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Safety Alert Trunnion Repairs

Purpose

This Advisory informs you that Waka Kotahi NZ Transport Agency (Waka Kotahi) has released an Industry Alert. The Industry Alert is aimed at heavy vehicle service providers and heavy vehicle operators regarding trunnion pin type suspension system. Tragically the failure of such an assembly led to a person being fatally injured.

Key points

- understand the risks of reconditioning this type of trunnion pin suspension system
- only use Original Equipment (OE) trunnion pins and trunnion housings purchased from a reputable supplier for this type of suspension system
- ensure that these suspension units are repaired according to the manufacturer's instructions by suitably qualified people.

The Industry Alert follows and can also be read [here](#).

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Industry Alert

Risks associated with trunnion pin type suspension systems

This industry alert provides information about the risks associated with repair or refurbishment of trunnion pin type rear suspension systems common to many heavy vehicles.

Key points

Service providers and vehicle operators should:

- Understand the risks of reconditioning this type of trunnion pin suspension system
- Only use Original Equipment (OE) trunnion pins and trunnion housings purchased from a reputable supplier for this type of suspension system
- Ensure that these suspension units are repaired according to the manufacturer's instructions by suitably qualified people.

An incident where the trunnion pin was ejected from a heavy vehicle suspension causing fatal injuries was investigated by the Police Commercial Vehicle Safety Team (CVST). The Police investigation and report in 2019 found that the incident was mainly caused by the trunnion pin breaking. In addition, the overhaul techniques and replacement parts used during a recent refurbishment of the truck's rear suspension assembly were of concern.

The Police investigation found that the incident was mainly caused by the trunnion pin breaking. The broken portion of the trunnion pin separated from the suspension assembly and was ejected from the wheels into the path of another vehicle. The investigation also found that the overhaul techniques and replacement parts used during a recent refurbishment of the truck's rear suspension assembly were cause for concern and should be investigated further with support from manufacturers and repairers.

This industry alert is aimed at heavy vehicle service providers and heavy vehicle operators to ensure all repairers of heavy vehicles are aware of this issue. It addresses the trunnion pin type suspension where the pins and housings are separate from the cross shaft (figures 1 and 2).

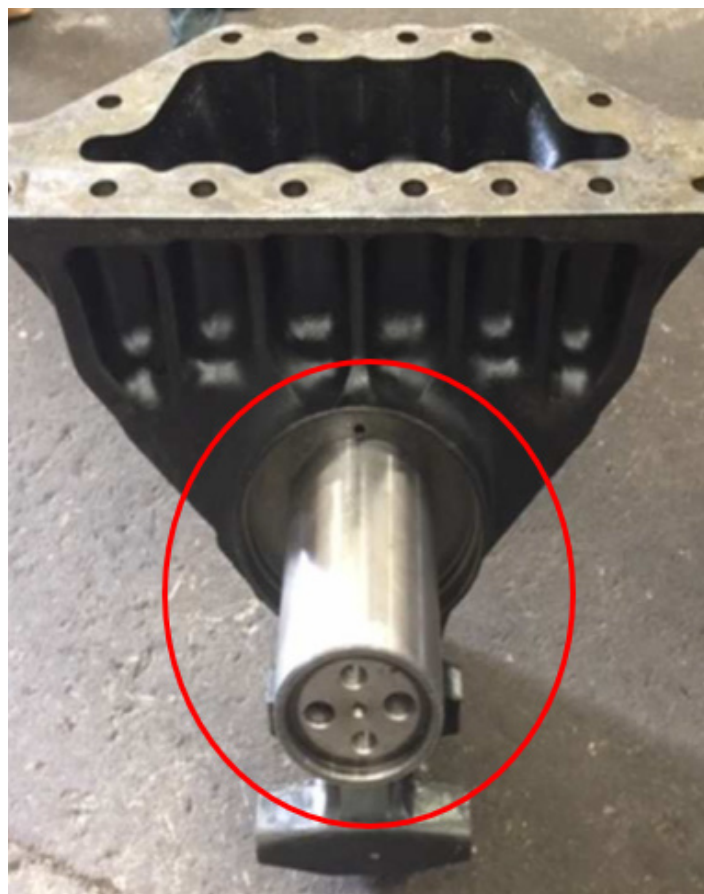


Figure 1: Trunnion housing and pin assembly (source NZ Police)

