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ScienceScope

PUBLICATION OF THE CSIR | VOLUME 6 | NUMBER 2 | APRIL 2012
SOUTH AFRICA'S COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

Research and development for industry: Advanced manufacturing



The CSIR offers a range of analytical services to test food and beverage samples, as well as environmental samples - water, soil, air and waste.

Many industries, government bodies and private individuals are reliant on independent expert testing for quality control purposes, to ensure food safety and legislative compliance. The laboratories perform organic, inorganic and microbiological analyses and are SANAS ISO17025 accredited. Clients throughout Africa make use of these analytical services. The CSIR also has the only facility in the region for testing biotoxins in shellfish.

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Trailers designed and manufactured locally for Smart Trucks



A CSIR and industry partnership in action: Johan Hagg from the trailer manufacturing company Afrit, Arie de Lange from fleet operator Unitrans, and CSIR researcher Christopher de Saxe.

Heavy vehicle designers can now use innovative solutions and the latest technology to meet required performance standards with improved safety outcomes and productivity, while resulting in the more effective use of local road infrastructure.

THE PERFORMANCE-BASED STANDARDS (PBS) approach, adapted for local conditions and recommended by the CSIR for heavy vehicles, has been taken up by various companies as part of the 'Smart Trucks' research programme. The trailers of Smart Trucks, which conform to PBS, are being manufactured locally, according to preapproved specifications and routes.

"Proposed Smart Trucks have to undergo a comprehensive approval process and meet regulatory requirements before the trailers are manufactured," notes local PBS expert, Paul Nordengen of the CSIR.

The concept design of a Smart Truck must indicate key dimensions, axle unit masses and the tyre sizes. The design standards for the trailers include high- and low-speed directional and

non-directional manoeuvres in which standards such as tail swing, low-speed swept path, static rollover threshold, rearward amplification, yaw damping and high-speed transient off-tracking are assessed.

"Principle approval is also required from the provincial departments and national Department of Transport, according to the Abnormal Load process. The final assessment reports together with the final vehicle design and proposed routes must then be submitted to the Smart Trucks Review Panel for approval," explains Nordengen, who chairs the review panel.

Only once the final operational approval is received, may the applicant proceed to buy vehicle components and manufacture the trailer according to the approved design and specifications.

Design

Required vehicle design features include:

- ABS/EBS braking systems
- Retarders/intarders
- Side marker lights (truck tractor – 'horse' and trailer)
- Abnormal load signs on the front and back of the vehicle
- A vehicle management system for monitoring the driver's performance, including speeding, harsh braking or acceleration and vehicle location.

Fleet operators

Smart Truck demonstration projects are being used in the forestry and mining sectors, with a number of other projects in the design phase representing various industry sectors.

"As a fleet operator, Unitrans chooses the horse, or truck

tractor, from existing suppliers according to the loads our trucks have to be able to pull. Our trailer design and manufacturing partner is Afrit," says Arie de Lange, Unitrans technical manager for agriculture and mining services.

"Unitrans decided to go the Smart Truck route as it cuts down on the number of vehicles.



Truck trailers manufactured according to performance-based standards.



CSIR expert Paul Nordengen who chairs the Smart Trucks Review Panel.



A heavy vehicle that conforms to the requirements as set out in the 'Smart Truck' research programme.

The risk is thus reduced in terms of the number of accidents occurring, while accident levels are also down due to all our vehicles on the road having to comply with safety standards as set out in the PBS. The Smart Truck definitely leads to increased productivity. We can, for example, move more tons of cargo per kilometre with these trucks," notes De Lange. A reduction in emissions per ton of cargo transported is another positive spin-off.

"The CSIR also undertakes road wear analyses of our trucks to inform us which kinds of tyres cause the least damage of the roads we are permitted to use," he comments.

The fleets of participating operators of Smart Trucks are accredited through the Road Transport Management System self-regulation programme. The PBS approach thus allows for

a good 'match' between a vehicle and the subset of the road network it will use, ensuring protection of the road infrastructure and adherence to acceptable safety standards.

"We receive operational data of the Smart Trucks on a monthly basis to monitor compliance, and to evaluate the benefits of the PBS research programme demonstration projects," notes Nordengen.

Trailer manufacturing

"In collaboration with the client, we design the PBS trailers within the length and height specified and according to the needs of the client, in this case Unitrans," says Johan Hagg, sales executive of trailer manufacturer Afrit.

"It is a very thorough, and thus long, process to get approval for manufacturing a Smart Truck trailer. This is to ensure that all safety requirements and PBS specifications are met. From the

start of the initial paperwork to getting the go-ahead for production in the factory, usually takes up to three years," Hagg notes.

"Logistics service providers have expressed a growing need for Smart Trucks as they realise they will need fewer vehicles with the longer trailers," he says. The longest truck-trailer combination to have been built at Afrit was 43 m, for use in the mining sector.

Human capital development

Christopher de Saxe of the CSIR conducts research within Nordengen's group on the possibilities of PBS for car-carrier trucks. As part of its human capital development drive, the CSIR enables De Saxe to complete his MSc in engineering through a studentship at the University of the Witwatersrand (Wits).

"Wits and the CSIR have been contracted to perform PBS

assessments of proposed car-carrier designs," says De Saxe. Initial analyses of low-speed manoeuvrability have shown that a large percentage of the existing South African fleet fails to meet the requirements of the 'tail swing' standard. Tail swing is the amount by which the rearmost outer corner of a vehicle or trailer swings outwards during a low-speed turn.

"To date, two car-carrier designs have undergone detailed assessments and have been modified to address the tail swing problem. The design modifications have resulted in improvements in other safety-critical aspects of the vehicles. This is a good example of PBS at work in improving overall vehicle safety," concludes De Saxe.

— Hilda van Rooyen



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