Is this the future?

If I told you that in a few years time you could be driving an 18m long vehicle around narrow country lanes without any fear of cutting corners or having to use the wrong side of the road, you would probably think I was mad. If I said that not only would you be able to do this but you'd also be able to travel at 100mph without any fear of accident or collision, then you would be sure that I was mad. However, I am not mad and what I am suggesting is perfectly feasible. The Government doesn't think it's pie in the sky either, because it's considering spending half a million pounds on a development project?

BladeRunner would be capable of carrying 105 passengers in comfort at speeds of 100 miles per hour.

The technology to achieve this unlikely scenario is a reality. A working model of the system has also been built and it works; and a full size vehicle demonstrating part of the technology also exists.

The project is called BladeRunner and has been developed by Carl Henderson of Silvertip Design working in conjunction with Lancaster and Northumbria Universities.

From time to time projects like this come to the surface but usually they do not go any further because there are either practical difficulties or they are hugely expensive. BladeRunner is neither. Its designers claim it is a true inter-modal form of transport, which could totally revolutionise the way we move freight and passengers around the country.

At first glance BladeRunner looks like a giant, articulated lorry with advanced styling but it isn't. It began as a truck project primarily aimed at making big artics more stable, which is why the trailer manufacturer Don-Bur got involved at an early stage.

The heart of the system is the ability for the front and rear motive units to precisely track each other so that if the front goes around the corner so will the back in exactly the same track. Self steering bogies are not new, they've been used on trailers for over 60 years, but they have always had a weakness in that they can only really be used at slow speeds. Once the vehicle is going at speed the steering wheels have to be locked in the straight ahead position and manoeuvring is achieved by tyre scrub. On big trucks the natural oscillations between the trailer steering axles and suspension make the vehicle unstable at speed unless it is locked. On BladeRunner that doesn't happen. The axles steer all the time and the steering does not oscillate because the system has in-built features which negate those actions.

Carl began his studies into how to overcome the problems of manoeuvrability, trailer outswing and stability of artics by learning to drive one and spending hours on the road collecting data on how such vehicles react in different situations, over different types of road and with different loads. He then set about trying to design out all the faults and that is what he has achieved with BladeRunner - it is precisely manoeuvrable, it has no outswing and it is very stable.

At first it appears that the vehicle is a conventional artic with a fifth wheel coupling and indeed it does have a fifth wheel, but that is only for locating the load carrying module allowing it to be easily disengaged for maintenance. In the lowered position it does not carry any load or perform any other function. The actual turning motion for both the powered front module and the rear module is carried out by turntables. Even the driver's cab is independent of the chassis and can thus be locked up to the load carrying unit, removing the normal gap between cab and trailer and its attendant problems of unstable aerodynamics.

Although the unit has a fifth wheel coupling, this is used only for locating the load carrying module.

The bogie is a positively steered unit faithfully following Ackerman geometry. In essence, the development of any angle between the load carrying unit and the bogie induces push and pull on drag links, connected to the steering arms of kingpins mounted on the wheel hubs. The linkage for this positive steering is controlled by the master controller - a small gate or flapper hanging from hinges on the underside of the module within the perimeter of the turntable. From the bottom corner of the flapper a link runs to the steered axle. This is just a reaction link, which does not move. From the opposite corner of the flapper a second drag link runs to the steering arm on the axle. When the load carrying unit moves at an angle to the bogie, so does the flapper. It cannot move the reaction link so it pushes or pulls the steering drag link and steers the wheels. Any movement of the axle is transmitted along the reaction link and simply swings the flapper. The desired wheel steer angle remains unchanged.

Both the forward wheeled module and the rear module are identical with the exception that the front axle is manually steered, although it doesn't have to be, but more of that later.

The giant vehicle can carry 115 cu.m. of freight and takes 30 pallet stacks. In passenger carrying mode it can carry 105 passengers on two decks in considerable comfort and can be low flat floored on the bottom deck for direct wheelchair accessibility. The passenger capsule is independent of the drive units so there is no transmission of road shocks and minimal noise from the mechanical units.

