LOW VOLUME VEHICLE TECHNICAL ASSOCIATION Inc

Modified Kia Carnival LWB Safety Inspection Request

Purpose of this LVVTA Information Sheet:

The purpose of this LVVTA Information Sheet is to provide information to Authorised Vehicle Inspectors (AVIs) about two potential modification-related mechanical problems that have been identified within a number of imported modified long wheelbase Kia Carnival vehicles. The problems relate directly to rear suspension modifications made by an overseas post-manufacture modification company as part of a 'self-drive' system, to enable improved entry and exit for disabled persons.

To ensure that each vehicle is safe for their users while they await local re-engineering to resolve the potential problems, LVVTA has recommended to ACC that each vehicle undergoes a safety inspection by an AVI, with particular attention paid to the problem areas outlined within this LVVTA Information Sheet, which details the specific inspection process necessary to mitigate any safety-risk associated with these issues.

Please note that this is nothing to do with a Warrant of Fitness inspection. This LVVTA Information Sheet specifies the background and inspection details for an independent inspection of the areas described under *'Inspection requirements'* on page 4, which any AVI may carry out, and for which the AVI will be paid as specified under *'Payment arrangements & technical support'* on page 5.

It should also be emphasised that these problems are in no way a reflection of the New Zealand modification industry, nor a reflection of Kia vehicles or Kia New Zealand; - all of the issues are associated with non-OE modifications carried out by an overseas modification company.

The intention is to arrange for a thorough on-hoist visual inspection service which will ensure that the vehicles are safe to be operated until permanent repairs can be carried out, a period of up to six months.

Vehicle background:

The vehicles have been modified by a European company which specialises in the modification and adaption work on motor vehicles to enable disabled persons to safely and independently enter, exit, and drive vehicles. The vehicles in question are a group of 2.9 diesel Kia Carnivals, manufactured from 2008 onwards,

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to which the modification company has, amongst many other modifications, lowered the floors and provided a system by which to enable the vehicles to 'kneel' in order to assist entry and exit of disabled persons, by reducing the ramp angularity for their wheelchair access to and from the vehicle.

The left rear corner of the vehicle is lowered to aid wheelchair access by an electro-mechanically-actuated lever arm *(see photo at right)* which compresses the left rear coil spring. Approximately 50 of these vehicles have been imported into New Zealand by the ACC for their clients, who are highly-dependent on these vehicles for their continued mobility and independence.

Please note that, so far as LVVTA is aware, the problems are only present with the long wheelbase vehicles, and therefore the scope of this LVVTA Information Sheet is limited to only long wheelbase Kia Carnival vehicles. The affected vehicles are also limited to the 2.9 diesel versions, which were not sold new in NZ.

Potential mechanical problems:

Since the potential mechanical problems have been identified in recent weeks, a thorough analysis of the condition and cause of the problems has been carried out, and LVVTA has been involved with ACC and a number of industry experts to design an engineering solution for the potential problems. While this process has taken place, ACC followed expert advice in ordering the vehicles off the road to ensure the safety of their clients. The two problems are as follows:

<u>Fractured rear lower trailing arms:</u>

Fracturing of the rear lower trailing arms have been discovered on four vehicles, which LVVTA believes is caused by incorrect suspension geometry and poor workmanship involved in the trailing arm modification process. The problems with the rear lower trailing arm is a result of the lower positioning of the forward pick-up points of the lower trailing arms, and shorter arm length, carried out in order to make room for the lowered floor.

As a result of the shortened and repositioned trailing arms, the suspension travel arc no longer pivots about the axle centerline, causing a geometry disturbance which has manifested itself in a number of ways as the suspension goes through its range of travel; including decreasing the wheelbase much further than it should (particularly as the suspension goes into compression), incorrect suspension upright angle (or king-pin inclination), and a misalignment between the top and bottom spring seats.

Elongation of the pivots in the original Kia cradle that the control arms attach to have been noticed on some vehicles, and although initially thought to have been caused by the ram pressure (1 ½ tons) exerted by the lever arm applied at the control arm pivot, LVVTA now believes that the pivots were deliberately slotted as part of the assembly process, found to be necessary at the European modification factory because of the misalignment caused by the incorrect trailing arm geometry.

Fractured lever arm:

Fracturing has also been found around the pivot boss area of the electro-mechanically-actuated lever arm used to lower the rear left corner of the vehicle (to assist disabled occupant entry and exit by reducing the wheelchair ramp angle) on four vehicles.

The overseas modification process incorporates a lever arm system that compresses the left-side rear spring.

LVVTA believes that the fracturing of the lever arm is caused by the 3:1 mechanical disadvantage in the system which applies unnecessarily high loads and overloads the lever arm and other components within the Kia's suspension system.

It should be noted that any damage to or failure of this arm will not affect the vehicle's on-road safety, as the lever arm is only in use when the vehicle is stationary.

