Projects ◇ Technology

NEW FACILITY FOR CIVIL ENGINEERING AT THE UNIVERSITY PRETORIA

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The South African transport engineering industry currently faces challenges including a lac civil engineers, limited training and a shortage of training and testing facili compared wi countries. Engineering 4.0, a civil engineering research and laboratory facility at the Univer Pretoria, completed in March 2020, was built to help address these challenges and impres architectural design.

Top training and testing areas

The project consists of a training laboratory, road materials reference laboratory, concrete research laboratory, timber and structural member facility, an accelerated pavement testing and an active traffic track.

It also has a small reception area and auditorium, with next phases of the development foc on expansion of the laboratory to other civil engineering disciplines.

ARC Architects were the lead architects of Engineering 4.0 and the project is a collaborativ between SANRAL, the University of Pretoria and the Council for Scientific and Industrial Research (CSIR). ARC Architects have a longstanding relationship with the University of P a portfolio of various buildings at the university, such as the Aula, Engineering 3 and Mining Centre.

According to Wynand Steyn, head of the Civil Engineering Department at UP, research and laboratory facility needed a simplified structure to house a complex programme and the vis was to provide an internationally renowned platform for academic and job training support. design of this project, which began in June 2019, is uniquely different because it provides r interaction between the inside and outside of the building, which is something not typically in a research and laboratory facility.

Features to enhance education aspects inside the building include a glass-floored secti thick reinforced concrete floor displaying reinforcement inside concrete, as well as open structures showing trusses and supports.

Linking engineering to nature

The design links research and testing that happens inside the building to the understandin all civil infrastructure placed in nature needs to be balanced with its location. The interactio between the internal laboratories and natural forest around the facility make it different to a standard civil engineering laboratory that typically cuts out most natural light and views.

Engineering 4.0 has an impressive external open-view design, allowing students to be con reminded of the work being conducted inside the laboratories, even when they are socialis outside. The open-view design encourages discussion and learning and keeps the link to r where users inside can see their outside surroundings.

A large volume of the concrete and steel shell of the building creates a warehouse-type sp that is adaptable for future purposes; and is currently divided into two large laboratories an smaller laboratories. Steel columns are used on the ends of the elongated structure with cl and the structure is not just a rectangular shaped box, but has features to make it look like than a large open volume from the outside.

All external walls are in a tilt-up design because of weak soil conditions and because exter foundations would have been needed if normal brick-type walls were used. Tilt-up construc cost-effective, low maintenance, fire resistant, allows for shorter building times and enables students to see the results at close range.

Educating by showcasing examples

Features to enhance education aspects inside the building include a glass-floored section reinforced concrete floor displaying reinforcement inside concrete, as well as open roof stru showing trusses and supports.

Other features include the open heating, ventilation and air-conditioning system showing intricacies of the system, an ablution section displaying the complexities of ablution facilitie floor inlays relevant to civil engineering sciences.

Engineering 4.0, a civil engineering research and laboratory facility at the University of Pr completed in March 2020.

The glass foyer frame is made up of H- and I-beams creating a linear and radial grid that intersects through a forest area, creating a relationship between the interior space and surrounding environment. H-beams emphasise the rotation of each column along the radia walkway, while horizontal I-beams create continuity between the vertical and horizontal ele and connections between the two.

