UPRIGHT CITIZENS

Having spent a career in the construction products industry, Nick Elliott was seen as the ideal choice to lead the updating of IRTE's best practice guide on vehicle roll-over. He speaks to Will Dalrymple

Now semi-retired, Elliott was formerly Hanson's distribution manager. He says the process of updating the best practice guide led him to reflect on his own memories of driving. He recalls: "Thirty or forty years ago, motorcars weren't capable of going as fast around corners as they are today. Even a 2005-year Ford Focus has 130hp, with low-profile tyres and lots of grip. Lorries are very similar. There is better suspension, better steering, low-profile tyres, disc brakes. Some drivers think that lorries are the same as cars. They are, but there's a bigger bang when they eventually go over the point of no return."

In many ways, commercial vehicles are well-equipped to resist tipping: they are heavy, and have axles that spread wide to make a stable base. Most vehicles above 18t gvw are 2.4m wide. Also, in the past decade a number of electronic stability control and automatic braking systems have been implemented to help prevent roll-overs (see also *www.is.gd/onewup* and *www.is.gd/vocagi*). So it perhaps makes sense that the first version of this guide, produced a decade ago, focused on engineering solutions to the problem.

But this one turns instead to driver education and training. It was a preference that was agreed within the five-person workgroup set up by IRTE chair John Eastman, who was aiming to address the needs of the construction products world with the guide, and so approached Elliott, who had served as chair of construction trade organisation the Mineral Products Association. Elliott also had experience of IRTE best practice guides, having worked with Ian Chisholm on the IRTE's tipper stability guide 20 years ago. "Having the link between the two associations was the key thing," Elliott states. Other working group members were: Carl Milton, Cemex northern regional logistics manager, Matt Avery, Aggregate Industries logistics performance manager and Lee Downer, TJ Transport fleet manager.

Driver education had a particular resonance for Elliott. He explains: "From 2013-2016 I worked for Hope Construction Materials as national transport manager. We had 12 mixer trucks turn over in the space of two and a half years. I can't imagine how we didn't have a fatality. We reviewed it and looked into it, and the outcome was, in all instances, that the driver had done something incorrectly. We have to support them, of course, and sometimes other road users didn't help by swerving in front. But drivers are professionals, and they should be prepared for that, and other events."

WHY IT HAPPENS

The ability of the vehicle to resist toppling is called the roll-over threshold. It depends on factors such as the position of the load, the speed of the vehicle, the tightness of the bend, and road furniture such as kerbs. As for the latter, Elliott observes: "If the driver overcooks it coming into a corner, and the truck is leaning over and starts to slide, and hits a solid object like kerb, that might push it over."

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During cornering, centrifugal forces will tend to pull the vehicle's centre of gravity outwards. And when the vehicle's centre of gravity shifts outside of the track of the vehicle (as seen from behind), it will tip.

Tall vehicles are particularly at risk, and in the UK, some double-deck trailers stand nearly 5m tall. Other vehicles, such as car transporters, concrete mixers and powder tankers, carry significant loads at height. Vehicles with a very high centre of gravity are more unstable than squatter ones because it takes less force to shift their centre of gravity to the tipping point (see diagrams below).

Articulated vehicles are also more likely to tip, because the fifth wheel is not able to resist turning motions the way a rigid chassis would, and also because of inconsistencies in braking between tractor and trailer axles. If the drive axle locks up, but trailer axles and the tractor steer axle does not, it will jack-knife; conversely, if the trailer axles lock up and the tractors' don't, the trailer will swing.

Elliott observes: "The document aims to help operators understand that they need to educate and encourage drivers to be mindful of all of these laws of physics that play a part in keeping vehicles upright."

That doesn't just include tips about driving, but also about loading. For example, imagine a car transporter doing a multi-drop operation. From a logistical point of view, it makes sense to offload the bottom cars first, and then the top. Otherwise, the bottom ones have to be moved twice. But emptying the bottom row while leaving cars just on the top makes the load much less stable.

