APPENDIX B
Selected Case Histories – Local Agencies
a) Thousand Oaks
The City of Thousand Oaks –
Experience with Asphalt Rubber Hot Mix

Contacts:  Tom Pizza, P.E.
Engineering Division Manager - Capital Projects
Public Works Department
Telephone: (805) 449-2430

Grahame Watts
Environmental Programs Analyst
Telephone: (805) 449-2453

Summary: The first contract for Asphalt Rubber Hot Mix (ARHM) was awarded on May 28, 1991. At the time, it was the largest municipal ARHM project ever awarded in California constructing 51,271 tons of ARHM at a contract value of $3,024,677. The cost per ton was $55.25 but included other items of work.

To Date: The City has placed 284,000 tons of ARHM on 100 miles of arterial and residential streets. 930,000 scrap tires have been diverted from landfills.

Future Use of ARHM: The City plans to place 25,000 tons of ARHM overlays annually as part of its street maintenance and rehabilitation program. Recently, the per-ton cost of ARHM has averaged $49 for combinations of day/night work, arterial and residential mixes.

Editor’s Note: The following article has been edited to conserve space.

Introduction

The City of Thousand Oaks awarded its first contract for Gap Graded Asphalt Rubber Hot Mix (ARHM-GG) for street maintenance overlays on May 28, 1991. At that time, it was the largest municipal ARHM project ever awarded in California. 51,271 tons of ARHM were placed for a final contract value of $3,024,677. The cost per ton of ARHM was $55.25 (note that the final contract value also includes other items of work). The City then awarded contracts of approximately $1.5 million each in consecutive years for a total of 284,000 tons of ARHM placed on approximately 100 miles of arterial and residential streets. Recently, the per-ton cost for ARHM has averaged $49 for combinations of day/night work, arterial and residential mixes. All work was competitively bid in accordance with public contracting codes and prevailing wages were paid.
Background

The passage of Assembly Bill 939 (California Integrated Waste Management Act of 1989) provided impetus and the requirement to reduce waste disposed of in landfills. The City Council believed that the use of recycled tire rubber in pavements would help support market development efforts in complying with the California Integrated Waste Management Act.

Various alternatives using crumb rubber from scrap tires were considered. After researching all the available data, publications, discussions with other agencies, pavement consultants, Caltrans, and evaluating the City’s needs, RACTC was selected to be used on residential, collector and arterial streets, with a minimum thickness of 1-1/2 inches.

The cost of ARHM was an issue. On a per-ton basis, the cost of ARHM overlays was approximately twice that of a conventional asphalt concrete overlay with pavement reinforcing fabric. (Editor’s note: The 2:1 equivalency would reduce the final cost of ARHM-GG.) ARHM-GG would meet, and very likely exceed, the city’s ten-year design life requirement while requiring less routine maintenance. Tire rubber additives, such as an antioxidant, ultraviolet and ozone inhibitors contained in the asphalt rubber binder, retard the pavement aging process. Other attributes included increased skid resistance, improved riding qualities, and reduction in tire noise.

Cost savings, both tangible and intangible, are associated with a pavement with a longer life span, including the costs of specifications, contracting and inspection, traffic inconveniences, construction noise, and other inconveniences to the public.

Constructing Rubberized Asphalt Overlays

The City of Thousand Oaks contract specifications for road improvements are usually based on the State of California, Department of Transportation (Caltrans) standard specifications. The contract special provisions for the ARHM overlays were based on the Standard Specifications for Public Works Construction, (Greenbook).

Aggregate gradation and asphalt rubber binder content are slightly modified for arterial and residential street applications. The City specified Type B asphalt-rubber with AR4000 paving asphalt. An AR4000 tack coat is applied to the existing surface before paving.

The contracts included cold milling to six feet from the edge of gutters, with City forces doing the removal and replacements, crack filling, and street sweeping before paving. City crews also re-striped the newly paved streets. Windrowing of paving material was initially not permitted in our specifications, but following successful demonstrations by paving contractors, it is now allowed on arterial streets.

ARHM concrete paving is similar to conventional asphalt concrete. Since the material tends to be stickier, material haulers had difficulty keeping the tires of their trucks clean. As a result, the
material tended to be tracked far from the work areas. Special attention had to be paid to street sweeping, use of rock dust blotters, and equipment clean up during the course of the work.

The specifications require that a vibratory roller be used for the initial breakdown rolling. In addition, the temperature of ARHM-GG must exceed 290 degrees Fahrenheit and be high enough so that pavement temperature does not fall below 240 degrees Fahrenheit before two passes with the breakdown roller are completed. Rubberized asphalt concrete that has cooled to below specified temperatures before completion of the breakdown rolling may not attain the required density. (Editor’s note: Current specifications require breakdown rolling to be completed before the temperature drops below 275 degrees Fahrenheit. The Greenbook Committee is considering changing this figure to 290 degrees Fahrenheit in order to assure 95 percent relative compaction.)

The ARHM surface appearance tended to be coarser than conventional asphalt concrete of similar class. Excessive coarseness or loose aggregate could be a sign of material or construction not by the specifications.

A comprehensive quality control program is indispensable for good results. In addition to monitoring by Department inspectors, the City also contracts with a testing laboratory for plant and field testing. Nuclear gauges are used for density testing of the compacted material.

**Noise Study**

The City conducted a limited noise study survey to decide if differences in road noise levels existed on newly paved streets and if there were differences in noise levels between convention and ARHM pavements. The noise survey initially confirmed that streets newly paved with either convention asphalt or ARHM are quieter, but the survey continued to show that streets paved with ARHM can be two to five d.b.a. quieter than those paved with conventional asphalt concrete. Long-term noise reduction advantages are still under study.

