



Pavement Recycling Systems

Helps City of Santa Ana Rehabilitate Aging Road System

Written By: Brian Hoover

The history of roads and transportation in Santa Ana began with its founder, William Spurgeon back in the 1870's, when he built a road through the mustard fields to make easier access to Anaheim and to meet the Wells Fargo Stage. Since then, Santa Ana has become the principal administrative and political center of Orange County and is also the county seat.

Today, Santa Ana, California is the 4th most densely populated city of more than 350,000 people in the United States. It shares this designation behind only New York City, San Francisco and Chicago. This means high traffic counts and heavy loads will travel each day on Santa Ana's 317 miles of local roads and 112 miles of arterial streets. Over 50 years of this daily use has left Santa Ana's roads and streets in serious disrepair.

Like every city throughout California, funding has been very hard to come by and bringing their roads up to speed seemed a nearly impossible task for Santa Ana officials. One thing was certain however, maintenance could no longer be deferred, and citizen complaints were beginning to pour in. Assessment districts and bonds were some of the funding options being considered. The assessment strategy was abandoned due to lack of public



(Above) Pavement Recycling Systems takes the old road material off-site where it is crushed, screened and mixed with a recycling agent.

support, which left the City considering a Certificate of Participation Bond (COP). A COP is a tax-exempt lease obligation, where the investor buys a share of the lease revenues made available by a government entity. This plan proved to be viable and the new street improvement program, duly dubbed, Residential Street Repair Program (RSRP), was launched in 2007, with an approximately \$60 million COP. In addition to the COP, RSRP funding included other sources including Community Development Block

Grant, local revenues such as Gas Tax, Measure M and Proposition 42. The plan had envisioned \$100 million in 5 years to improve 100 miles of the residential roads.

Traditionally, maintenance and reconstruction has been implemented on a "worst street first" basis, however city officials decided to implement a different strategy in order to get more work done in a wider area. A "best streets first" philosophy was put into motion, allowing for maximum funding impact. By maintaining the better streets



first, the City was able to protect them from further, more costly deterioration. In the first year of the program, approximately 64 miles of streets were rehabilitated with the use of slurry seal, a thin asphalt overlay, or total reconstruction. As the program continues, more invasive and consequently more costly techniques are being implemented. However, due to ever-rising material costs, the City continued to investigate several environmentally and cost reducing alternatives to remove and replace. This led the general contractor they selected to contact Pavement Recycling

Systems, Inc., headquartered in Mira Loma, California.

Pavement Recycling Systems, Inc. has been leading the way with a full range of state-of-the-art recycling solutions since 1989. Today, they are an employee-owned company dedicated to solutions that reclaim, preserve and rehabilitate pavement at any stage of the life-curve. Their proven alternatives have been tested and proven to cut costs, reduce environmental impact and raise quality. The City of Santa Ana chose several solutions to help rehabilitate their aging pavement.

Cold In-Place Recycling

The City of Santa Ana chose the Cold In-Place Recycling method where only minor rehabilitation or major preservation was needed. In the end, a large percentage of the roads and streets were treated by recycling the asphalt layer. PRS Division Manager, Don Matthews explains, "If the AC is cracked and tired and generally worn out, but the underlying base structure is still sound, then you just want to recycle the asphalt. The strength and durability of the asphalt can be restored through the CIR method. You simply use



(Top) - A Terex Cedarapids CR551 paving machine was used to install the recycled pavement.

(Above & Right) Cold Central Plant Recycled material to be reused.



the existing value in that asphalt and recycle it, put a thin cap on it and you restart the design life.

Cold In-Place Recycling (CIR) begins with the grinding of the upper 2 to 4 inches of the existing asphalt. This asphalt is recycled in place and then treated with a recycling agent. Next a new lift of 1.5" hot mix asphalt is applied. The process is considered green for several reasons. First it reduces the cost of hauling and disposal. For every mile of 3" CIR you will use approximately two truckloads, as compared to mill and fill, where you would utilize approximately

83 truckloads. This process also lowers the amount of greenhouse gas emissions, in some cases as low as 20% of the carbon emitted when compared to mill and fill. Simply put, you mill the old asphalt and a recycling unit is pulled directly behind that will crush the AC, screen it and then mix it with a recycling agent. All of this is done within a long train of equipment that is both environmentally clean and extremely efficient."