Asked whether centre of gravity measurements should be used more frequently in transport, Eastman, who himself worked in the car transporter industry, observes: "The problem has always been there." He says that the risk is of drivers becoming a little complacent and wanting to save time. "A lot of it is down to education of drivers, and making sure that they in turn carry out their responsibilities and checks, and ensuring that the load is not only secure, but also in the right position."

Elliott describes how at Hope he helped develop an operational code for drivers of concrete mixers, based on the thickness, or 'slump' of the concrete (defined as the fall in height of the material, poured on a horizontal surface from an inverted conical container, in one minute). He says: "When in a mixer truck, 200 slump concrete won't ride up the side of a barrel. The blades inside slice through it like a knife through cake. When you get to the 25 stuff, which you use under garage bases and behind the back of kerbing, it will go up the inside of the drum, and when lumps fall off [at the top], the truck rocks back and forth. If you get it at the wrong time at a bend, the truck can tip over." As a result, Hope warned drivers about the effects of the load, and in fact recommended against operating the mixer when carrying concrete from 25-50 slump. (Instead, drivers should mix for a few minutes when they arrive on site).

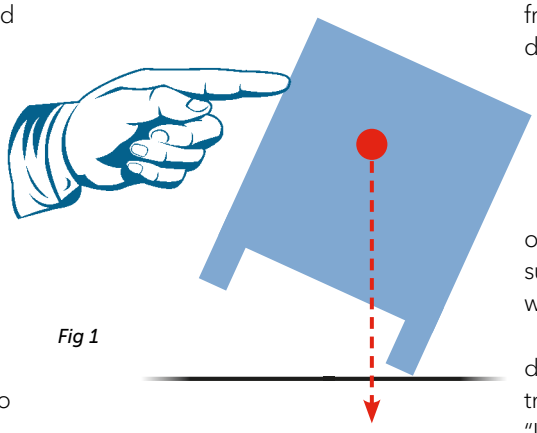

Fig 1

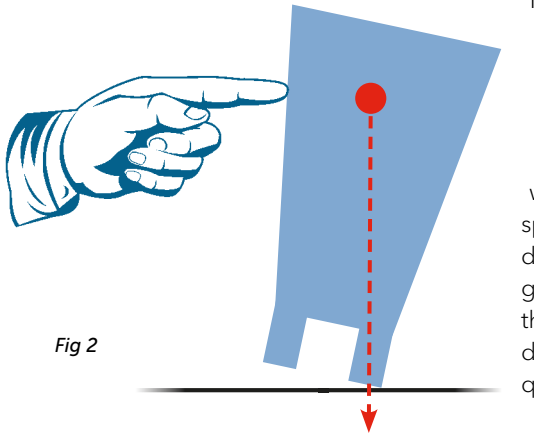

Fig 2

Similar destabilising forces might be experienced by vehicles negotiating S-bends while carrying particularly vulnerable loads, such as milk tankers without ballast, or box vans carrying animal carcasses that are hanging from high rails, he says.

Asked whether the industry should develop centre-of-gravity calculation tools, Elliott suggests that it might be useful for trailer suppliers to supply that data in three scenarios: empty, half-full and fully-loaded. Drivers would then have some warning about the risks.

But such proposals are out of scope for the best practice guide, argues Eastman. "That's got to be education from the operator's point of view, depending obviously on the type of operation that they are doing, so that they understand the dynamics of the vehicle going down the road." Drivers are responsible for how they approach a roundabout or sharp bend, or deal with ordinary traffic conditions or sudden movements. All of those factors will affect vehicle stability.

Finally, Elliott urges operators to draw on another helpful resource: the trailer and vehicle suppliers. He advises: "It costs the same to buy a truck that will do the job perfectly as it does to buy a truck that won't. It's about specifying the wheelbase and the axle positions so that it works. You've got sales engineers in the OEMs that will actively help you to get the right specification. What we're saying in this document is, don't just assume that you go buy a standard 4x2 off the shelf and that's it. You can actually impact the design of the vehicle by asking the right questions in the first place." TE