2012 Annual Report to the Legislature and the Department of Resources Recycling and Recovery Senate Bill 876 Waste and Used Tires

Purpose

This report was prepared in accordance with Senate Bill 876 (Escutia) (Stats. 1999, ch. 838, § 20), which amended and added numerous sections, to the Public Resources Code, including Section 42889.3, which states:

> *On or before January 1 of each year, the Department of Transportation shall report to the Legislature and the board on the use of waste tires in transportation and civil engineering projects during the previous five years, including, but not limited to, the approximate number of tires used every year, and the types and location of these projects.*

Background

According to the California Department of Resources Recycling and Recovery (CalRecycle), Californians generated an estimated 41.1 million waste tires in 2010. Of these tires, 33.2 million were diverted from disposal or stockpiles through recycling, reusing, retreading, or as tire-derived fuel (TDF). For the approximate 7.8 million tires that did not have an established secondary use, the expansion of the existing markets for waste tire usage such as rubber hot mix asphalt (RHMA)[1], playground mats or other surfacing, civil engineering applications, and TDF will assist in addressing potential tire stockpile issues and their associated environmental impacts.

Caltrans' Efforts

The California Department of Transportation (Caltrans) has established a variety of uses for recycled content tire products for civil engineering applications in transportation projects. Caltrans is committed to helping reduce the number of waste tires entering California's landfills by aggressively pursuing innovative uses for these tires. Although RHMA is viewed by many as the main avenue to aid in this effort, Caltrans is also pursuing other uses that can potentially consume larger quantities of waste tires. "Shredded waste tires," also known as tire-derived aggregate (TDA), consume large quantities of tires when installed as lightweight fill material in Caltrans engineering applications. Caltrans also uses waste tires in other asphalt applications and innovative products.

Caltrans uses RHMA as an alternative to hot mix asphalt (HMA). RHMA is similar to HMA except that it incorporates crumb rubber harvested from waste tires. Based on the projects awarded in 2011, 35.9 percent of all flexible pavements, by weight, were designed with rubberized asphalt. Caltrans saw a significant increase in RHMA usage in the 2011 calendar year. This was attributed to three factors. Management has continued to promote the usage of RHMA throughout Caltrans by emphasizing the policies, guidelines, and procedures on RHMA. Additionally, savings from lower than expected construction bids in the 2010/2011 fiscal year, enabled additional paving projects to be funded.

[1] Rubber hot mix asphalt (RHMA) and hot mix asphalt (HMA) supersede the rubberized asphalt concrete (RAC) and asphalt concrete (AC) terms used in previous reports. The RHMA and HMA terms are consistent with accepted industry and academia references and will now be the exclusive terms used for this report.

Lastly, Caltrans implemented warm mix asphalt (WMA) technology that allows the asphalt material to be placed at cooler temperatures than that of HMA, eliminating some of the temperature restrictions that limit RHMA usage. Because of these factors there were six large projects awarded in 2011 that incorporated nearly two million waste tires. This new technology also works for rubberized warm mix asphalt (RWMA) used in several large projects awarded in 2011. A complete list of Caltrans' projects that incorporate waste tires is included in Appendix 1.

Waste Tires Used in the Caltrans Projects					
Year	**Number of Tires Used in Pavement Projects[1]**	**Number of Tires Used as TDF[3]**	**Number of Tires Used as TDA[1,4]**	**Number of Tires Used in Other Applications[1,5]**	**Totals**
2008	3,888,962	412,500	176,957	164,858	4,643,277
2009	3,610,106	385,000	109,637	142,547	4,247,290
2010	4,147,433	462,000		264,543	4,873,976
2011	6,654,776	462,000		307,259	7,424,035
2012	4,500,000[2]	462,000		285,931[6]	5,247,931
Subtotal	22,801,277	2,183,500	286,594	1,165,138	**26,436,509**

[1] Based on projects listed in Appendix 1. Formula for conversion of RHMA tonnage to number of waste tires consumed is 2.72 tires/RHMA metric ton or 2.47 tires/RHMA US ton.

[2] Actual quantity through second quarter is 3,098,146 tires with an estimated projection of 4,500,000 tires through the end of the calendar year.

[3] Based on CalRecycle's recently published California Waste Tire Market Report: 2010, waste tires used as TDF in 2008 was 7.5 million, 7.0 million in 2009 and 8.4 million in 2010, and projected for years 2011, and 2012. This amount was then multiplied by the estimated Caltrans share of cement usage of 5.5 percent to determine the number of tires used as TDF.

[4] Amount represents TDA used as lightweight fill material. If experimental installations continue to perform as anticipated, proving that this is a good engineering application, then this can be adopted as a standard tool. Additional pilot projects are being aggressively pursued.

[5] Other applications include the use of waste tires used in asphalt – rubber binder material for chip seal projects and in the production of rubber weed abatement mats.

[6] Actual quantity through second quarter only.

To further enhance Caltrans' effort to reduce waste tire stock piles in this country, Caltrans revised its project specifications to limit the crumb rubber used in Caltrans' pavement projects to only material produced in the United States from waste tires taken from vehicles owned and operated in the United States. Imported crumb rubber is not allowed.

In October 2009, Caltrans issued Pavement Policy Bulletin (PPB 09-02), Quieter Strategies for Noise Sensitive Areas. The goal of this bulletin is to promote quieter pavements strategies that maintain noise reduction benefits without compromising safety, ride quality, or the sustainability of pavement surfaces. RHMA is one of the approved quieter pavement strategies established through research data collected throughout the state and nationally. This policy will increase the use of RHMA in noise sensitive areas and contribute to Caltrans overall waste tire usage totals.

