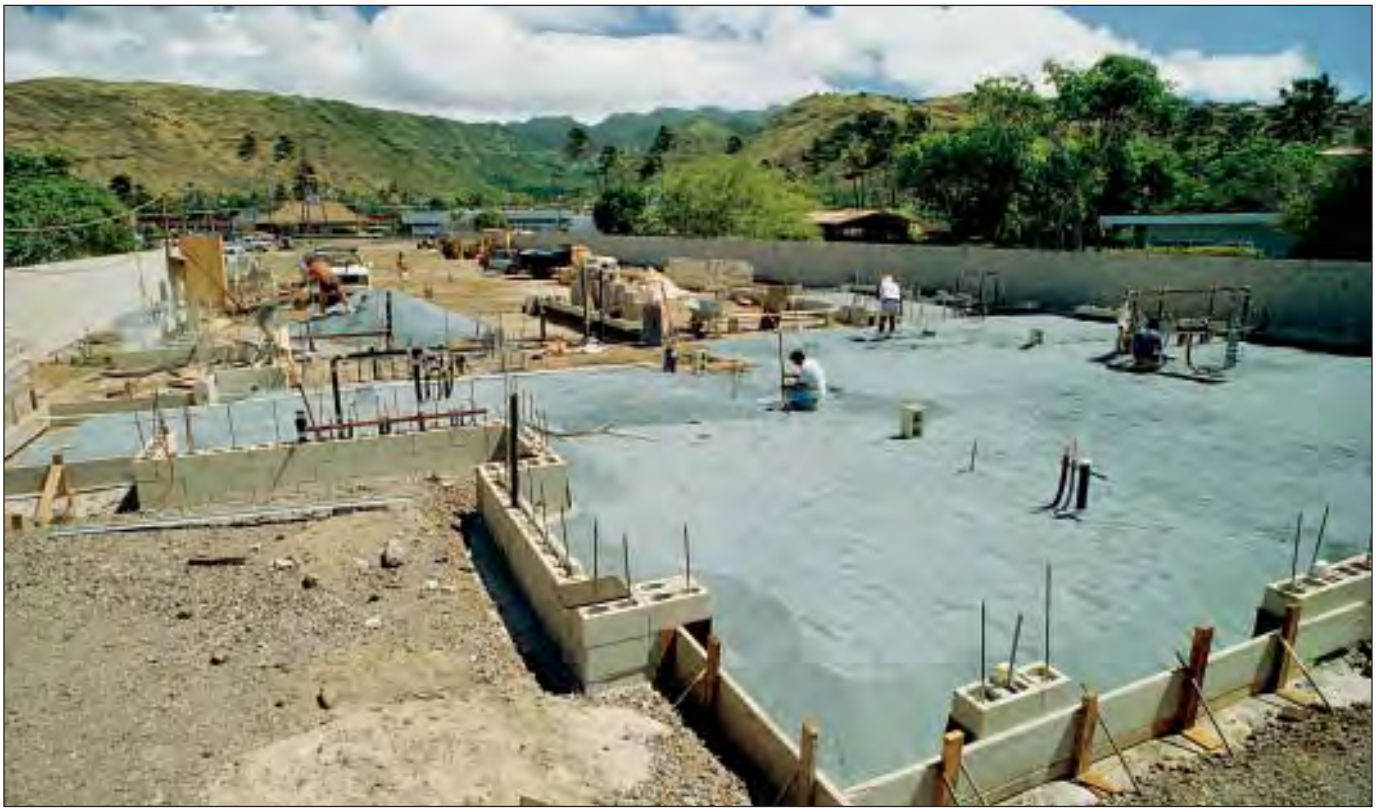
RESEARCH UPDATE

A Barrier For Formosan Subterranean Termites



University of Hawaii research developed installation guidelines for termite-resistant particle barriers in pre-construction and post-construction applications.

The cost for prevention, remedial treatments and repair costs for the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, have been estimated at $100 million annually in Hawaii (Tamashiro et al. 1990b). The problems associated with this economically important insect pest have escalated with the shift towards urbanization as residential developments arise in areas formally used to for plantation agriculture of pineapple and sugarcane.

