

Reduced Spine Compression During Off-Road & Track Performance Driving

The CG-Lock® (CG=Centre of Gravity) device was invented for the track – for performance drivers wanting the benefits of a racing harness but none of the hassle... now, new evidence suggests that this device can also lead to significantly less spinal compression.

Vehicle accidents are amongst the highest causes of serious injury and mortality for the Military when in challenging environments such as Iraq and Afghanistan. The injuries are most often from spinal compression and/or head & neck trauma. The Armed Forces often drive large military vehicles at high speeds on rough terrain in training and combat. A very different setting, but track day performance drivers are also exposed to high G-forces on the body when driving undulating circuits. A large number of vehicle accidents result from being out of control due to (i) the lack of immediate feedback from the vehicle-to-driver and (ii) ergonomic difficulties steering and braking at speed.

'Lofting' - A recognised problem: Driving over rough terrain (4x4s) and performance driving on undulating circuits (performance cars) **'lofts'** the driver (lifts the driver off the seat significantly reducing 'effective' body weight) resulting in loss of leverage to control the vehicle and loss of feedback *from* the vehicle. In essence, control of the vehicle is inhibited by driver 'lofting'. At those moments the driver is 'weightless' and 'unattached' to the vehicle. Not being physically 'connected' to the vehicle at all times, significantly reduces the necessary sensing of vehicle dynamics, especially traction of the tyres, leading to delayed, under- or over-compensated steering and braking, resulting in a high accident rate and significant morbidity. The same principle is true with performance driving, on undulating sections of the race circuit, where control of the vehicle is compromised during the 'weightless' moments.

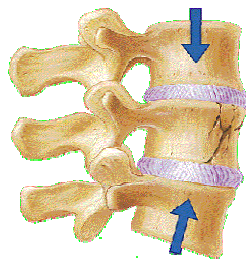
Once the vehicle has 'landed' the suspension takes the load of the vehicle and the driver/passenger 'falls' back hard into the seat with much increased G-forces.

A simulation of the forces acting on the human spine while driving in an off-road vehicle or performance car was devised using a servo hydraulic actuator to rapidly displace a 45.5kg weight vertically. The force was applied through a stiff spring damper system to simulate vehicle suspension and seat springing.

A standard automotive-3-point type seatbelt was used to restrain the weight in the control (baseline) test series. The tests were repeated identically with a commercially available "occupant stability" device (the CG-Lock®) attached to the seatbelt.

Results suggest that off-road (and undulating circuit 'track day') driving in a standard seatbelt can lead to (i) peak spinal loads in the order of 2.5 times body weight during upward accelerations and (ii) significant weight reduction (half body weight) as the seat descends. These forces indicate significantly reduced control of the vehicle over rough terrain and on track. **Use of the CG-Lock device reduced peak spinal loads to 1.75 times body weight (>30% reduction) and maintained 90% of body weight during the descent phase. Real life spinal forces are calculated to be more than double those tested in this study.**

These results suggest that drivers and passengers using the CG-Lock device have reduced spinal cord compression (and resulting injuries) when in off-road (e.g. Military 4x4) or performance (e.g. Police, track day) vehicles. The results also support previous data that the CG-Lock improves driver control, during high performance driving.



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Post 'lofting' - Spinal Compression: When a vertebra breaks and then collapses, it is called a vertebral compression fracture (see centre figure above). Compression fractures happen most commonly in the thoracic spine (the middle portion) from causes such as osteoporosis or impact after falling in the sitting position (particularly evident in off-road driving). In the worst cases the resulting compression of the spine can put pressure on the spinal cord and nerves, either from the compression itself or from the protrusion of bone into the nerves of the spinal cord. Fracturing becomes more likely when the spine bends forward at the same time that downward pressure impacts the spine. For example, falling to the floor in a sitting position simultaneously bends the spine and thrusts the head forward. This posture, combined with the traumatic impact on the buttocks, concentrates pressure on the front part of the spine, and this pressure can cause a fracture. Vehicle occupant "lofting" results when regular seatbelts are used - the vehicle descends after rising rapidly over rough terrain (or over the brow of a hill on performance driving). The actual "lofting" occurs when the vehicle (and its seat) settles faster than the occupant, leaving the occupant momentarily suspended above the seat (making the driver's perceived weight much lighter than normal).

Download words, photos & illustrations from cg-lock.co.uk.

Lap Belt Cinch (Europe) Ltd (see cg-lock.co.uk) market and sell the CG-Lock®, a unique product specifically designed to improve the stability, control and comfort of drivers and passengers in any vehicle. The CG-Lock fits in minutes to any standard seatbelt and is fully removable in seconds.

The CG-Lock is patented, and has been independently crash tested and has demonstrated that when fitted, does NOT interfere with the safety of the factory fitted 3-point seatbelt with or without a pre-tensioning device (full details at cg-lock.co.uk).

Although the CG-Lock has 80% of the benefits of a full racing harness, but none of the hassle, the CG-Lock is not intended to replace a racing harness and is not a safety device. The CG-Lock is sold at Back in Action (see backinaction.co.uk) for in-car posture benefits.

CG-Lock is proud sponsor of: **BLOW-ME**, the alcohol breath testing service for events worldwide (blow-me.co.uk) to promote responsible, safe driving. **BackCare**, the charity for healthier backs (backpain.org) and the **British Motorsport Marshals Club**, without whom track days could not take place (marshals.co.uk)

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