



SOLUTIONS DRIVEN:

Investigating and Resolving Steering System Service Failures for Commercial Vehicles

Public safety concerns associated with steering system failures concerning the detachment of the steering box from the chassis prompted a UK based commercial vehicle firm to approach **CSA Group Leyland** for assistance in resolving the issue. The vehicles had been in production for approximately 24 months, and the increasing number of service failures related to two distinct modes of failure: Cracking / fracture of the chassis attachment points (upper bracket and ferrule welds); and the fracture of the mounting bolts without any other chassis cracking. The latter was of particular concern to the customer, as they had no idea why it occurred and there were no warning indications / pre-cracking that could be spotted at service inspections.

CSA Group proposed a data collection exercise to investigate the problem-causing service inputs. The company is a cost sensitive small volume producer, so a small number of recorded data channels were chosen to allow rapid investigation of the problem and provide true input loads for any future design work / rig tests. A full bridge strain gauge was fitted on all 3 steering track rods, positioned and wired to measure only axial load, since the gauge configuration cancelled out bending loads and torsion sensitivity.

Quarter bridge strain gauges were fitted across the known crack locations on the upper bracket for fatigue damage calculation, life estimation and design analysis / test rig correlation against the driven vehicle. Prior to fitment of the three track rods, a test rig was used to perform an axial load calibration. Incremental tensile and compressive loads were applied whilst measuring the associated mV/V strain output from the gauge system to make each track rod function as a load cell. A series of driven steering tests – including standard and abuse driving in unladen and laden conditions - were undertaken to record possible inputs & associated loads / strains. The data was processed and reviewed, revealing that almost all general maneuvering events caused significant fatigue damage in the upper bracket. The vehicle firm was informed and **CSA Group** devised further series of tests to allow production of a proven revised design and reliable, cost effective service repair.

