

Sustainable Practice: Pavement restoration featuring a hot-in-place recycling segment

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General background of the area

Phoenix, Arizona, is located in the heart of Maricopa County. The headquarters for the Maricopa County Department of Transportation (MCDOT) is located in the southwest portion of the city and has jurisdiction for all of the transportation routes for the unincorporated portions of the county. This amounts to over 2,000 miles of paved roads. Maricopa County is large, encompassing over 9,200 square miles with a population of over four million residents. Needless to say there are many roads and streets in this busy metropolitan area surrounded by more suburban and rural areas which essentially surround the Phoenix metropolitan area and about 27 other cities that have lesser populations.

The County has a Green Government Council which has a strategic initiative to develop and use green practices in the day-to-day operations of the various agencies within the County government. MCDOT has a goal of reviewing and implementing various work processes that lead to a sustainable and green government in accordance with this initiative.

So, when various projects are undertaken by MCDOT, they are evaluated for possible inclusion into a plan to use green practices that will either save money, save fuel, or reduce greenhouse gas emissions. Recently, such a project was identified in the northwestern portion of the greater Phoenix area in a retirement community called Sun City. It is outside the city limits and is included in the unincorporated portion of the county

which is the reason that MCDOT has jurisdiction over this particular area.

This project consisted of reconstruction and rejuvenation of a number of sections of roads in the northwestern portion of the valley that were in a reasonable proximity of each other. The total project included both hot mix repaving and hot-in-place recycling of the existing pavement. The reasoning behind the decision to use two different methods was somewhat convoluted but makes sense when you consider the parameters and limitations of the methods. A discussion will be forthcoming later in this article as to the choices and the criteria used to make them.

Project information

The overall project consisted of 725,000 square yards of pavement to be restored to like-new condition. The project was bid out and the bids were opened on March 1, 2012. The successful prime contractor was Sunland Asphalt of Tempe, Arizona. The notice to proceed was issued on April 4, 2012. The substantial completion was accomplished on July 2, 2012. The project used 55,660 tons of asphalt rubber concrete pavement. The total cost per square yard, for the entire project, was \$10.55 per square yard.

The roads paved in the project using both methods are as follows:

Sun City Roads:

- 99th Avenue from Olive Avenue to Beardsley Road (7.0 miles). This is the section featured in this article as the hot-in-place recycled section.

- Del Webb Boulevard from Grand Avenue to Bell Road (2.5 miles), totally removed and replaced with hot mix.

Other Roads:

- Salome Highway from Wintersburg Road to Old US80 (9.8 miles)
- Wintersburg Road from Salome Highway to Thomas Road Alignment (3.8 miles)
- I-17 Frontage Road Circle Mountain Road to Old Stage Road (2.9 miles)
- Circle Mountain Road from New River Road to 22nd Street (2.3 miles)
- 7th Avenue from Carefree Highway to Desert Hills Drive (3.0 miles)

Hot-in-Place Recycling process

For the purposes of this article, the focus is on the section of 99th Avenue from Olive Avenue to Beardsley Road (7.0 miles). This section of road was selected to use the hot in-place recycling process for the following reasons:

1. This section of roadway is long and straight with very few issues with regard to tapered valley gutters, conflicting objects and unusual circumstances that would cause a long paving train such as the hot-in-place recycling paving system to have to maneuver extensively.
2. The number of square yards easily exceeds the minimum economic



This photo shows the recycled material being placed by the screed on the repaver. This material has essentially the characteristics of new AR mix due to the restoration of the mix during the recycling process.

level that would be attractive for a company to consider mobilizing and bringing in a large hot-in-place recycling paving train to accomplish the work. (This amount is approximately 80,000 square yards or so depending on several factors such as location, geometrics and type of work to be accomplished.) In this case there were over 200,000 square yards to be restored to a "like new" (defined more accurately later in this article) condition.

- Due to the type of paving train and the rapidity of the recycling and repaving process, it was likely that traffic in the Sun City area would be minimally impacted by the process.

The rest of the pavement segments, which were less favorable candidates for the hot-in-place recycling process, were overlaid with a 1.5-inch-thick layer of hot mix asphalt concrete pavement. Not all asphalt pavements are automatically good candidates for the hot-in-place recycling process. A PCR of at least 40 and a minimum 2½" to 3" of existing AC are essential for the hot-in-place recycling process.

The recycled segment was repaved by Cutler Repaving Inc. The process treated 218,095 square yards of pavement. The process was to use a long paving train and recycle and repave in one pass. The milling depth was one inch of cold milling prior to placement of one inch of hot-in-place recycling.

The pavement was initially 17 years old. Dynamic Modulus (E*) testing of the recycled AR compared favorably to the (E*) of new asphalt rubber (AR). The test results developed by AMEC (a consultant

on the job) showed a favorable comparison to new AR pavement. The entire recycling portion of the project was accomplished in 16.5 days. The entire section was repaved in only two passes by extending the screed to a width of 18 feet wide. Due to the wide paving width, some cross slope issues were resolved in the recycling process.

Here are the facts for the costs of just the recycled section. The total cost was \$675,722 for the 218,095 square yards. That is a cost of \$3.098 per square yard. The estimated savings was conservatively estimated to be at least \$500,000. The roadway surface is like new and the appearance is also good. The ride and smoothness are very good. In short, hot-in-place recycling is a good candidate for a sustainable practice for the future since it is lower in cost, uses less material, generates less greenhouse gas and produces good results. The caveat is that a potential project should be large enough to justify the mobilization costs and the roadway area recycled should be large enough to justify bringing in large equipment of this type.

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The project was selected as the Roads and Bridges Hot-in-Place Recycling project of the year by the Asphalt Recycling and Reclaiming Association.

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