Through an interagency agreement, Caltrans and CalRecycle conducted research to seek opportunities to expand the use of RHMA in Caltrans projects. This research helped to confirm the

cost-effectiveness of Caltrans strategies for RHMA, confirmed the feasibility of recycling reclaimed RHMA into newly placed pavement, and established the core elements for product deployment through statewide training and partnerships with industry. Funds were also used to develop an on-line RHMA training course for Caltrans employees.

The increased use of RHMA comes with opportunities to test the limits of the product and placement. The successful installation of RHMA is dependent on many factors, with the most critical ones being related to temperature. RHMA is produced at a higher temperature than HMA and must also be placed at hotter temperatures during construction. The ambient air temperature of the construction site at the time of material placement plays a key role in the ability to compact the material for good durability. Forensics on three recent RHMA pavement failures attributed those failures to installations conducted outside the acceptable temperature range. All three projects were constructed in the fall season, or at night when temperatures had dropped dramatically.

In 2010, Caltrans began using RWMA. RWMA is prepared at lower temperatures than RHMA and allows for a larger ambient temperature range during placements. This temperature difference also allows for longer haul distances from the asphalt plant to the project location, increasing the opportunities for this pavement strategy to be used. In 2011, District 3 utilized a RWMA mix into a project that used 400,000 waste tires. Because of this project and several other large RHMA projects, 2011 was an exceptional year for waste tire usage.

Caltrans considers TDA as the first option whenever lightweight fill is required for a project. To support Caltrans' consideration of project-specific TDA uses, CalRecycle has provided Caltrans with access to industry experts to supplement education to Caltrans' technical staff to promote the innovative use of shredded waste tires in highway construction.

Although the need for lightweight fill is infrequent, the most recent TDA application was with the Confusion Hill Realignment Project in District 1. Here, lightweight fill material was strategically placed over a culvert, approximately 90 feet below the roadway, to bypass a significant landslide area on U.S. Highway 101 in Mendocino County. TDA was selected for this project due to its many good engineering characteristics including durability, high permeability, and low earth pressures. Stage 1 of the construction project was completed in 2008 and stages 2 and 3 were completed in 2009. A total of 286,594 waste tires were used on this project. This was the first independent project where Caltrans did not rely on CalRecycle to furnish or deliver the TDA to the jobsite. The limited number of TDA suppliers close to the project site as well as a limited number of properly equipped trucks to deliver the TDA, made it difficult to receive the material in a timely manner. Another issue was inconsistent aggregate size, with much that was delivered found to be larger than anticipated. This required additional TDA to be placed to account for settlement and deflection of the TDA once it was compacted in place. Although, these were viewed as relatively minor issues, they have been noted and will be shared as lessons learned for future projects.

Caltrans will continue to research retaining walls built with TDA used as backfill material. The results from the research will give parameters for use in seismic design. These results may allow for a significant reduction in the retaining wall mass in future designs, ultimately reducing the costs for such structures.

In addition to RHMA and TDA, the use of tires as a fuel supplement in cement kilns and cogeneration facilities constitutes a large market for the consumption of waste tires. Based on CalRecycle's California Waste Tire Market Report: 2010, of the approximate 41.1 million waste tires generated in California in 2010, approximately 8.4 million were consumed as TDF in various cement kilns in California. These kilns produce cement used to create concrete Caltrans uses in many of its construction projects.

Other transportation applications that incorporate waste tires include asphalt-rubber binder material used in chip seals and rubber mats. Asphalt-rubber chip seal projects are used to correct surface deficiencies and to seal and protect the pavement against the intrusion of surface water. Caltrans will continue the installation of rubber mats underneath guardrails as a method of vegetation control. This application has performed well in addressing Caltrans' historic maintenance need to suppress fire risk through weed control, while reducing herbicide usage and the exposure of maintenance staff to traffic and chemicals.

Although program funding continually fluctuates, Caltrans' recent focus on RHMA and TDA as strategies of choice has allowed Caltrans to increase its percent usage of waste tires. The recent experience of lower than expected construction bids also allowed for more projects to be funded. Appendix 2 compares the various pavement types (by weight) constructed by Caltrans each year. Appendix 3 shows the increasing percent usage of RHMA when compared to all flexible pavement strategies.

Summary

Caltrans has promoted the use of RHMA as a roadway pavement strategy, and will continue to use RHMA as the strategy of choice when evaluating flexible pavement designs. The increasing percentage use of RHMA versus HMA is expected to continue on a positive trend. As Caltrans helps to reduce the number of waste tires entering into California's landfills and stockpiles through the means described in this report, Caltrans will continue to look for new and innovative uses of recycled waste tires for transportation projects.

Caltrans' use of RHMA is largely dependent upon the available funding in the State Highway Operation and Protection Program (SHOPP) for pavement projects, where maintenance project needs continue to exceed the funding available. However, the limited work in the construction industry has resulted in more competition, lower bids, and transportation project savings that allowed more projects to be funded.

One final observation to note is that there is a substantial investment of State and federal funds on local roads. Some of these investments include the local share of the State Transportation Improvement Program congestion relief programs, and gas tax revenue. Although Caltrans cannot accurately quantify the use of RHMA on local roads, it is a pavement strategy currently used by many local agencies.

Caltrans is dedicated to the stewardship of natural resources and will continue to look for opportunities for innovative uses of recycled products in transportation projects.