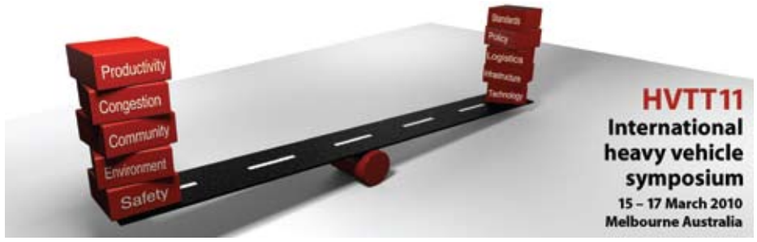
An Australian Abroad

When the HVTT 11 convenes in Melbourne in March 2010, one of the speakers will be a long time supporter of this conference, an Australian working at the cutting edge of innovative heavy vehicle design in the UK.

Professor David Cebon is Professor of Mechanical Engineering at Cambridge University and also goes under the title of Director, Cambridge Vehicle Dynamics Consortium and Head of Cambridge University Engineering Department's Transport Research Group. In addition, he serves as the chairman of the International Forum for Road Transport Technology (IFRTT) Scientific Committee assessing the papers to be presented at the Heavy Vehicle Transport Technology 11 conference to be held in conjunction with the International Truck, Trailer and Equipment Show (ITTE) in Melbourne in March next year.

Although he has spent much of his working life at Cambridge University, he is an Australian, having gained his initial degree in engineering at Melbourne University. David initially arrived in Cambridge to work on his PhD and has not looked back since. That was in 1981 while he was working in the field of vehicle and road interaction. David was following on from some work being done at the time by the Australian Road Research Board (ARRB) in this area by Peter Sweatman.



The aim of this research was to measure the effective impacts on the road by different suspensions. David's work led him into the area of trying to quantify the amount of damage done to road pavement by trucks. Up until this time, very little work had been done in this area. Civil engineers had looked at roads and mechanical engineers had looked at trucks, but there had not been any study on how they affected each other.

These initial studies led to a long period of work going deeper into the subject and developing an understanding of the relationship between truck suspension and the pavement. David is still involved in this area and is currently undertaking a study for the New South Wales RTA to help them analyse their HML scheme in relation to poorly maintained air suspension systems.

"Road friendly suspensions are air suspensions but if they don't have well maintained shock absorbers, they bounce all over the place and they cause very high dynamic loads," says David. "So poorly maintained vehicles with air suspension actually can be worse than a vehicle with leaf spring suspension. The road friendly regulations don't have any in-service performance requirements."

This raises the issue of the potential need for an in-service performance requirement for any suspension system certified to be road friendly. David is helping research by providing information to aid a cost benefit analysis balancing the cost of a maintenance program against the possible road damage caused if those suspensions are not properly maintained.

In general, David's research is involved with heavy vehicle suspension design and dynamics, analysing these and looking for improvements in productivity, safety and maneuverability. Much of his work

"In Australia, the heavy vehicle industry is very innovative and there are lots of great new products, this is an opportunity to showcase those products to an international audience."

is involved in looking to reduce energy consumption and improve safety.

"In the last few years, we have been working on ABS systems and we have developed a completely new way of doing truck ABS," says David. "We have reduced stopping distances substantially and reduced air consumption substantially as well. This project involves new brake hardware, new brake control algorithms and sensing and we reckon we can reduce stopping distances by 20 to 30% and reduce air consumption by up to 70%. ABS systems haven't been looked at for quite some time, it is quite old technology so we've had a new look at that."

On the new system, the basic foundation brakes are the same but there is new control hardware. There are new pneumatic valves and new control strategies enabling much quicker control of the air system. Current ABS systems measure wheel speed and use this information to try and stop locking up. The new system gathers much more information enabling the system to predict much more accurately if and when a wheel may lock up. This is allied with much faster valves mounted next to the brake chamber to improve response time.

"Our objective is to make trucks stop like cars," says David. "At the moment truck stopping distances are about 40% longer than a car's and we are trying to make them equal. We will get fairly close I believe. We are not looking for small measures, we are looking for big measures."