**ARHM Performance**

The performance of the ARHM overlays has been very satisfactory. Due to the many cul-de-sac streets in the City, bulb paving procedures were written into the specifications to prevent cooling of the ARHM before completion of the lay down and rolling operations.

**Community Response and Conclusion**

Community response has been favorable. The ride is smooth and quiet. The City will continue its annual ARHM overlay as part of its street maintenance and rehabilitation program.
In 1991, the California Integrated Waste Management Board recognized the City for its recycling efforts—the City received an award for an “Innovative Recycling Approach” for its use of ARHM.
b) Burbank
The project resurfaced Glenoaks Boulevard from Providencia Avenue to Scott Road and Magnolia Boulevard from Third Street to Glenoaks Boulevard. Repairs were made to damaged underground storm drain culverts and concrete sidewalk, curb, gutter, and driveways. Additional improvements consisted of sub-surface groundwater collection systems and traffic signal head modifications.

The street resurfacing operations included grinding off the top 1-1/2 inches of pavement, sealing the cracks, and placing a 1-inch overlay of asphalt rubber mix. Rubberized Asphalt Concrete (RAC), rather than conventional asphalt concrete (AC), was used due to it being more economical, having a longer life expectancy and higher resistance to reflective cracking. An additional benefit over conventional AC is the reduced traffic noise of up to 5 decibels, as studies have documented. We have received many positive comments from citizens on the smooth, quiet ride over the new pavement surface.

The 1.7 mile roadway section was last resurfaced over 20 years ago and is Burbank’s fourth and largest project using RAC. Approximately 7,500 tons of RAC were used, diverting 22,500 scrap tires from landfills. FAC has previously been constructed on sections of Alameda, Palm and Orange Grove Avenues, as well as on San Fernando Boulevard.

The contractor, Silvia Construction Company of Rancho Cucamonga, performed very well during the four months of construction between January and April 2000. The start of construction was delayed to accommodate the retail business owners during their November/December holiday sale season. This $1 million project was completed on schedule and within budget, using 11.5% funding by Gas Tax Funds and 88.5% Federal Transportation Funds.
c) San Buenaventura
The Use of Asphalt Rubber Pavement in The City of San Buenaventura, California

Contact: Lyle W. Swaney  
Street Superintendent  
Department of Public Works  
Telephone: (805) 652-4519

Editor’s Note: This following article has been edited to conserve space.

Background

In the summer of 1988, staff visited various locations in the Los Angeles area where rubberized asphalt had been used, including one 15-year old project. We were impressed with what we saw. The condition of the pavement was excellent considering the amount of traffic and the years the pavement had been in place.

In the summer of 1990, the City constructed its first asphalt rubber hot mix (ARHM) project on Wake Forest Street. This particular street is adjacent to a high school and a large postal center and it has a tremendous amount of bus, truck and vehicle traffic going to and from those facilities.

Since the City had never used ARHM, the contractor was required to guarantee the pavement against all failures and maintenance repairs for five years. If any maintenance was required in that time, those repairs were to be guaranteed for five more years. The project called for a two-layer system consisting of a thin stress absorbing membrane (SAM) chip seal with a final surface course of ARHM. Approximately 1,200 tons of ARHM were placed. This project was the first in a California municipality to call for a guarantee on a asphalt rubber pavement rehabilitation project. This landmark project was used as a model by the Federal Highway Administration Special Projects No. 14, Innovative Contracting.

Because of the performance of the Wake Forest project, the City used ARHM on two additional major arterial streets, Kimball Road and Telephone Road.

From June 1990 to September 1999, the City completed more than 32 projects using 141,000 tons of asphalt. On 22 of those projects, we used 81,000 tons of ARHM covering 140 lane miles.

Cost

In 1990, the cost of the Wake Forest Street project was $71 per ton. The average cost since then for ARHM has been $55 per ton versus $38 per ton for conventional. The cost for ARHM varies
depending on the size of the project. In addition to cost-effectiveness, ARHM provides a quieter ride and requires substantially less surface preparation.

**Follow Up—Wake Forest Street Project**

In 1996, while identifying locations for slurry seal projects, I reviewed the condition of the six-year-old Wake Forest project. There was no raveling and only slight oxidation with no voids or reflective cracking. The surface was smooth and tight and I expect many more years of life.

**Quality Control**

A quality control program is indispensable for good results. It is extremely important that the asphalt coming out of the truck is as close to 300 degrees Fahrenheit as possible with a minimum of 290 degrees Fahrenheit when it hits the pavement. The inspector should continually monitor and check the temperature of each load. A crucial time to start testing is at the beginning of the work so you can identify and resolve problems as they occur—not down the line. It is crucial that the inspector be on the job at all times when the asphalt is going down. Nuclear gauges are required for density testing of the compacted materials in order to get immediate results. The following items are critical:

- the temperature of the mix
- the temperature of the surface
- the temperature during compaction

Remember, let the inspector inspect the project and let the contractor supervise the job. The contractor is responsible for getting the job done. The inspector makes sure that the job is being done according to specifications.

**Future Outlook**

The City of San Buenaventura plans to continue using ARHM, including resurfacing 50 to 75 year old streets that are existing Portland cement. With the use of ARHM, the City will lay down about 1" to 1-1/2" lifts, depending on surface conditions.

In addition to using ARHM, the City is also proposing its first rubberized slurry project in 1999.