Road/rail

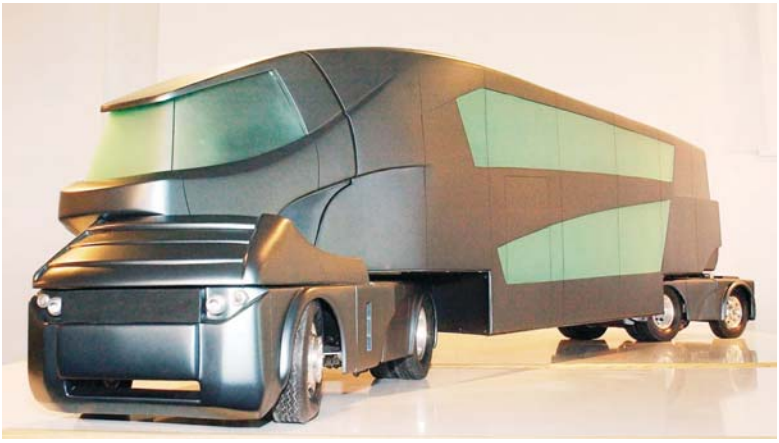
BladeRunner can not only run on conventional roads, it can also run on rails. Buses that can run on rails

as well as roads have been tried many times before. As far back as the 1930's Leyland built some but they have always had major drawbacks. The rail drive gear was cumbersome and achieving drive was difficult. BladeRunner is different. Because both sets of wheels can be used to carry load at the same time, it does not have to use the rail wheels for driving. That function is maintained by the road wheels and the conventional drive system. Similarly, braking is also controlled using the conventional road wheels. Sophisticated systems determine the amount of load to be used by the rail wheels or the road wheels and automatically adjusts them to the circumstances required. More on the rail when cruising, more onto the road wheels for braking, acceleration and when climbing hills. The rail wheels merely perform the function of locating the vehicle and carrying load. The vehicle can transfer on and off the rail track at speed and at any point along the guideway where there is adjacent pavement. By using a combination of cameras and inductive sensors BladeRunner can pick up the rail lines and automatically guide the vehicle to them, at which point the rail wheels can be lowered precisely into position. Similarly, to leave the rail track, the driver merely lifts the rail wheels off the track and once the automatic sensor guidance is disengaged the vehicle can be steered manually.

So why bother with rail wheels at all? Economy. Rail wheels running on rails have only 20% of the resistance of tyres running on road so the vehicle can be operated much more efficiently and more safely at high speeds. Once you have given the vehicle the ability to move from road to rail easily then the way is open to introduce other economic and environmental benefits. Since the vehicle is now operating on a dedicated formation you can suspend electric wires over it and give the vehicle the option to be powered by electricity which is far more economical, offers the option of regenerative braking and can also be used to recharge batteries. As you now have the vehicles operating on a dedicated formation you can also introduce obstacle sensing so that the possibility of collision is removed. If the unit senses an obstruction ahead, say for example a broken down unit, the system will automatically slow your vehicle down and if necessary bring it to a standstill without the driver doing anything. There should be no risk of the one behind running into you because that would be stopped by the same system. You can then retract the rail wheels and revert to conventional tyred drive and simply drive around the obstacle and regain the rail track ahead of it.

By adding automatic coupling equipment you could use one unit to push or pull the stricken unit off the track or you could run two or three units in tandem. Hey isn't that a train? The forward drive unit of the stricken unit can then be unhitched from the load carrying module since it is located simply by the fifth wheel and a replacement unit slotted into place for the vehicle to carry on its way.

To pick up passengers or deliver a load again the vehicle can simply drive off the rail track go to its pick up or delivery point using conventional roads and then return to the rail track to continue its journey.



BladeRunner may look unconventional but it has the possibility of answering many of the transport problems in the developed world.

The test track for the scale model shows just how simple the infrastructure needs to be.

Rail

The system turns the conventional idea of railway track on its head. The track would simply consist of two rails set into a concrete bed. There are no points or junctions or signalling systems because they are not needed. The vehicle can assume road mode to make any deviations and sensor systems can prevent vehicles colliding. Thus you could have a single ribbon of steel running from London to Edinburgh. Because the vehicle is basically only using the rail wheels for load carrying wear on the track is minimal.

As both front and rear modules mimic each other, there is no cut in on corners.

