Wheels of

Recent claims might cause some operators to be concerned about certain 'improvements' on wheels for trailers and trucks. John Challen checks out the story so far and also highlights useful security products

Above: Checklock wheel nut retainer Below: Disc-Lock's three-piece Safety Wheel Nut assembly

The June 2012 issue of Transport Engineer raised results of research suggesting that some commercial vehicle wheels running on spider and star shaped hubs are suffering untested load stresses, leading to cracking and severe damage. Readers will recall that the initial investigation was carried out on an LBF machine by commercial vehicle wheel specialist Dr Sundararajan, of Wheels India.

Concerns were raised due to the implication that, if true, such modern hubs could prove costly for operators. The research indicates that some truck wheels could see their life expectancy roughly halved and, even more importantly, become dangerous – although this journal has seen no evidence of problems to date.

In response to these revelations, the Department for Transport says it intends to run independent tests, once it has seen the research data, to check the claims – and could yet put procedures in place, if they are proven correct. At present, all quality wheels are tried and tested to European Tyre and Rim Technical Organisation (ETRTO) standards on a circumferential hub with a continuous contact diameter – universally acknowledged as the main criterion by the Association of European Wheel Manufacturers (EUWA).

"The Minister listened astutely to our findings and stated that the DfT will undertake published, independent research and instruct VOSA to ascertain the scale of the issue," asserts John Ellis, managing director of Motor Wheel Service, which went public with the research report. "No timescale has yet been set, but we will continue to liaise with government and assist wherever possible," he adds.

While this investigation is ongoing, operators may wish to contact hub and wheel manufacturers, as products originally replaced or refunded under warranty may no longer be considered appropriate by some, if the product is shown to have operated on a non-circumferential hub. Due to the differing characteristics of the various hub shapes, interchangeability can also be affected, as mounting those wheels on hubs with yet another shape can, it is argued, further reduce the attachment area – leading potentially to increased surface pressure and an undefined attachment of wheel to hub.

Whatever the outcome of the independent investigation, Ellis remains convinced: "The research is undeniable. Wheels designed and manufactured to ETRTO standards are being placed on axles that are non-standard or non-circumferential," he insists. "This is leading to the early fatigue of wheels, primarily displayed as cracks, approximately halfway through the lifetime expectancy."

Problem-solving products

Away from cracking hubs, there are other problems in the world of wheel security – a good deal related

to them falling off – but thankfully there are also a whole host of solutions. One of them is the Safety Wheel Nut, from Disc-Lock, described by the company as a "heavy duty, free spinning, vibration-proof nut". Specifically designed as a solution to lost wheels from trucks, trailers and buses, it is now available in a range of nut sizes from 18mm to 22mm.

Unlike a standard two-piece wheel nut, the Disc-Lock Safety Wheel Nut is split into three sections, comprising a nut, a hexagon-flanged washer and a flat faced cup washer. These sections are joined together to form a one-piece assembly with an O-ring. The top two sections have interlocking cams which, when subjected to vibration, attempt to rise against each other. As the angle of the cam is greater than the pitch angle of the thread on the stud, a wedging action takes place, causing the nut to maintain the clamping force and to lock.

Another potential wheel loss prevention part is Parma's Prolock security measure. In the UK, the initial interest in its clamp came from bus companies, with the likes of Arriva Bus and London United investing. Following that exposure, a number of truck operators, such as HE Payne and Hoyer, have also specified the clamps – designed for wheel nuts in the 24 to 33mm diameter range – and Parma is expecting more to follow suit in the coming months.

Fitting over the top of two adjacent wheel nuts, these clamps aim to prevent detachment, even in the event of a loss of clamping force and, according to one unnamed operator, have proved a shrewd investment. Following trials against a similar product, an albeit unverified report for the mystery customer concluded that "in some combinations, deflection of the tabs did provide better retention force. The retention force of the standard Prolock is at least three times higher than provided by [similar products]".

One for the future

Business Lines is a further company that focuses on wheel security solutions and is looking to grow its range of products, which include the Checkpoint wheel nut indicator and Checklock SQ wheel nut retainer. Like Prolock, the latter links two adjacent wheel nuts. However, this stainless steel wheel nut retention device doesn't require any fitting tools, so reducing fitment, removal and maintenance times for workshop staff.

To complement these products, Business Lines is preparing to add a further solution to its portfolio: the Checkthread toolkit. This is designed to help operators check the integrity and quality of wheel studs, stud holes and stud entrance surfaces for damage that may have been caused by loose wheel nuts. Due for release in the coming months, the company believes that the new toolkit – currently undergoing pre-production testing – will give transport companies extra peace of mind over the safety of their wheels. TE

fortune?

Parma's Prolock fits over adjacent wheel nuts for extra security

IRTE guidance

The FTA/IRTE, ATS and SITA UK best practice guide on wheel security, launched in late 2009 (Transport Engineer, November 2009, page 13), is as relevant today as it was then. And with an introduction that reads: "When wheels become detached from a moving vehicle, they can accelerate up to around 150km/h, going out of control like a bouncing bomb, reaching a height of 50m before colliding with other vehicles or road users – at an equivalent force of 10 tonnes", fleet managers are left in no doubt as to the importance of getting this right.

The guide is clear that such events are rare, but also refers to TRL's report, back in 2006 for the DfT, which suggests that there are 7,500-11,000 wheel-fixing defects every year in the UK, resulting in 150-400 detachments, 50-134 leading to damage-only accidents, 10-27 injury accidents and between three and seven fatalities. TRL also identified potential concerns with conventional wheel fixings over joint relaxation, torque-to-clamp ratio and component temperatures – any of which might compromise the clamping force (compression of the wheel, hub and drum together) and hence security of the wheel fastening.

Overall, however, TRL observed that problems would not arise, so long as "all components are in good condition and properly tightened". But when there is a problem with any of the above, the mechanism of failure is well known. As the IRTE guide explains, when the clamping force becomes less than the other forces on the wheel, the wheel moves relative to the hub. That results in side loadings and loosening of the remaining nuts, leading to elongated stud holes, fatigue failure of the studs, fretting fatigue cracks – and ultimately catastrophic failure and wheel separation.

TRL's report shows that failed or worn studs are responsible for most incidences of defective wheel security (45% and 23% respectively). Likely causes include: settlement; insufficient tightening; over-tightening, leading to stretched or broken studs; and incorrect lubrication of threads and interfaces, leading to friction losses on the wheel nuts. And note, the IRTE guide warns that, although any nut movement should be easy to identify, settlement is more difficult to see.

What's more, 19% of wheel-fixing problems reported by VOSA still involved trucks fitted with nut movement indicators and similar devices. The IRTE wheel security guide is currently being updated to consider aluminium wheels in more detail.