

Simulating 20 years of heavy road traffic

A mobile laboratory enabling an engineer to test new road building material and proposed new construction techniques, writes Sarah Wild. Imagine the civil engineering and build environment learning that can be derived from such kinds of simulation. Obviously the cost is much too high for any one university to invest, but collaboration and partnerships with owners could give students most valuable experience.

IF YOU are going to spend millions of rand on a road, you need to know it is going to last, surviving a heavy traffic load for 20 years — and that is where the Council for Scientific and Industrial Research's (CSIR's) heavy vehicle simulator comes in.

Although the simulator was first developed in the 1970s, there is still sustained demand for it — locally and internationally — and it is a source of royalties for the mainly state-funded research institution.

"The simulator is a mobile laboratory ... (that) can apply up to 20 years of traffic to a road surface in as little as three months," says Chris Rust, strategic research manager at the CSIR's built environment unit.

"This allows an engineer to test, for example, a new road building material in a very short period of time."

The only alternative to test road materials is to build a short test section and then wait 20 years to see if the material works, he says, adding that roads are usually designed to last for about 20 years.

"This technology has been used extensively in SA to improve our road design methods and road materials," he says.

One client is the South African National Roads Agency (Sanral). "It's the only way in a short time frame that we can simulate what we expect to occur over a 20-year period. The technology is very reliable," says Louw Kannemeyer, Sanral's strategic network planner.

"The simulator is specifically designed to analyse the whole pavement structure, especially for heavy vehicle traffic — new design, new construction techniques," he says.

Sanral used to own two of the simulators until the early 1990s, but now uses a service provided by the Gauteng public transport, roads and works department.

The HVS (Heavy Vehicle Simulator) Technology Development Programme led by the department operates its own simulator, which is used to do tests in Gauteng and the Western Cape.

It says on its website the programme has contributed to areas such as the development of road design standards and guidelines, road material specifications and guidelines, the implementation of labour-intensive technologies and the provision of cost-effective, fit-for-purpose road infrastructure engineering solutions.

It is not surprising SA's road builders would choose to use the programme's simulators — depending on the specific model, the machine carries a \$1,2m-\$2m price tag (about R9,6m-R16m). "The special machine for airfields costs about \$3,6m," Dr Rust says.

However, there has been significant international interest. There are six in the US — at universities, the California and Florida transport departments, and the US Army Corps of Engineers — and one apiece in Sweden, China and India.

There are also machines on order, says Dr Rust, citing the example of Costa Rica's National Laboratory of Material and Structural Models.

The CSIR licenses the manufacture and marketing of these machines to Dynatest, a company in the US.

"They build the machines, sell them and maintain them," Dr Rust says, adding that a number of Dynatest machines have been built with the help of South African manufacturers.

"The CSIR assists with the technical expertise on the use of the machines and is also involved in a number of research programmes," he says.

In fact, he cites the research programme as one of the most important parts of the machinery sale. "It isn't just about selling the machine.... In the US, they have a problem where the roads freeze. In SA, we don't know about the effects of that. There is a two-way flow of knowledge."

Since the technology has been around since the 1970s, "there is no doubt that every road design undertaken in SA, at present and in the future, has been, or will be, influenced by the results that were generated by the HVS programme," the Gauteng public transport, roads and works department says.

Mr Kannemeyer says the cost of the machines can be justified. "The actual cost of the device — with bells and whistles — is about \$1,8m-\$2m. Compare that with constructing a road. A kilometre of new road can cost R20m- R80m. So that's why you have to look at the cost of equipment versus the value of the data and the cost of building the roads."

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Science and Tech Correspondent, Business Day Wanted to be an astronaut but found out it involved living in a tincan for months. So she writes about it instead