Formation

Taking a conventional three lane motorway, it would be perfectly feasible to convert the centre lane into a dedicated system for this type of transport. You would take up the conventional road surface and lay down the simple concrete bed with the rails set in it. At junctions there would be a separate slip road, which would peel off from the rail track and go up and over the junction. The vehicle could access it by simply raising the rail wheels and reverting to conventional drive. The vehicle can then either pick up or set down passengers before heading down the other side slip road and back onto the track or divert to other places using conventional roads. The sequence of guiding the vehicles, landing on the rail lines and grouping the vehicles in the guideway can all be controlled automatically removing the need for any conventional pointwork or complicated signalling systems. In one move you have removed two of the major infrastructure and maintenance costs of conventional railways.

Maintaining rail track properly is hugely expensive, as we have seen in recent years. The dynamic forces of heavy trains running on the track cause deformation and cracking of the rail itself. Additional stress is put on the rail and its fastenings wherever a bend is encountered because the dynamic forces being exerted through the wheels are trying to push the curve into a straight line. The rail has to be supported on a complicated system of beams (sleepers) with fastenings and then supported on a base, which is stable but has a degree of movement (ballast). All these items have high maintenance credentials and working on them causes massive disruption because the train cannot go around the problem other than by a complicated system of pointwork and signalling allowing it to run on an adjacent line (if one exists). BladeRunner doesn't have that problem; the vehicle can simply leave the track, drive around the obstacle and regain the track.

Cost

Assuming that there are 3000 kilometres of motorway in this country, it would cost £500,000 to

£1 million per kilometre to convert one lane of the motorway to the system. So technically the whole network could be converted for £3,000,000,000 or alternatively this £3 billion could be spent converting 3,000 km of the under-utilised branch line network into productive dual-mode guideway. There would also be the cost of the vehicles, but to put the potential cost savings in true perspective - the Government has recently announced spending of £26 billion on upgrading just one small section of the rail network! Once installed the maintenance costs would be minimal. The embedded track could be guaranteed for at least 25 years and the inner feeder lanes would benefit from the reduction in heavy axle loads year on year.

Feasibility

Don Bur has already built a trailer using the bogie technology. The trailer, built with dispensation from the DfT, is 16m long overall the equivalent length of a drawbar trailer outfit. It can carry 30 pallets, four more than a normal 13.6m trailer yet it can still turn within the 5.3m radius inner and 12.5m outer turning circles and achieves that without any tyre scrub. The demonstration film shows a conventional

The rail wheels are used only for location and a proportion of load carrying, they are not powered.

13.6m artic and the 16m one equipped with the SCM bogie tackling the same slalom course. The smaller truck just about manages to complete the course at 30kph but at that speed there is considerable movement of the trailer. The vehicle has to take a wide arc and there is considerable cut in by the trailer wheels and outswing of the rear of the trailer. The vehicle can be seen to be close to overturning. The SCM bogie fitted trailer whizzes through the slalom at 40kph with little movement. It does not need to take a big arc, there is no cut in of the rear bogie and because the bogie is right at the back of the vehicle there is no outswing either.

As mentioned earlier Silvertip have built a one eighth scale working model of the BladeRunner and at their Skeeby, Richmond, North Yorkshire premises they have a demonstration track. Seeing this vehicle in action is quite breathtaking. It literally does everything its designer says it will. It appears a feasible intermodal machine, which could have huge implications for the future - vastly reduced Government expenditure on construction and maintenance of new and existing roads and railways; dramatic reductions in the level of emissions; dramatic reductions in the amount of energy used; dramatic reductions in vehicle running costs and, once it was built, drastic reductions in the cost of delays through congestion.

It could also be developed to provide a sensible alternative to long car journeys. Cars, particularly small ones like Smart cars, could simply drive to the interchange and drive onto the intermodal BladeRunner and be whisked to the other end of the country. Though this would take away the flexibility to stop wherever you want that endears the car to users.

The next stage is for a full size vehicle to be built and that is just about to happen. At the same time, thought is also being given to setting up a trial area where the concept can be tested and demonstrated.

Already vehicle manufacturers, bus and rail operators like FirstGroup and Government agencies from many countries are taking a keen interest in the project.

BladeRunner could have the potential to answer many of the major problems facing the developed World in achieving effective movement of people and freight without adding to pollution, covering the countryside in ever bigger roads, reducing fuel usage and reducing congestion. I hope this is one invention, which will be backed by our Government and not allowed to go overseas for development like so many splendid British inventions have.

Who knows ten years from now the vehicle winning the 60th UK Coach Rally could be a BladeRunner. It would walk the driving test because it steers in reverse the same as it does forwards and its sensory features would stop you demolishing the garages!

By Rob Orchard