Indian-origin Canadian professor tests road that self-repairs in Karnataka

A team led by an Indian-origin professor at a Canadian university has come up with a road that is self-repairing, has greater longevity and is resistant to severe climactic conditions.

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Professor Nemkumar Banthia (centre) in Thondebavi village in Karnataka where the new self-repairing road, based on advanced technology, was built recently.(Courtesy UBC)

In recent months, Nemkumar Banthia, professor in the department of civil engineering at the University of British Columbia (UBC) has had his eyes fixed on a road.

That road, though, happens to be more than 12,500 km from Vancouver, where he is based. It's a demonstration project in a village about 90 km from Bengaluru and uses advanced materials and technology that could help with enhancing rural road connectivity.

The project is the result of research that marries materials science and structural engineering to create self-repairing roads that are cost effective, have greater longevity and are sustainable.

Banthia, who graduated from IIT-Delhi before moving to Canada 34 years ago, undertook the project under the auspices of the Canada-India Research Center of Excellence IC-IMPACTS, where he is scientific director.

In 2014, his team selected Thondebavi village, after a series of interactions with gram panchayat members and the local community. Based at UBC, the center is focused on research collaboration between Canada and India to develop and implement "community-based solutions to the most urgent needs of each nation".

Construction of the road, which connects Thondebavi to the highway and replaces a dilapidated dirt track, was completed in the late winter of 2015, but the last few months were critical as it had to be monitored for how it lasted through the extreme heat of an Indian summer and the monsoon. Now, it can be claimed a success.

The dirt track that existed in Thondebavi village before the new self-repairing road was built. (Courtesy UBC)

The road's thickness, at about 100 mm, is about 60% less than that of a typical Indian road, reducing cost and materials. About 60% of the cement is replaced with flyash, thus curbing the usual carbon footprint,

especially as cement production releases greenhouse gases. It comes with built-in crack healing, as high strength concrete is supplemented with fibre reinforcement with nano-coating that makes it absorb water and keeps the road hydrated.

The new self-repairing road that connects Thondebavi village to the highway. (Courtesy UBC)

Watch | How Professor Nemkumar Banthia's team came up with the self-repairing road

Banthia described this as a "cute mechanism" and explained: "These are fibres which have a hydrophilic nano-coating on them. Hydrophilia means they attract water and this water then becomes available for crack healing. Every time you have a crack, you always have unhydrated cement and this water is now giving it the hydration capability, producing further silicates which actually closes the crack in time."

Also, native drainage prevents the village from turning into a marshland as it often did during monsoon months.

Banthia, originally from Nagpur, said he expected the road to last about 15 years, far beyond the two-year lifespan of the average rural or mid-town road in India. It's also 30% cheaper in terms of a first time cost, though the savings, he said, would be substantial over its life cycle.

Villagers, he said, have taken to the new road, since it connects each of the hamlet's 1,200 residents, and allows them to take their produce to market easily.

With India requiring about 2.4 million km of rural roads, it isn't surprising that this project may be replicated in other states, with initial discussions underway for similar roads in Haryana and Madhya Pradesh. And the technology doesn't have to be limited to villages since conversations have also been held with the ministry of road transport for a highway demonstration project. "There is a great deal of interest," Banthia said.

That interest is not limited to India. Closer home, such a road could soon be constructed for a First Nations community near Edmonton in the Canadian province of Alberta. That comes with its own climactic challenges – extreme cold, winter snow and the thaw. But Banthia is confident such roads will show the path ahead for rural communities to overcome the connectivity deficit.

https://www.hindustantimes.com/india-news/indian-origin-canadian-professor-tests-road-that-self-repairs-in-karnataka/story-BwcmgEox5GXBNViXjeZ7MM.html

This concrete composite can help buildings withstand quakes

The project was funded by a Canada-India research collaboration centre and this material will be tested in a building in Uttarakhand before the end of the year.

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Prof Nemkumar Banthia and Salman Soleimani-Dashtaki examine a wall retrofitted with a coating of the quake-resistant material after a test.(Image courtesy: UBC Public Affairs)

A concrete coating developed by researchers in Canada that can help withstand earthquakes will be tested in a building in Uttarakhand later this year.

The spray-on composite developed at the University of British Columbia is the latest

grassroots-oriented innovation to have emerged out of a premier centre for technological collaboration between Indian and Canadian institutes.

The eco-friendly ductile cementitious composite or EDDC, is currently being tested at an elementary school in Vancouver. Once those tests are complete, it will be applied to a school in Roorkee, according to Nemkumar Banthia, professor of civil engineering at UBC, who supervised its development, which was led by Salman Soleimani-Dashtaki, a scholar at the University's department of civil engineering.

Banthia is also scientific director of the India-Canada Centre for Innovative Multidisciplinary Partnerships to Accelerate Community Transformation and Sustainability or IC-IMPACTS, which funded this project.

UBC described the new material as "new seismic-resistant, fibre-reinforced concrete" and noted that it "is engineered at the molecular scale to be strong, malleable, and ductile, similar to steel—capable of dramatically enhancing the earthquake resistance of a seismically vulnerable structure when applied as a thin coating on the surfaces."

Professor Banthia told HT the purpose has always been "to create a material that behaves like steel."

Concrete is brittle and cracks under stress leading to the collapse of buildings. One of its major characteristics, Banthia explained, is that "it can deform three times more than steel does. If you look at steel, it will continue to take stresses, (whereas) steel will bend, give you a great deal of ability to deform the structure and the structure would still remain intact."

The material is sprayed on to unreinforced masonry walls, as exists in his parents' home in Nagpur, Banthia said.

"And three-quarters of buildings in India are built that way. These don't take a lot of earthquake shaking because they will collapse very very easily. The same structure, when you put this coating of EDCC, we were able to take up to 9.1 Richter earthquakes on the walls that we tested. We still couldn't fail it."

In fact, the research team took the ground motion data from the 2011 Tohoku earthquake in Japan, which led to the Fukushima disaster, and simulated stress tests on walls coated with the substance.

"We are very confident that even a 10 mm coating of this highly ductile, elastoplastic, steel-like material is the one which can actually help us survive a number of these buildings during earthquakes," Banthia said. In addition, 70% of the cement usually required for such material has been replaced with fly ash. "We can now utilise the 150 million tonnes of fly ash India has in these highly optimised sprays," Banthia said.

The test at a school in Roorkee will commence before the end of this year and that area was chosen specifically as Uttarakhand is among the most seismically vulnerable regions in India.

Founded just four years ago, IC-IMPACTS has funded 38 research projects and 15 demonstration projects of which EDDC is the latest innovative outcome.

This summer, another project under its aegis was a new type of concrete for pavements, that uses fibre from discarded tyres.

Last year, it also developed technology for self-repairing roads, with a pilot project undertaken in Karnataka.

This transcontinental partnership features the UBC, University of Alberta and the University of Toronto in Canada and multiple leading institutes in India, including several IITs.

https://www.hindustantimes.com/world-news/this-concrete-composite-can-help-buildings-withstand-quakes/story-SpZUcelnepI3eKgXQpQvoL.html