Otagaki et al. (1970) reported that residents of Hawaii use more pesticides in and around the home than residents in other urban areas of the United States. A major contribution to this pattern has been the repeated use of soil treatments to prevent penetration by Formosan subterranean termites. Unfortunately, concrete foundation walls

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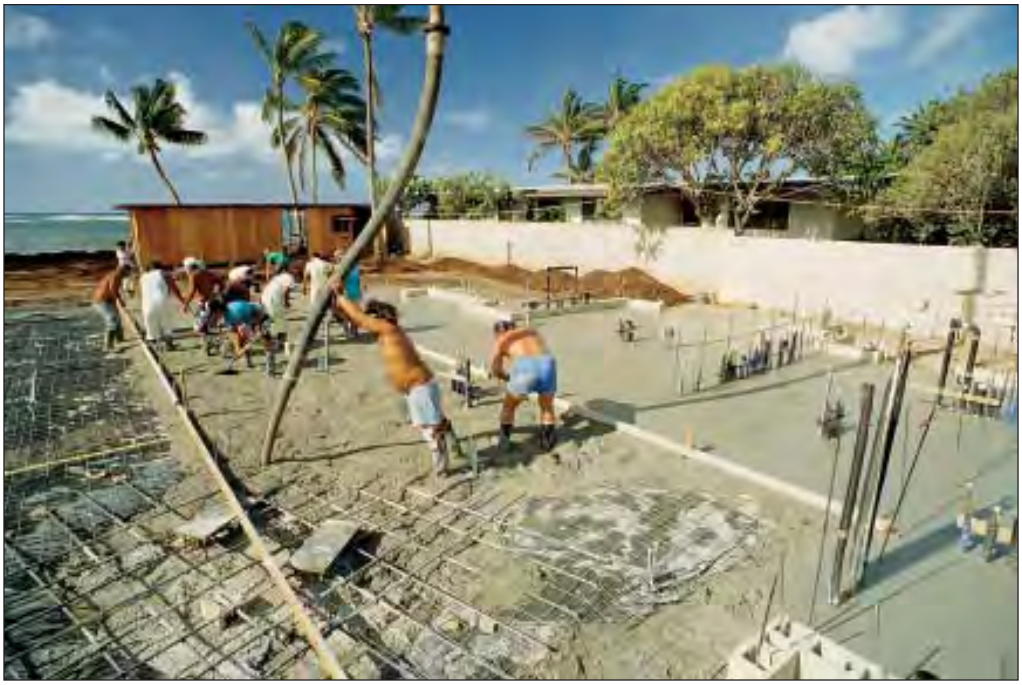

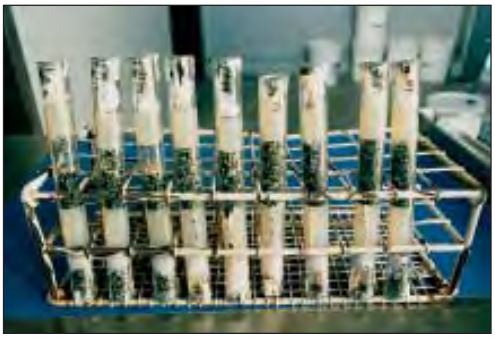

A cooperative extension project was developed in the Department of Entomology at the University of Hawaii at Manoa to help resolve issues with Basaltic Termite Barriers (BTB) and improve BTB installation practices in Hawaii. This project involved labor-intensive work and attention to detail. A cement truck feeds concrete to a concrete pump (top left). BTB in place before the concrete pour (left, middle). BTB is installed behind a retaining wall (left, bottom). Concrete is distributed over the slab area (above, top). Researchers performed a field test in which wooden stakes were placed in the center of prospective gravel sizes (based on lab test) in high termite pressure location (above, left). Cardboard surrounded each test unit which was evaluated for termite damage at the end of the experiment period. Those sites with damaged cardboard indicated that the site was challenged by termites. Researchers set up a laboratory tube test in which 4 cm of the test gravel were sandwiched between to pieces of 8% agar; Formosan subterranean termites were added to the bottom portion of the tube (above right).

and concrete slabs of the type normally found in cost-conscious construction are rarely sufficient alone to keep termites from reaching structural wood (Grace 1999). Although use of cyclodiene insecticides in Hawaii ceased in 1998, the reduced longevity of replacement termiticides (Tamashiro et al. 1990a, Grace et al. 1993) has resulted in an increase in the frequency of subterranean treatment applications (Tamashiro et al. 1990b).