David's team is working with brake manufacturer Haldex to develop this technology. If the tests verify the effectiveness of this brake system, Haldex is expected to develop the new braking system commercially. Currently, the work is being done by computer simulation and laboratory rigs but will be fitted to a test truck early next year.

"A road train will be able to stop like a car," says David. "This is what you call a big hairy, audacious goal. But if we, as scientists and universities, can't have goals like this, who can? We can't leave it to industry to do those things because they won't."

In Europe, there has been much interest in multiple trailer combinations to improve productivity and reduce carbon footprints, so the team at Cambridge University are working to find ways to make these vehicles work on European roads. Road congestion and fuel consumption are the big drivers for change in road transport in Europe and road trains are seen as a possible solution.

"In Europe we would have to get these vehicles around small medieval cities with narrow corners, and up and down small country lanes through villages," says David.

"If we want to use longer vehicles, they have to be much more maneuverable. We have been working for some time on what we call active steering systems for trailers. These will enable the trailers to track perfectly behind the prime movers under all conditions, no matter what the speed.

"We have built a fully steered B-double and the second trailer tracks the drive wheels of the prime mover perfectly. We can drive that around the UK standard roundabout better than the standard semitrailer. If we wanted to, we could add a couple more trailers on the back and still track around the roundabout. It will also reverse around corners into loading bays.

"It also steers at high speeds to follow the prime mover exactly or to help with roll stability control. We can reduce rearward amplification of lateral acceleration by up to 20% compared to a semitrailer."

The steering system is so finely tuned it is able to make the trailer cut in slightly when cornering at high speeds in order to improve roll stability outcomes for the combination. It can help the roll stability program by steering the trailers to avoid a rollover, instead of using

individual wheel braking to steady the combination.

"I think, in the long term, the problems of congestion and fuel consumption are going to get so immense that these larger trucks are going to be impossible to resist in Europe," says David.

"There are such serious problems with carbon dioxide and fuel that if you can provide a solution which reduces fuel consumption by 20%, you would be negligent not to do it. As these carbon targets begin to bite, then the politicians are going to have to grow some balls. The really big 'bang for your buck' solutions are going to come from vehicles' dimensions and reducing congestion."

Next year's HVTT conference will be the kind of forum where ideas like those being worked through by David and his team will be presented and discussed by the leading thinkers on this kind of design in the world. David himself, has been involved with all of the conferences starting from the first in 1985 in Canada.

"The HVTT conference is an unusual one because it involves both the heavy vehicle and the infrastructure aspects and that doesn't happen anywhere else," says David. "That combination of civil engineering and mechanical engineering fits in well with my original interest in road damage caused by trucks. It is the only major international conference which has that as its theme, so it is important to me.

"There is a good combination of researchers, regulators and industry people. It's a pretty practical conference. The Chairman of the Forum is Anders Lundstrom from Scania, so we are led by an industry person. It's a good combination of all those issues concerned with heavy vehicles, legislation, road damage and safety. Maneuverability, rollover, Jack knifing, rearward amplification, economics, congestion and extra dimensions, all that really practical heavy vehicle stuff is included in the program."

There is also participation by legislators with the National Transport Commission heavily involved, along with legislators from the States. The conference will be an opportunity for all of the stakeholders involved with road transport to listen and learn about what's going on around the world.

"In Australia, the heavy vehicle industry is very innovative and there are lots of great new products. This is an opportunity to showcase those products to an international audience," says David. "That should not be underestimated, Australia is way ahead on many of these issues, particularly those associated with the long combination vehicles and with PBS, which has been driven by Australia, the NTC and others. Australia leads the world in this area and this conference is an opportunity to pass that on around the world.

"Australia can also learn from what is going on in other parts of the world at the conference. Work being done by people like myself and others around the world on infrastructure, vehicle technology, vehicle regulations and performance measures is going to be presented to the regulators and innovators working in Australia. The HVTT is an opportunity for communication across disciplines and across the world."