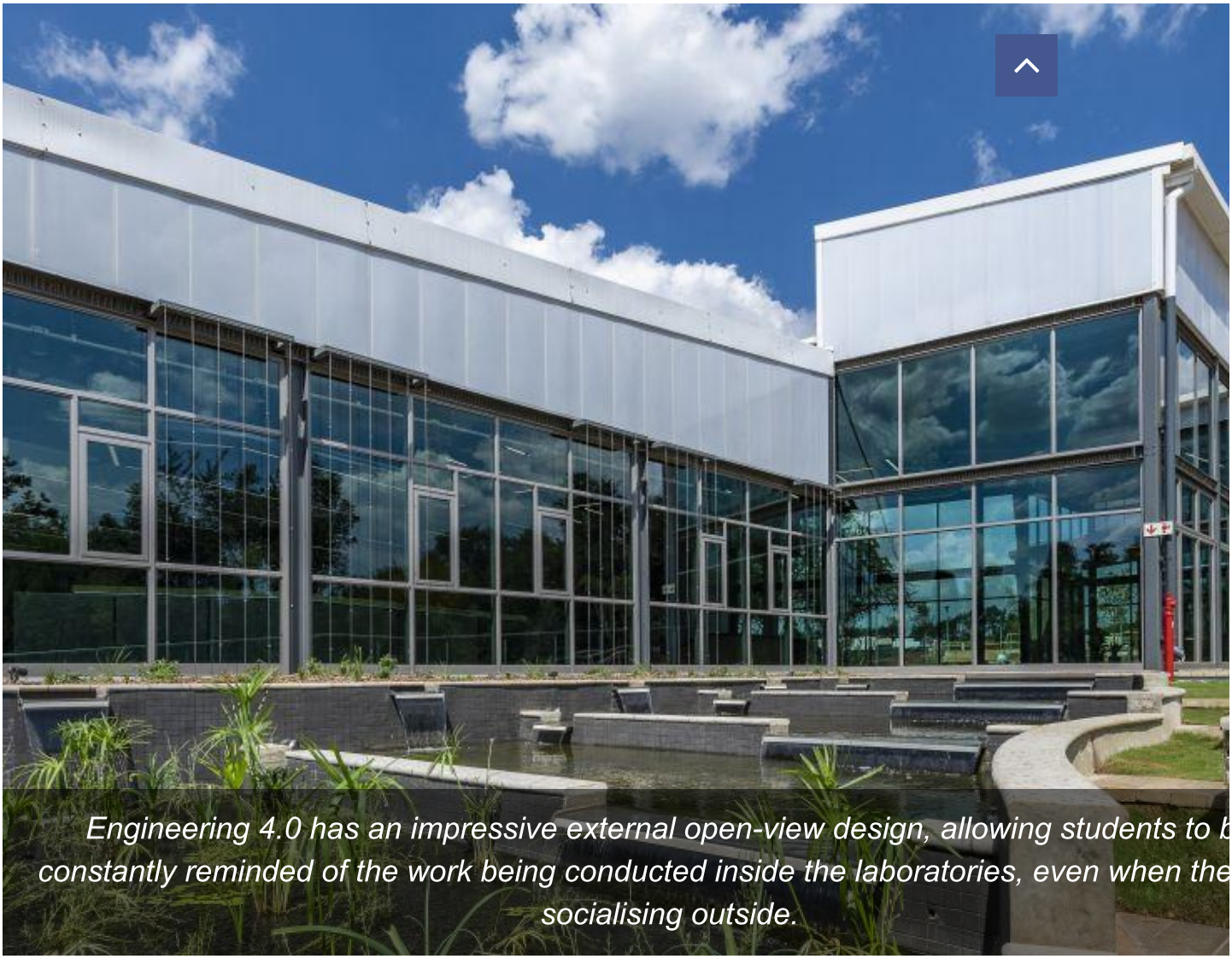
The layout of the reception area is well suited to serving the different laboratories and testi areas, and channels different stakeholders from technicians to external parties or students different parts of the facility successfully. Through the layout, the road materials reference laboratory can be operated as a sterile space where only dedicated staff and materials car without influences from students.

Links between the internal laboratories and natural forest around the facility make it diffe a standard civil engineering laboratory that typically cuts out most natural light and vie

Providing opportunities to experiment

The first facility is a training laboratory, with dedicated laboratory stations in a layout that al each technician to independently conduct testing and to be certified. The second facility is road materials reference laboratory, where learners will conduct duplicate testing of road b materials for South Africa and where comparative testing between South African, Southern African, African and international laboratories can be done.

The third facility is a large concrete research laboratory with material preparation areas an rooms that have a range of temperature and humidity levels for treating concrete samples environmental conditions found throughout Southern Africa. He says this laboratory has a strong floor, which consists of 900mm deep reinforced concrete with a compressive streng 80+ MPa used to conduct large-scale tests on concrete samples to determine failure criter