Particle barriers have been tested and are gaining in popularity worldwide as physical alternatives to insecticide barriers to prevent subterranean termite penetration and attack on structures. Although diatomaceous earth did not prove too effective (Grace & Yamamoto 1993), crushed basalt (Tamashiro et al. 1987a, 1987b, 1990b, 1991), granite (Smith & Rust 1990, French & Ahmed 1993, French 1991, 1994; Ahmed & French 1996), quartz and coral sand (Su et al. 1991), silica sand (Ebeling & Pence 1957, Ebeling & Forbes 1988), brick, concrete, limestone and natural sand (Miles 1997a, 1997b) and even glass shards (Pallaske & Igarashi 1991) screened to specific particle sizes have proven to be effective in preventing termite penetration, although the effective particle size ranges differ from one termite species to another (Su & Scheffrahn 1992).

DEVELOPMENT OF BTB. The development of the Basaltic Termite Barrier (BTB) as a permanent physical barrier for use in Hawaii was the result of extensive laboratory and field tests with the Formosan subterranean termite (Tamashiro et al. 1987a, 1987b, 1990b, 1991). Positive laboratory and field research results and the commercial potential of BTB led to its patent by the Office of Technology Transfer and Economic Development at the University of Hawaii at Manoa. Subsequently, this technology also led to development of a similar crushed granite product that is marketed in Australia as Granitgard (Granitgard Pty. Ltd., Victoria).

Ameron Hawaii (formerly known as Ameron HC&D) first commercialized BTB on Oahu, Hawaii, in 1987; and the product was adopted into the Uniform Building Code of the City and County of Honolulu in 1989 as an alternative to chemical preconstruction soil treatments. BTB has been primarily available on the island of Oahu, where it is produced, due to the special equipment requirements for screening the crushed rock to the proper size distribution. Use of BTB on the island of Hawaii is expected to increase, however, since it is now also manufactured on this island. This physical barrier is primarily used as fill beneath concrete slab foundations and as backfill for retaining walls during new construction and around the perimeter of the concrete foundation slab after it has been poured. A minimum four-inch layer of BTB is recommended for these applications. BTB can also be used to fill the interior hollow voids in hollow tile (concrete masonry unit) construction. Although the primary use of BTB is in new construction, post-construction uses are being developed.

ACCEPTANCE AND IMPLEMENTATION. Although it is the most successful

patent held by the University of Hawaii, BTB has not been as widely accepted as was hoped by consumers, architects and contractors in Hawaii as a substitute for pre-construction chemical treatment.

It can be difficult and labor intensive to install BTB since the layer beneath the concrete slab must be consistently thick, unbroken and uncontaminated in order to be effective. We have observed several BTB installations in Hawaii that failed to prevent Formosan subterranean termite infestations in structures with either monolithic or floating concrete slab foundations. Lewis et al. (1996) also observed occasional failures when a sand barrier was used to prevent *Reticulitermes* spp. infestations in California. Investigation of the structures where failures were observed in Hawaii by coring through concrete slabs to evaluate the BTB barrier revealed two common installation faults: contamination of the BTB with natural grade material (e.g. soil, gravel, etc.) and failure to maintain a minimum four-inch BTB layer beneath the slab.

Another difficulty that arises during installation when BTB is used as fill material under a monolithic concrete slab is the resulting angle of repose at the concrete footing. The construction industry standard is 45 degrees, but the fluid-like nature of BTB results in a 30 degree angle of repose when it is dry and 38 degree when it is wet. This condition increases the amount of concrete needed and thus the costs of construction. Further concerns include displacement of the BTB caused by the impact of concrete when it is poured and when construction workers walk on the material and contamination of BTB when removing concrete form stakes.

A cooperative extension project was developed in the Department of Entomology at the University of Hawaii at Manoa to help resolve these issues and improve BTB installation practices in Hawaii. Objectives included the development of pre- and post-construction installation and use specifications for BTB in Hawaii; instructional seminars for developers, architects and building industries throughout the State on implementation of the specifications; and incorporation of the specifications into the Uniform Building Code for all counties in Hawaii. A 16-minute videotape was produced (Yates 1997) for use in these seminars and was distributed to libraries throughout the state to illustrate acceptable installation procedures for BTB beneath and around concrete slabs and when the product is used as backfill behind hollow tile retaining walls. We provide these guidelines at www.pctonline.com/BTBinstallation in order to further encourage proper use of the Basaltic Termite Barrier and as an aid to entomologists, architects and contractors in other regions who are considering the use of particle barriers to prevent termite infestation.

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