The City of Santa Ana also used the alternative asphalt foam in place of emulsion in winter and spring seasons when the

ambient temperature did not allow traditional CIR. This resulted in expediting the project delivery and completing the CIR phases ahead of schedule.

Cold Central Plant Recycling

In extremely tight areas like a cul-de-sac for instance, the CIR train is not practical and Cold Central Plant Recycling (CCPR) is the next best choice. This is the very same process with respect to mix design, performance and behavior; however it differs in that the recycling train cannot be used and it requires the use of smaller mills to get in and out of tight areas. After milling, the



(Top) Cold In-Place Recycling train.

(Above) The old worn out road being removed.

(Left) Laying down the base course of new recycled pavement.



(Above Left) Deteriorated street in need of repair. (Above Middle) Cold In-Place Recycled windrow ready to be picked up and paved. (Above Right) Finish capped "renewed" road.

material is loaded into trucks and taken to a central location where it is crushed, screened and mixed with a recycling agent. The material is then trucked back to the job site where it is repaved. CCPR, while slightly higher than CIR, is still less than a mill and fill/remove and replace method.

Full Depth Reclamation with Cement Treated Base

It would have been less expensive and more efficient if the City of Santa Ana could have used the CIR or the CCPR process on all of the streets and roads, but some of the pavement and subgrade were just too far-gone. Don Matthews comments, "By coincidence, the first two streets we started the CIR process on happened to also be the worst two streets. The subgrade was so soft that our train kept breaking through and bogging down. It was clear that the CIR process would not work here. To the credit of the City of Santa Ana, they continued on and were determined to go green and reuse existing materials whenever possible."

To investigate a street's structural integrity, an instrument called a dynamic cone penetrometer was used to core and examine the relative strength of the subgrade. Most of the areas were deemed to be receptive to the CIR process, while the failing areas were subjected to yet another rehabilitation process. These areas

required Full Depth Reclamation ("FDR") where all of the AC, and a 8" portion of the base, sub-base, and native soil were pulverized in-place and blended with cement. The blended material is then graded, compacted and allowed to cure. The FDR with cement process substantially improves the load-bearing characteristics of the underlying street structure upon which new asphalt pavement is placed. When having to reconstruct the entire asphalt, base and/or subgrade section, the FDR method provides similar cost savings as the CIR/CCPR process does when only reconstructing the asphalt section. Both recycling processes are economically and environmentally sound alternatives to the traditional remove and replace construction methods that have been used in the past. This process has been reserved for worst case street situations.

Pavement Recycling Systems, Inc. has served as a subcontractor to several different general contractors on the 6 out of 10 initial phases the City of Santa Ana put out to bid. As illustrated in this article, several different solutions were utilized, depending on what was warranted in each individual situation. Pavement Recycling Systems is committed to the belief that recycling is the best long-term solution to the pavement portion of our nation's

infrastructure challenges. For more information on Pavement Recycling Systems, Inc. visit them online at www.pavementrecycling.com or call 800-966-7774.

The City of Santa Ana, through the RSRP, offers a model for leveraging public works dollars, cutting costs, improving efficiency and finding more environmentally friendly ways to serve the community. City officials were very impressed with how well the recycled mat performed in areas with stable subgrade. Overall, the Residential Street Repair Program has been deemed a success, as evidenced by the approximately 40% cost savings over conventional reconstruction methods and 100% of the old asphalt originally planned to be removed was actually reused onsite. Using innovation in both pavement preservation treatments and in project delivery (bid documents), the City is able to improve 260 miles of the roads by the end of this program for \$72 million. This is over two and a half times as many miles as originally envisioned for 72% of the cost and 2 years ahead of schedule. For more information on RSRP, contact Souri Amirani, Deputy City Engineer for the City of Santa Ana's Public Works Department at samirani@santa-ana.org CAM