Ultra-thin Concrete Road Surface, using Stonerod® basalt fibre mesh in 50mm thick topping.

Early in the 1980"s, The Council for Scientific and Industrial Research (CSIR) in South Africa, started actively investigating Ultra-thin Reinforced Concrete Pavements (UTRCP). Adrian Bergh, before his retirement, along with his team was engrossed in providing sensible work and growth opportunities for communities living near un-surfaced roads. It was understood by both governmental and other agencies, that low-skill levels and unemployment would cause enormous drains on the fiscus. If methods could be developed to harness the massive labour pool, and at the same time improve basic services to outlying areas, a win-win scenario would develop. Unfortunately, it seems nobody is listening.

From 2002 until about 2010, the CSIR conducted ultra-thin concrete road pavement (UTRCP) research. In the Roodekrans experiment, different thicknesses of concrete pavement were laid. During an 8 year period more than 1 million standard axles travelled over the exit road from the Roodekrans quarry. Performance of the UTRCP exceeded expectations, with only isolated cracking of the concrete being noted.

The team research included traffic loading simulations using a purpose built load repetition frame and a heavy vehicle simulator. Photographs of the test frame and the heavy duty simulator can be seen in the following web page, which gives details of the research: (https://researchspace.csir.co.za/dspace/bitstream/handle/10204/6613/Dlamini1_2012.pdf) E80 loads, which are a commonly used single axle equivalent load of 80 kN, were common for over eight years and topped 1 million axles.

In early September, 2016, HBA Consulting Engineers placed an ultra-thin basalt reinforced white-top concrete overlay over a worn and pot-holed asphaltic pavement. The location of the trial was on Abraham Van Wyk Road, the access road to the Roodekrantz Quarry Area, in Ruimsig/Muldersdrift, Roodepoort, Gauteng, South Africa. [26º04'02"S 27º51'43"E]. The concrete encapsulated a "modified" Stonerod® basalt mesh product.

The white-top 3m x 5m test section was marked out on the old asphalt pavement. The asphalt was washed with water and broomed clean and a 25mm high steel frame was fixed to the asphalt surface. A slab edge-thickening foundation was provided, inside the frame. Ready-mixed concrete was supplied from a local batch plant at 30 MPa and about 100mm slump. It was poured into the frame, hand leveled, and tamped.

The reinforcement was a reduced weight, (reduced cost) basalt mesh reinforcement. The original product chosen for the test was 450 g/m^2, 25mm x 25mm Stonerod® basalt fibre mesh. The product was lightened to approximately 225 g/m^2 by physically removing "+" pieces from the middle of four adjoining 25mm x 25mm apertures. The result was a 50mm x 50mm mesh that was half strength. The modification reduced the load bearing and reinforcement capabilities of the mesh, but in spite of the alteration, the mesh has performed admirably well.

Tel: +27 (0) 11 578 8600 Fax: +27 (0) 11 578 8800
Stonerod Technologies (Pty) Ltd 50 Graniet Street Jet Park, Boksburg, Gauteng
P O Box 75098 Gardenview 2047 Website: www.stoneod.com **Email: sales@stonerod.co.za**

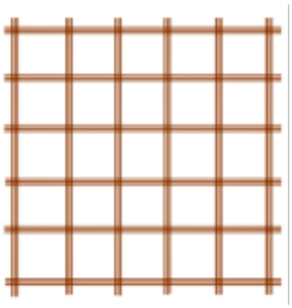

Figure 1: Flexible Stonerod® basalt fibre mesh.

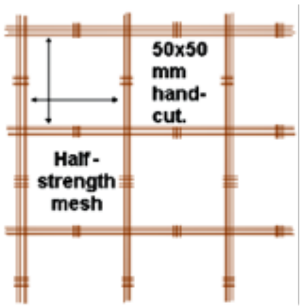

Figure 2: The "modified" half weight, half strength mesh.

Once the first layer of concrete had been placed, the mesh was thrown over the surface and pulled flat to remove any wrinkles. It was tamped into intimate contact in the wet concrete. Thereafter, a second height of 25 mm was added to the screed rail, making a total slab depth of 50 mm thick. More 30PMa concrete was poured into the frame and the concrete was screeded level. It was then covered with black plastic sheeting to provide curing.

The following day, the shutter was removed and small triangular ramps were provided by plastering ramp edges around the slab. The slabs were not joined to the main slab in any way. No shrinkage crack control methods were used. A "worst case" scenario was chosen, to fully assess the system.

		
Figure 3: Placing the first layer of concrete over the old tarmac	Figure 4: The soft mesh is pulled into position at the midway height.	Figure 5 In 39 months, 600 000 vehicles have used the test strip:

The test-strip was covered with plastic sheeting, for seven days to allow for curing, and then the 20MPa slab was opened to traffic. (30MPa concrete should achieve 20 MPa in seven days.) The strip immediately was put into service.

Traffic in the area is heavy and the strip has faced a real test. With traffic of +/-1625 axles in a 12 hour period, and an estimated annual traffic mass of >1.5 million tons, the system has proved successful. It is estimated that more than 600 000 vehicles have used the pavement. 62% of the vehicles are extra, heavy-duty loaded multi-axle dumper trucks.

The concrete has cracks. That is the nature of concrete. The only reinforcing is "lightweight modified" Stonerod basalt fibre mesh. The edge thickening has provided stress points and a longitudinal crack above the edge of the beam. Normal shrinkage cracking is present, but if the concrete had been saw-cut, those cracks could have been tucked out of sight. There isn't a pothole anywhere and no maintenance has been necessary.

The method is adaptable and could replace asphalt in milled pavements. No rutting, shoving or potholing has occurred in over 3 years. Asphalt is no longer the less expensive solution. It can also be used to surface rural roads using untrained labour and mentors.