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Use of Recycled Tire Rubber in Concrete

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USE OF RECYCLED TIRE RUBBER IN CONCRETE

THE NEED

More than 250 million scrap tires weighing more than 3 million tons are generated each year in the United States (Naik and Siddique 2002). This is considered as one of the major environmental challenges facing municipalities around the world because waste rubber is not easily biodegradable even after a long period of landfill treatment. One of the solutions suggested is the use of tire rubber particles as additives in cement-based materials.

Although concrete is the most popular construction material, it has some limited properties: low tensile strength, low ductility, low energy absorption, and shrinkage and cracking associated with hardening and curing (Wang et al. 2000). Several studies performed recently showed application of the recycled tire rubber might improve these weak characteristics of concrete.

THE TECHNOLOGY

While rubberized asphalt has been used for decades on roadways (in fact, Intermodal Surface Transportation Efficiency Act (ISTEA) set in 1991 mandated the use a minimum of 5% recycled rubber by weight of asphalt place and the percent of rubber used was to increase gradually up to 20% by the year 1997. The mandate was revoked in 1996 (Khatib et al. 1999)), rubberized concrete is a technology infant. Many studies have been performed to investigate the feasibility of the usage. Since a number of ways to use the recycled rubber in the concrete design are possible and there are still many factors and properties that should be investigated, it may be difficult to expect that mass production-base rubberized concrete is able to be available in the market today or next week. However, many study results have proven the mechanical and environmental advantages of the use of recycled tire as addition to cement concrete.

Many experiments were done to find out appropriate methods of rubber application. Commonly, fully replacing coarse aggregate (gravel) or fine aggregate (sand) with rubber is not appropriate because the loss of strength is too severe. However, with small portion of aggregates replaced, the loss in compressive strength was not significant. A research study by Khatib et al. (1999) and Schimizza et al. (1994) suggested that rubber





should not exceed 17-20% of the total aggregate volume. Experiments under the laboratory environments commonly presented that the use of rubber in the concrete cement mix reduced drying shrinkage, brittleness, and elastic modulus, which might improve the overall durability and serviceability of concrete cement.

THE BENEFITS

- Recycling of scrap tires suggesting an environmental solution.
- Reduction of plastic shrinkage cracking
- Diminishment of the vulnerability of concrete to catastrophic failure

STATUS

Recently, Dr. Zhu (Arizona State University) tried to apply rubberized concrete in the real world cases including dozens of residential and commercial sites. Crumb rubber of 8 percent of the cement weight was used.

BARRIERS

- Large variation of concrete performance according to the application method and ratio of rubber usage - sensitive to variations in procedure (Chung and Hong 1999)
- Costly procedure of rubber particle preparation



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REFERENCES

1. Chung, K., and Hong, Y. (1999). "Introductory behavior of rubber concrete." *Journal of Applied Polymer Science*, 72, 35-40.
2. Naik, T. R. and Siddique, R. (2002). "Properties of concrete containing scrap tire rubber - an overview." UWM CBU Report No. CBU-2002-06.
3. Wang, Y., Wu, H. C., and Li, V. C. (2000). "Concrete reinforcement with recycled fibers." *Journal of Materials in Civil Engineering*, ASCE, 12(4), 314-319.
4. Khatib, Z. K., and Bayomy, F. M. (1999). "Rubberized portland cement concrete." *Journal of Materials in Civil Engineering*, ASCE, 11(3), 206-213

REVIEWERS

Peer reviewed as an emerging construction technology

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