Assessment of the PG+5 Initiative

The primary goal of this study is to evaluate using a small amount of rubber in all asphalt.

WHAT IS THE NEED?

California is faced with the challenge of diverting more than 40 million scrap tires from disposal annually in the state. The California Department of Resources, Recycling, and Recovery (CalRecycle) is responsible for finding new uses of waste tires. In 2010, CalRecycle estimated that of the approximately 41.1 million reusable waste tires generated in California, 33 million of the tires (81 percent) were diverted through various alternatives including reuse, retreading and combustion.

In 2005, the Legislature passed and the Governor signed AB 338 which requires the California Department of Transportation (Caltrans) to use a specific percentage of crumb rubber per metric ton of the total amount of asphalt paving materials it uses each year. Specifically, as of 2013 Caltrans is required to use, on an annual average, 11.58 lb of crumb rubber per metric ton of the total amount of asphalt paving materials Caltrans used in the course of constructing and repairing the state highway system.

In 2006, the Federal Highway Administration (FHWA) Recycled Materials Policy was established. The FHWA policy states that recycled materials should get first consideration in materials selection, and that determination of use of recycled materials should include an initial review of engineering and environmental suitability, followed by an assessment of economic benefit, and restrictions that prohibit the use of recycled materials without technical basis should be removed from the specifications.

Caltrans proposes to reduce landfill disposal of scrap tires by requiring that all hot mix asphalt contain a relatively small amount of crumb rubber modifier (CRM). A relatively small amount of CRM in hot mix asphalt (HMA) is defined as either 5-10 percent by weight of the asphalt binder or 0.25-0.50 percent by weight of the aggregate. The proposed increase in the use of CRM is driven by environmental considerations, not enhanced performance, as has been the historical approach.
WHAT ARE WE DOING?

Caltrans has identified the following four approaches for using small amounts of CRM in dense-graded asphalt concrete (i.e., Type A hot mix asphalt [HMA]) while still meeting current Caltrans Section 39 specifications:

• **Approach-1: Wet Process with No Agitation, Complete Digestion**
  Caltrans PG+X for unmodified binders and meeting all current PG specifications, with addition of the CRM not resulting in a change to the PG grading of the base binder. It is anticipated that binders that already meet the current Caltrans PG-M specification would fall into this category.

• **Approach-2: Wet Process with Agitation, Incomplete Digestion**
  Caltrans PG+X for asphalt rubber binders and meeting anticipated PG specifications for asphalt rubber binders with changes to some components of the specification (e.g., solubility). Addition of the rubber should not result in a change to the PG grading of the base binder. It is anticipated that binders prepared using the same approach currently followed to prepare the asphalt rubber binders used in gap- and open-graded mixes (i.e., rubber particles smaller than 2.36 mm [passing the #8 sieve]) and in chip seals (i.e., rubber particles smaller than 1.4 mm [passing the #14 sieve]), but with lower CRM contents, will fall into this category.

• **Approach-3: Dry Process**
  Addition of between 0.25 and 0.5 percent CRM per ton of asphalt concrete mix (~5 to 10 lb/ton [2.3 to 4.5 kg/ton]) using a dry process. Mixes containing this rubber must still meet all Caltrans specifications. The PG grading of the binder should not be affected if this approach is followed.

• **Approach-4: Wet Process with Agitation, Complete Digestion**
  Same as Approach-2, but using other recycled tire rubber formulations typically with a finer rubber particle size, such as devulcanized tire rubber, which can be field-blended to achieve a binder containing between five and ten percent CRM (by weight of the binder) that still meets PG specifications, with potentially some relaxation for solubility. Addition of the CRM should not result in a change to the PG grading of the base binder.

Caltrans has requested that the UC Pavement Research Center (UCPRC) evaluate the technical feasibility, life cycle cost analysis (LCCA), and life cycle assessment (LCA) environmental impacts of each of these approaches. Caltrans has also requested the assistance of UCPRC with the development of test methods, specification language and guidelines.

WHAT IS OUR GOAL?

The goal of this project is to provide the information needed for Caltrans to decide whether and how to move forward with each of the four approaches and technologies that fall within them.

WHAT IS THE BENEFIT?

If small amounts of rubber can be used in all asphalt without reducing its life, Caltrans can meet and exceed AB 338 in its annual paving season.

WHAT IS THE PROGRESS TO DATE?

Approaches #1, #3 and #4 have been completed. Researchers have found that small amounts will provide good or slightly improved performance. Certain specifications need to be addressed (e.g. PG high grade bump, etc.) in order for Caltrans to set specifications for use. Approach #2 is finishing up and also shows promise.