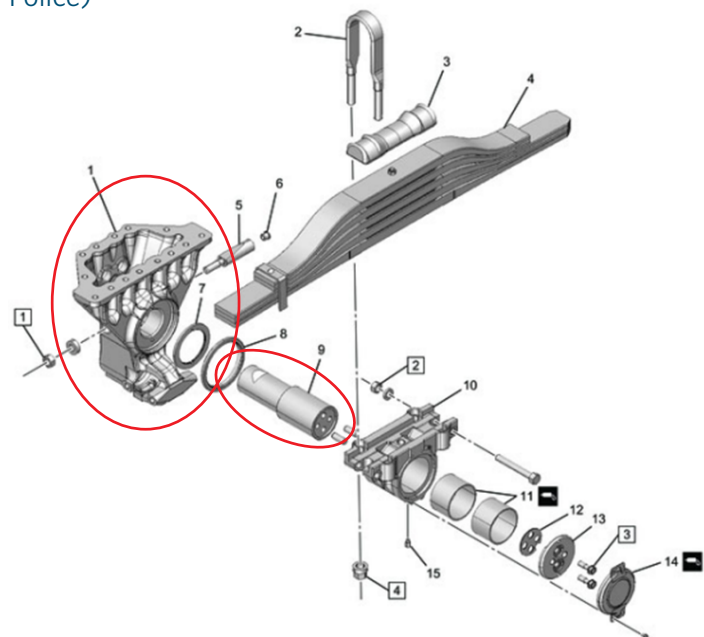


Figure 2: Exploded view of trunnion pin type suspension (source Isuzu NZ)

About trunnion pin type suspension systems

Trunnion pin type suspension systems provide vertical flexibility while supporting the weight of the vehicle. As the wheels rise and fall during operation the suspension springs absorb the energy, the suspension oscillates around the trunnion pin and the tyres should maintain contact with the road. The word trunnion simply refers to a pin or pivot on which an object may be rotated. A vehicle with this suspension system maintains equal load distribution on each axle under all loading conditions. Frontward and rearward forces are transmitted via upper and lower torque rods to the chassis through a cross member and sub frame.



Figure 3: A typical tandem axle trunnion type rear suspension system (source NZ Police)

The trunnion pin type suspension design is common to many makes of vehicle, however there are some variations in the way the trunnion pin or pins are supported which can have a direct influence on the wear rate and subsequent repair or replacement methods. The major difference between trunnion pin suspension systems is the way the trunnion pin is either mounted as separate items (figures 1 and 2) or cast as a one-piece unit (figure 4).



Figure 4: One piece trunnion pin type

Repair and replacement practices

Vehicle manufacturers using this type of suspension DO NOT support any repair, machining or refurbishment of the trunnion pin or the trunnion housing (indicated in figure 2).

OE service parts purchased from a reputable supplier are recommended for both the pin and the housing assembly as these manufacturers don't carry rebuilt or reconditioned items and have no repair method for them.

Pins

Aftermarket trunnion pins are available but metallurgic analysis of some of them found inherent flaws in both the steel strength and subsequent machining. One difference observed between an OE pin and a sub-standard aftermarket pin can be seen in figure 5. The shape of the notch has a profound effect on the load path transferred through the pin to the trunnion housing.

The OE pin (figure 5) is designed to have a tolerance fit in the housing. The steel grade and notch can sustain large lateral load transfer that would provide a long service life.

