The assessment of research needs will identify knowledge gaps and issues that preclude the use of certain materials and suggest specific research and development tasks to resolve them. Strategies for selecting research and development priorities will be identified and used to produce a research plan that sets these priorities. Chesner Engineering, P.C., is under contract to assist the agency with the project.

The second research project is Evaluation of Use of Crumb-Rubber Modifier in Asphalt Pavements. FHWA published a report to the U.S. Congress in June 1993 summarizing the state of the practice for incorporating recycled materials, including crumb-rubber modifier, into highway pavements. The report concluded that further research is necessary to assess the performance characteristics and recycling potential of this type of asphalt concrete. FHWA entered into a 60-month contract with Oregon State University in September 1994 to resolve many of the outstanding technical issues identified in the report. This research program is designed to produce guidelines that can be used by state highway agencies to incorporate crumb-rubber modifier into asphalt pavements.

The overall objectives are to evaluate crumb-rubber modifier technology as it relates to design, construction, recycling, and performance of asphalt-concrete pavements. Products of the research will include guidelines for mix and structural design and construction of this type of asphalt pavement. Guidance will also be developed for the production and quality control of crumb-rubber modifier mixes. The project will establish the long-term performance of these pavements and determine their recyclability.

Engineering Activities

In May 1995 the Environmental Protection Agency issued the Comprehensive Guideline for Procurement of Products Containing Recovered Materials (CPG). The CPG consolidated 5 existing item designations and added 19 new ones, including cement and concrete containing ground granulated blast-furnace slag (GGBFS).

Blast furnace slag is a by-product of iron production in a blast furnace, composed primarily of silicates and aluminosilicates of calcium. When cooled rapidly by immersion in water, and ground to a sufficient fineness, the resulting GGBFS exhibits cementitious properties that allow it to be substituted for a portion of the cement in a portland cement concrete mix. Although substitutions of up to 70 percent have been used, typical substitution rates range from 25 to 50 percent.

In implementing the requirements of the CPG, the Environmental Protection Agency recommends that procuring agencies allow the use of cement or concrete containing GGBFS as an alternative when appropriate. EPA also recommends that the procuring agencies review per-

Using Ground Rubber to Remove Petroleum from Water

Limited success in the containment and remediation of liquids containing petroleum products such as gasoline, oil, and solvents has led to increased interest in the development of new cost-effective technologies for remediation. Ground rubber from scrap tires may satisfy this need, as well as the need to develop a reuse market for used tires. Research has shown that many rubber polymers can sorb a variety of solvents, including aromatic hydrocarbons such as benzene, toluene, ethylbenzene, and xylene compounds (BTEX) in gasoline. One use of ground rubber as a sorption medium could be as an aggregate in slurry cut-off walls that are in contact with petroleum products. The swelling property of the rubber when exposed to BTEX may also help to decrease the liquid conductivity of a cut-off wall as organic compounds permeate the wall. Ground rubber could also be used as a sorption medium in pump-and-treat methodologies, or more importantly in in-situ reactive permeable barriers.

Initial research has shown that surface-treated, non-surface-treated, and differently sized tire-rubber particles have the ability to sorb O-xylene and benzene from water contaminated with these compounds. The sorption test results of ground rubber for benzene and O-xylene in aqueous solutions are promising. Further research is necessary to focus on the feasibility of ground rubber as an economically competitive sorption medium, and the ability of ground rubber to sorb multiple contaminants under natural groundwater conditions. The cost comparison should include the costs of regeneration or disposal, or both.

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