Local re-engineering process:

The engineering solution for both problems has been developed by a number of technical experts all working together with ACC and LVVTA, and the affected areas will be locally re-engineered during the forthcoming months on all of the potentially affected vehicles.

New one-piece trailing arms have been designed which will move the original Kia Carnival suspension geometry much closer to its correct OE specifications, and the entire 'kneeling' system will be discarded, and replaced by a locally-designed chain and sprocket system that does not apply any increased mechanical disadvantage or loading to any part of the vehicle's suspension system.

The re-engineering work is being carried out by Braiden International Ltd in Carterton, using Braiden International's chain and sprocket-based 'kneeling' system, and with the prototype suspension trailing arm development work carried out by Terry's Chassis Shop in Auckland.

Interim inspection process:

During the assessment and re-design processes, ACC and LVVTA have gained the necessary level of comfort in the present condition of the vehicles to be confident that, subject to an interim inspection and approval of the potentially-affected areas by an AVI, the safety risk associated with operating the vehicles in the short-term is very low in relation to the profound impact of reduced mobility and independence currently felt by the affected users in not being able to use their vehicles.

Once an AVI has inspected and approved each vehicle in accordance with this LVVTA Information Sheet, ACC will allow the vehicles to re-enter operation.

Inspection requirements:

An AVI is requested to carry out a thorough on-hoist (or over pit) visual inspection of any potentially-affected vehicle presented to him or her. The specific areas of inspection required are:

Rear lower trailing arm:

Each rear lower trailing arm (or radius rod) must be thoroughly inspected for cracking or fracturing throughout its length.

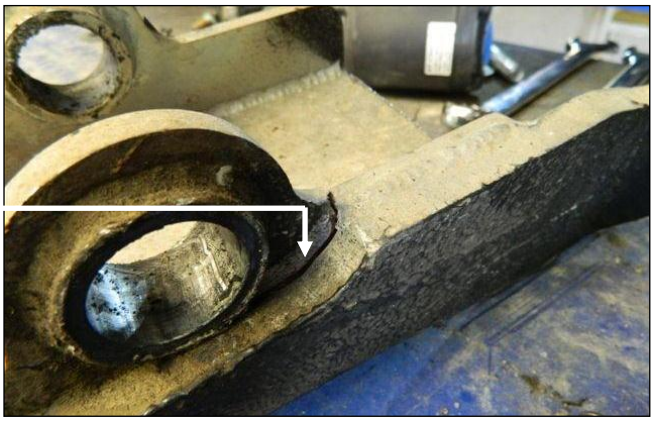
Particular attention should be paid to the welded areas where the flange sections have been joined.

See the orange-sprayed areas in the photograph at right for the typical areas where fracturing or cracking may occur.

Rear lever arm:

The rear electro-mechanically-actuated lever arm that applies the leverage force to compress the coil spring must be thoroughly inspected for cracking or fracturing. Particular attention should be paid around the lever arm pivot points. From examples viewed, the cracking has occurred where insufficient or poor weld quality is present.

See the area pointed out by the arrow in the photograph at right for the typical areas where fracturing or cracking of the rear lever arm may occur.



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If problems are identified during AVI's inspection:

Rear lower trailing arm:

If cracking is found on the lower trailing arms (or radius rod) where the flange sections have been joined, this may be ground out and re-welded by a specialist welder. The trailing arms are made from normal mild steel so no special or unusual welding processes need to be employed, however suitable welding equipment and methods (MIG or TIG) should be applied.

This is provided however that the cracking does not extend up into the web (vertical face) of the arm – if any cracking or fracturing is found on the trailing arm web, please do not proceed with localised repairs. Refer instead to the technical support point of contact provided below.

Rear lowering lever arm:

If any cracking is found on the electro-mechanically-actuated lever arm, this may be ground out and re-welded by a specialist welder. The lever arm is made from normal mild steel so no special or unusual welding processes need to be employed, however suitable welding equipment and methods (MIG or TIG) should be applied, and particular consideration should be given to the output capabilities of the welding equipment being used, given the thickness of the material being welded.

Payment arrangements & technical support:

Payment arrangement:

Any AVI who is able to perform the required inspection should contact Rochelle Williams at Braiden International Ltd on 0800 436 853 to discuss requirements and arrangements for payment.

As a guide, it is expected that an AVI will perform a thorough on-hoist (or over pit) visual inspection of the specific components referred to in this Information Sheet, which might involve, at the most, the amount of time and costs expected for a normal Warrant of Fitness inspection process. There is no need for any disassembly or component removal to facilitate this inspection.

Technical Support:

Any AVI who is performing the required inspection and is in need of technical support should contact Ian Clarke at Braiden International Ltd on 0800 436 853.

Finally:

If any assistance in the use of this Information Sheet is needed beyond that which can be obtained via the contacts provided above, please contact an LVVTA Technical Team Member at the LVVTA office.

Tony Johnson
Chief Executive Officer
Low Volume Vehicle Technical Association