Sub-standard aftermarket pins (figure 6) were found to have a lower steel grade and a notch design that promotes cracking at its base. The resulting fatigue and stress would lessen the expected service life, leading to premature failure. The use of these pins must be avoided.

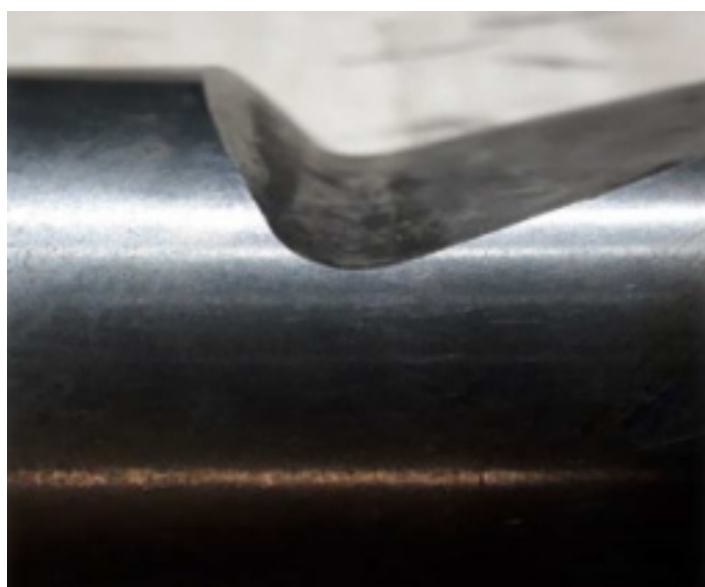


Figure 5: Genuine pin (source NZ Police)



Figure 6: Substandard pin (source NZ Police)

Housings

Trunnion housings provide the critical load path for the suspension as it pivots on the trunnion pins, the housing is a non-serviceable part that should not be reconditioned. Manufacturers' specifications dictate the acceptable tolerances for pin bore wear in both directions of load and inside/outside acceptable wear. There is no specification for ovality so any wear in the housing beyond the tolerances is not acceptable and the housing must be replaced. Only OE parts should be used when repairing or overhauling these suspension systems, the housings are designed with specific load structures and tolerances, these must be maintained to ensure the suspension unit has a long service life.

As with trunnion pins, investigations have shown trunnion housings are being refurbished using a variety of materials and procedures in an attempt to bring them back to manufacturers' specifications. While this may be an industry standard it is not best practice or sound engineering for these suspension systems, the methods are not approved by the manufacturers, and they do not offer a repair procedure. Using aftermarket parts or repair processes outside of the manufacturers' recommendations may weaken the housing and increase the wear rate of the components leading to fatigue, stress and premature failure.

Suspensions units

Investigations into the repair and refurbishment of rear suspension units focussed on a process that involves a worn core suspension unit being stripped and refurbished using aftermarket trunnion pins and reconditioned trunnion housings that have been fitted with an oversize proprietary bush and then machined to replicate the manufacturer's specifications.

While these procedures are relatively normal in the repair industry and can be used successfully on other components, this process is not supported by manufacturers. The risk of failure is vastly increased if an aftermarket pin and re-bushed housing are used together, especially if further re-bushing of the trunnion pin was also part of the repair.

Some procedures observed in investigations do not demonstrate sound engineering approaches for this type of suspension system. For example, one method included machining a worn trunnion pin undersize and then fitting a sleeve over the machined portion, but no mention is made of the material used for the sleeve or the surface hardness. In another method the trunnion housing bore was machined oversize, then fitted with a sleeve and line bored reducing the internal bore back to original specifications. These methods are not recommended.

Manufacturers do not support any refurbishment of the unit and specify if wear is measured with either the trunnion pin or the trunnion housing, either or both items must be replaced with OE parts. Manufacturers do not offer aftermarket parts for these suspension systems through their dealer network and service providers are reminded of their obligations under the [Land Transport Rule: Vehicle Repair 1998](#).