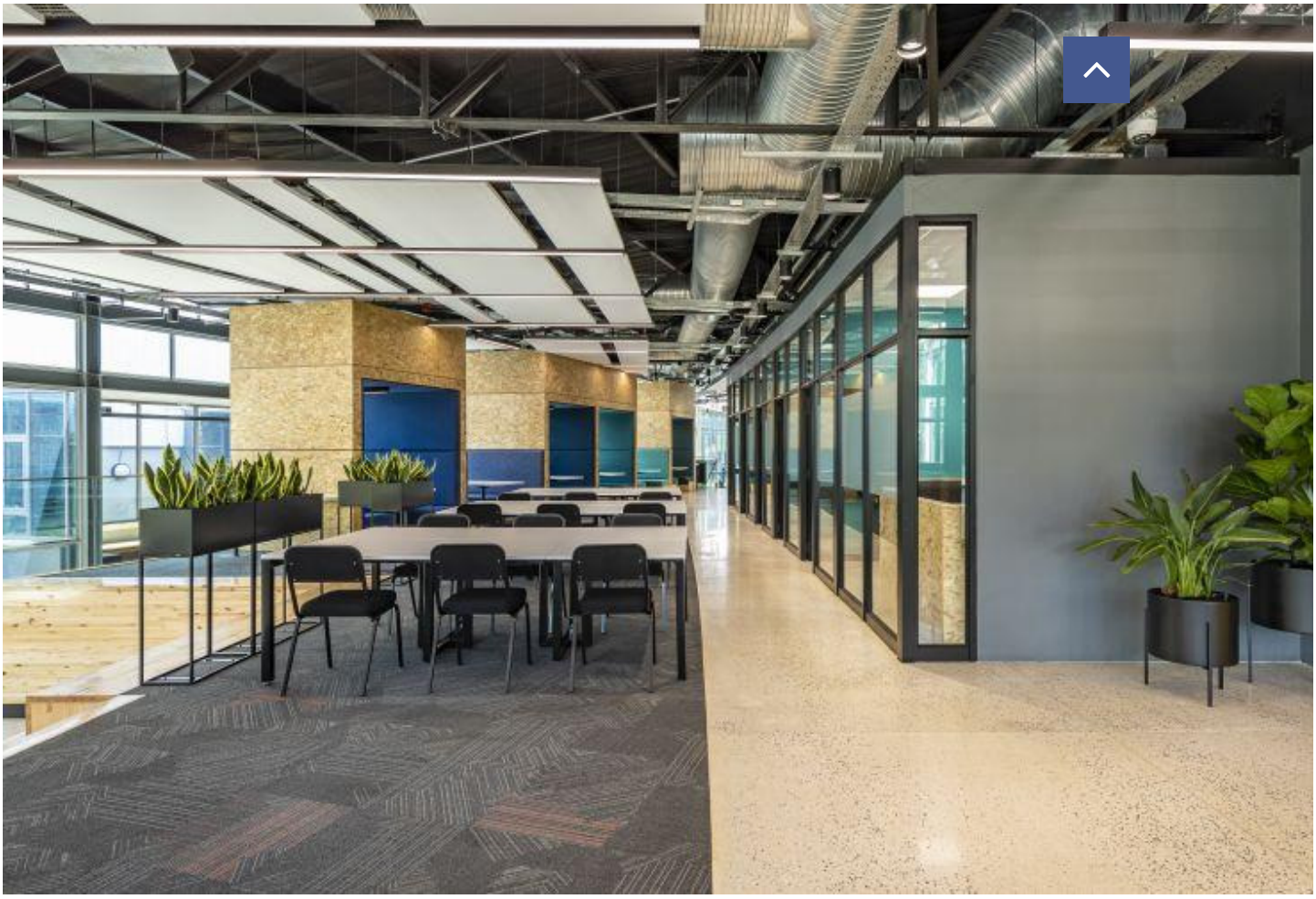


Engineering 4.0 has an impressive external open-view design, allowing students to b constantly reminded of the work being conducted inside the laboratories, even when the socialising outside.

Outside areas bringing theory to life

The fourth indoor facility is a timber and structural member facility where properties of sect engineered timber and steel structures can be evaluated. Outside the building there is an accelerated pavement testing facility, where pavement structures can be tested to destruct using devices, and there is an active traffic lane on the adjacent highway, where the respo road pavements to real traffic can be determined.

A storm-water retention model was used for storm-water design, with a lined primary pond allowing storm-water reduction of a 1:50 year flood, serving as a sediment trap with water treating water to enhance water quality. An unlined secondary pond covered by natural gra attenuates overflow from the primary pond when flooding occurs, preventing unnecessary being discarded and replenishing the natural groundwater table.



This functional, durable, aesthetically-pleasing building is a space for the training of engine and technicians, where students can evaluate material properties, test conditions of road pavement structures and compare it to real traffic and environment responses. It provides holistic approach to engineering sciences and should allow future civil engineers to unders materials and designs better, serving us with more sustainable and cost-effective road netv

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