted on projects in Districts 2 and 8 with limited success. Both projects had to be repaired by conventional HMA.

The Recycling Committee of the Pavement Preservation Task Group proposed the evaluation of a HIR project in 2009. A workplan was developed and the HIR strategy was proposed for a section of pavement in District 2, on Route 299 in Trinity County. The project limits were between post miles 26.1 and 36.9. This route is a two lane rural road in low mountainous terrain.

The HIR technique was used to convert the top two inches (1-inch open graded HMA over 1-inch dense graded HMA) into a dense graded final product. The AR2000 HIR single-pass operation train equipment by MARTEC was used on this project. The compaction requirement for this project was between 92 and 97 percent of maximum theoretical density. This project went into construction in August of 2010.

During construction several areas of concern were noted. Slow operation, low temperatures for rejuvenating agent and finished mat, roughness and poor surface characteristics, were observed during construction. One of the pavement heating units started a small grass fire on the shoulder adjacent to the work during construction. Because of the construction problems stated and the slow production rate (5 ft/min), only 6 lane miles of the 20 lane miles in the project was completed.

HIR pilot projects have revealed many challenges. Some of these challenges are as follows:

- **Underpowered equipments-** Issues with the pumps to deliver recycling agent to the millings and the grinder mechanical difficulties.
- **Frequent equipment breakdowns-** Old equipments and not in balance. Frequent adjustments needed.

- **Problems with heating units-** The heating devices had to be adjusted several times before target temperatures were achieved.
- **Oversize material or chunks-** Mixing problems in the Pugmill
- **Insufficient compaction-** The pavement temperature behind the paver was at or below the low end of the acceptable temperature range.
- **Rough finish pavement surface-** because of all the equipment breakdowns and excessive cooling of the material in the windrow.
- **Flushing-** Excess emulsion or rejuvenating agent.

In addition to the above challenges the constructability and environmental issues add to the overall concerns.

- **Constructability**- The HIR train moves much slower than a conventional paving operation. The amount of time needed for the HIR paving train to pass side roads and driveways may require detours or other accommodation to get traffic past the closure in a reasonable amount of time. HIR equipment requires more parking space than conventional paving equipment and takes considerably more time to pick up and mobilize to a different location within the project.
- **Environmental**- Unlike conventional paving, emissions from HIR operations occur on the project site instead of at an asphalt plant. HIR equipment uses incinerators to remove smoke but this may not be sufficient in areas that are sensitive to air quality restrictions.

Due to the challenges mentioned above and little benefit to Caltrans as a pavement preservation strategy, the Pavement Program recommends discontinuing HIR process until improvements can be made with the technology.

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