# STUDY ON THE USE OF ELASTO PLASTIC BAR CHIP SYNTHETIC FIBERS IN PORTLAND CEMENT CONCRETE PAVEMENT

Elasto Plastic Concrete's Bar Chip is a structural synthetic fiber that are engineered copolymer fibers used as concrete crack control reinforcement in civil infrastructure works. EPC's Bar Chip fibers are used as a replacement for steel fiber and welded wire mesh reinforcement. Manufactured in the highest possible standards, EPC's structural fibers feature a continuously embossed surface to ensure maximum bond with the cement matrix.

This study was conducted to evaluate the performance of synthetic-fiber-reinforced-concrete (SNFRC) to substantially improve the road structure's design life particularly in an aggressive environment. Concrete structure is known to develop macro-cracks when subject to tensile stresses. For plain concrete, the toughness is very low. Fibers like this product can increase the toughness by many orders of magnitude, as crack growth is resisted not only by the fracture resistance of the matrix but also by the resistance provided by the fibers bridging the crack.

Laboratory studies were performed incorporating elasto barchip fibers against without fiber in PCCP to evaluate and check if the designed flexural strength of 550 psi at fourteen (14) days can be attained. Laboratory test results showed as early as seven (7) days, it exceeds the requirement.

The first pilot road trial was constructed in March 2012 along Aklan West Road, Malay-Buruanga Section, Km. 265+440-Km. 265+879, Malay, Aklan while the second pilot trial was constructed in February 2013 along Roman Expressway, Km. 107+346.9 to Km. 107+559, Brgy. Mulawin, Orani, Bataan in order to determine its performance under local conditions.

Upon evaluation, the use of 1.25 kg/cu.m. of Elasto Plastic Concrete's Bar Chip in PCCP may be recommended to lessen the occurrence of cracks in concrete pavement.

Synthetic fiber reinforcement claims longer the design life of concrete, mainly based on its corrosion resistance property. The fibers in concrete only starts to work when the concrete cracks and it do very little before in terms of structural capacity. A crack in concrete will possibly allow moisture to come into contact with reinforcement. The degree of degradation will be dependent on the crack width, the concrete's environment and the type of fiber. The corrosion resistance property of synthetics can withstand alkalis attacks.

On roadways, the main idea of fiber reinforced concrete is to support a high level of traffic. The advantage of fiber reinforcement is that it reinforces through the full depth of the slab and prevents the crack from propagating wherever it may start. Similar to traditional rebar, fibers are used to distribute tensile forces in concrete, providing additional strength and crack control. Unlike traditional reinforcement systems, where the forces are distributed across a single layer of mesh, fiber reinforced concrete spreads the load across thousands of individual reinforcing fibers. The matrix of the fiber throughout the concrete provides greater control and produces a more ductile structure that is able to absorb high levels of energy. This tri-dimensional nature of reinforcement improves the anti-seismic characteristics of fiber reinforced concrete.

The undertaking of constructing pilot road projects with fiber reinforced concrete is limited to Portland-cement based concrete and specifically excludes the use of fiber in the production of fiber cement sheeting products. In this context, the matrix to which fibers are added comprises graded aggregates (from a combination of sand and coarse aggregates), a

binder (a combination of ordinary Portland cement, fly ash, slag and silica fume) and suitable admixtures.

The purpose of reinforcement in the concrete matrix is to carry tensile stresses. At some value of stress/strain, a visible macro crack will form. Fibers, bridging the macro crack, apply a restraining tension across the crack, an action akin to that of conventional reinforcement. The effect of fibres depends both on the type of fiber (material and geometry) and the fibre dosage.

Anyone with a basic understanding of construction understands the significance of concrete and steel, the combination of these two materials revolutionized modern building techniques.

This study aims to evaluate the performance of synthetic-fiber-reinforced-concrete (SNFRC) to substantially improve the structure's design life particularly in aggressive environments in response to the call for more resilient concrete infrastructures.

The focus of these pilot trial projects is to evaluate the performance of Bar Chip synthetic structural fibers in addressing the occurrence of cracks on Portland Cement Concrete Pavement subject to heavy load capacity and high levels of traffic; and to assess the crack control performance and long term durability of concrete pavements.

It has been observed that during the monitoring period, the completed pavements in Aklan and Bataan Pilot Trials developed temperature cracks, minor scaling and pokemarks. Aklan Pilot Trial has transverse crack at control section due to road shoulder erosion caused by heavy rains and flashfloods from upstream after the project completion. The said transverse crack did not develop further; a line ditch canal was constructed to control the same. On the other hand, pavement distresses like scaling and pokemarks were prevalent along right lane of Bataan Pilot Trial.

Comparing the laboratory tests results, the flexural strength requirement of 550Psi at 14 days utilizing Barchips (1.25 and 2.50 kg/cu.m.) were attained and exceeded in 7 days in Bataan and 14 days in Aklan but generated almost the same results compared with the conventional in the field. In terms of controlling concrete distresses, PCCP with Barchips performs well in time as compared to conventional, both for two pilot research projects.

It is recommended that Barchips can be used in Portland Cement Concrete Pavement in addressing the occurrence of cracks subject to heavy load capacity and high levels of traffic; and to evaluate the crack control performance and long term durability of concrete pavements.