Engineering path to integrated transport

Much political lip service has been paid to 'integrated transport'.

By that, in practice, is meant more convenient transfer of freight or passengers between road and rail. Any efforts at its implementation have, however, been thought only in terms of organisation and planning. But a physically seamless engineering solution has emerged in the form of a dual-mode vehicle that self-transfers between road and rail at the flick of a switch.

The project's leader is Carl Henderson who runs the Silvertip design consultancy. His design initiatives have found their niche in heavy commercial vehicles. In 1999, when searching for a way to eliminate tyre scrub damage and improve the stability of long semi-trailers, he invented a self-steering trailer bogie. Further progression of that articulated vehicle has led to the novel idea of the dual-mode vehicle.

Many test sessions have been completed and demonstrations publicised locally. The model has been exhibited at London's Science Museum. So far there has been perplexing reticence in industry and government circles to take the Bladerunner – as the dual-mode vehicle has been called – to full size glory.

Yet the dual-mode mover of either freight or people, says Carl Henderson, should be recognised as a fine example of how engineering can come to the rescue of floundering economics. Rail transport, is fine where there is a well invested infrastructure but is restrictive. New infrastructure is particularly expensive. Many rail systems do not meet real transportation needs resulting in the unpleasant economic realism of public subsidy. Heavy rail is struggling to justify its capital worth and maintenance cost proportional to the use being made of it. Light-rail too is inflexible and requires significant capital investment for new signalling, infrastructure and vehicles.

The dual-mode Bladerunner diminishes both these capital and restrictive use burdens. It promises a

low entry cost to significantly increase volume traffic on the existing rail infrastructure, removes the railway's inflexibility from being point-to-point transport only and at the same time offers the perfect opportunity to tether vehicles at intervals to draw mains power and recharge batteries. Furthermore Bladerunner preserves rail's inherent assets of: low rolling resistance and by dual-mode exclusive pathway.

Beyond that, though, the Bladerunner is totally technically revolutionary. For example Bladerunner can, by deploying load transfer between steel and rubber tyred wheels (both sets in rail contact), stop more quickly, ride over railway junctions and simplify, if not eliminate, signalling.

When the rail-wheeled axle, on trailing-arm suspension, is hydraulically lowered the load it carries relative to the air sprung road-wheeled axles is variable: a large proportion for straightforward rail travel to take advantage of the energy-saving low rolling resistance, but less proportion when a bias to traction grip is needed for acceleration, braking or gradient performance.

Road freight vehicles with retractable railway axles have been designed before but with penalties of heaviness and performance limitations because of attempts to drive the rail wheels. The Silvertip

dual mode does not do this.

The driving and braking power comes from the road-mode tyres still contacting the rails. Only light rubber-tyre contact is needed for normal motion because the rolling resistance on rail is a fifth of that on road – much less power needed, so there is less consumption of fuel. By being able to change from rail to road transit, the dual-mode vehicle can go off rail and steer past another vehicle or obstruction on a tramway.

Indeed dual-mode is a means of letting a 'tram' drive over to bus stops, affording other dual-mode vehicles (which could be freight carriers) a clear tramway. When there is flush hard standing, a dual-mode vehicle can change route at junctions without relying on a railway points system.

Further than that, the dual-mode vehicle can deviate from a railway and carry on by road to deliver or collect just like an ordinary bus or truck. No time need be wasted in transferring goods or people from one mode of transport to another. It could be the most versatile interpretation of 'intermodal' yet devised.

Technology has marched on since the previous attempts at commercial vehicles with rail as well as road wheels, entailing cumbersome and slow transfer from one mode to another. Modern electronic developments now make it possible to achieve in-motion automatic alignment with a railway track, using optical guidance, supplemented in a final precise phase by inductive sensors. A camera monitor in the cab affords the back-up of manual override.

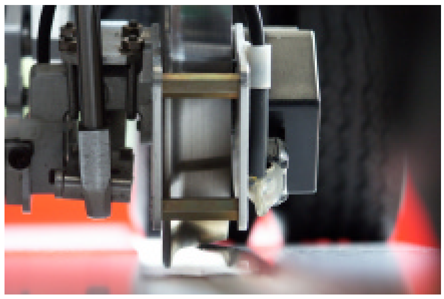
Such technology and the accompanying steering bogie developed from previous Silvertip work all means extra cost. The overall outcome is nevertheless a price less than half that of a tram, confidently predicts Carl Henderson.

Conservative costing by Carl Henderson indicates that the yearly depreciation charge would typically be £3,300 more than that of a normal articulated truck but that the savings on running costs would be £7,600. On rail a 45 per cent saving in fuel could be expected. Railway maintenance costs would be slashed, he asserts, because the ingenious engineering provides a small degree of steering of the rail wheels when going around bends, obviating the alternating stick and slip that causes rail wear. Bends with a radius as tight as eight metres can be tolerated. Dual mode does mean a loss of payload. Addition of each retractable rail axle adds about half a tonne. Another 1.5 tonnes would be added in the steer-linked turntables that are part of the whole vehicle.

However, payload volume is now often the limiting operational factor more than payload weight. In overall form the Bladerunner's starting point is an ordinary 40-tonne articulated truck. Indeed, most of the components are perfectly standard, in quantity production – and this gives the vehicle a basic cost advantage.

It also conforms to the dimensional and weight confines set by established road-vehicle regulations. Where the Bladerunner deviates from vehicle format convention – apart from the dual-mode aspect – is that the cab is remounted on the front of the semi-trailer. That eliminates the gap between tractor and trailer – able, for freight, to give more interior load length and provide room for an extra row of pallets. When the semi-trailer is coupled it plugs into the back of the cab, which is on a platform integrated with the fifth-wheel turntable. Normal articulation remains for road travel, but can be rigidised by turntable lock when there is rail guidance or when the tractor is uncoupled.

Economic appeal is enhanced operationally as a consequence of positioning the trailer bogie near the rear end. That significantly enhances the ride quality and affords a dropwell length of seven metres in the space between the tractor and the trailer's bogie. Either even more freight volume or, for passenger carrying, a low floor giving easy access, then ensue. Thanks to the self-steering trailer bogie (already proven in an experimental



articulated vehicle built by Don-Bur Ltd., Stoke-on-Trent) the whole vehicle's manoeuvrability complies with the 12.5 and 5.3m turning radius corridor stipulated by European directive.

With the dual-mode Bladerunner the exclusive routeing, speed and fuel economy of rail is combined with the convenience and organisational economy of road – efficient door-to-door transport with minimum handling and a choice of power source. This potential should, one would think, excite political support for taking the concept to operational test phase. ¦