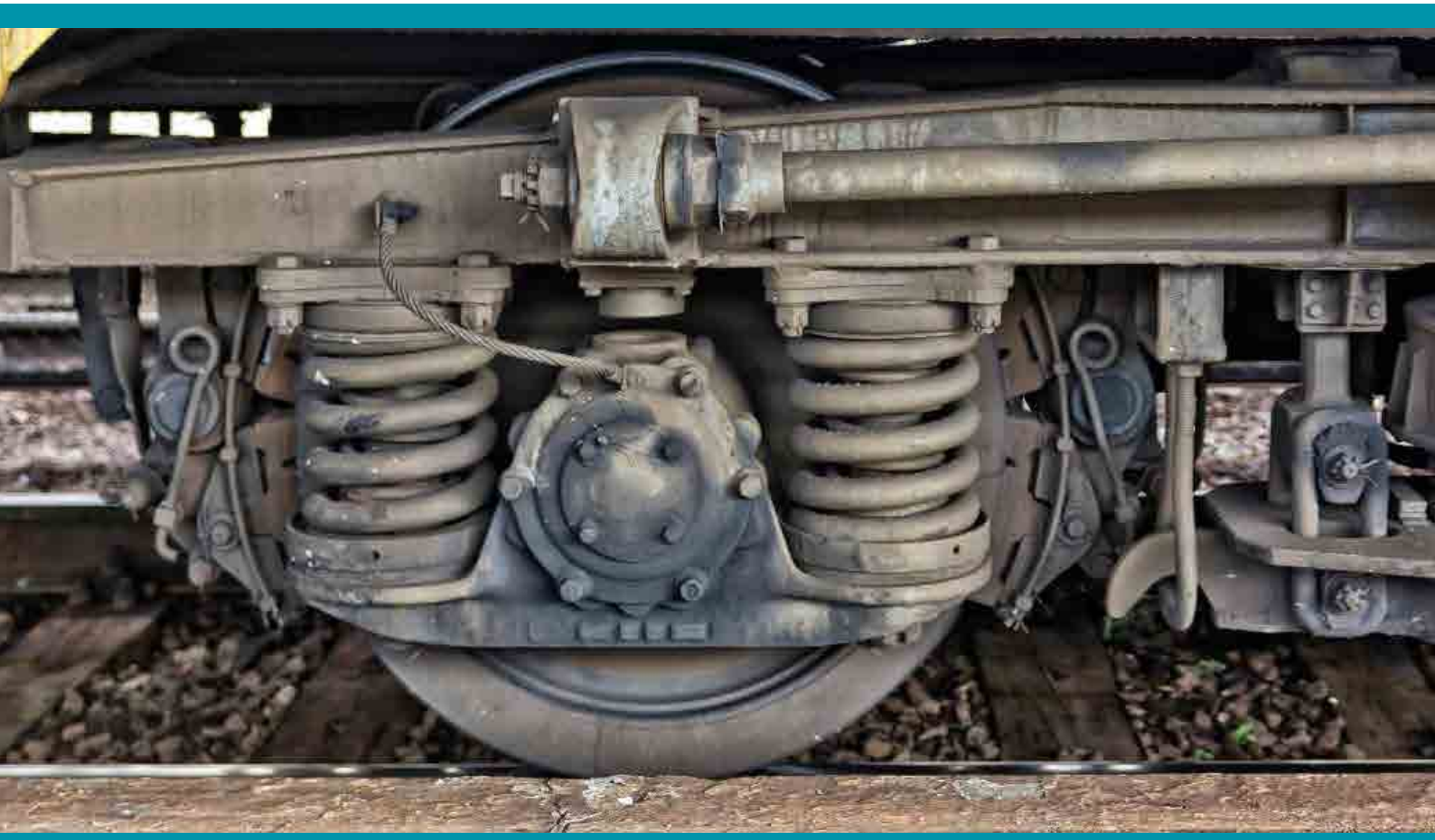
European Metrology Research Programme

Delivering Impact



Testing for safer suspension systems

Spring-loaded mechanisms used to dampen unwanted movement are used in civil engineering and transportation. For example, devices are often used in rail carriages to provide smooth travel at high speeds. To confirm spring-loaded mechanisms are fit for purpose and meet European safety standards, they must be tested with high loads that simulate in-service conditions. Improved testing methods are needed to provide the reliable measurements that underpin public safety.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Many civil engineering and transportation projects require devices that can dampen vibrations and absorb shocks. Spring mechanisms can be used for this purpose and are commonly found in applications ranging from high-rise buildings to car suspension systems. Railway carriages, for example, have spring damper systems placed between the axle and the undercarriage. These allow the entire train to travel smoothly at high speeds and also ensures passenger safety by maintaining contact between the carriage's wheels and track.

Mechanisms used to limit unwanted movements, whether preventing buildings swaying during earthquakes or carriages moving at speed along tracks, play a vital role in ensuring public safety and must be tested for their ability to withstand the considerable forces experienced in service. A problem with testing springs is the distortion caused to their shape as they are squashed. This can significantly change the way test loads are applied leading to inaccurate results. Any mis-alignment of the test machine is amplified by spring distortion during testing. This creates a major source of measurement error. Reliably assessing spring performance requires improved methods for monitoring test machine alignment.

Large machines capable of providing testing at the extremely high loads anticipated in use cannot be moved to calibration labs for performance confirmation, so devices are required to transfer links to the SI units to them. Greater accuracy in the calibration of these devices and ways to assess any machine mis-alignments are needed to ensure high load testing provides reliable results to underpin safety assessments.

Solution

The EMRP project *Force traceability in the meganewton range* developed a novel high-load measurement device based on six transducers, instruments that convert force to an electrical output, arranged to record all the forces that operate during spring testing. To establish robust links to SI units, this hexapod's performance was validated by comparison to another well-characterised high-load measurement transfer device. By using the hexapod it is now possible to check the alignment of machines used for high load testing and to measure forces acting in other directions to that applied by the machine during spring testing.

Impact

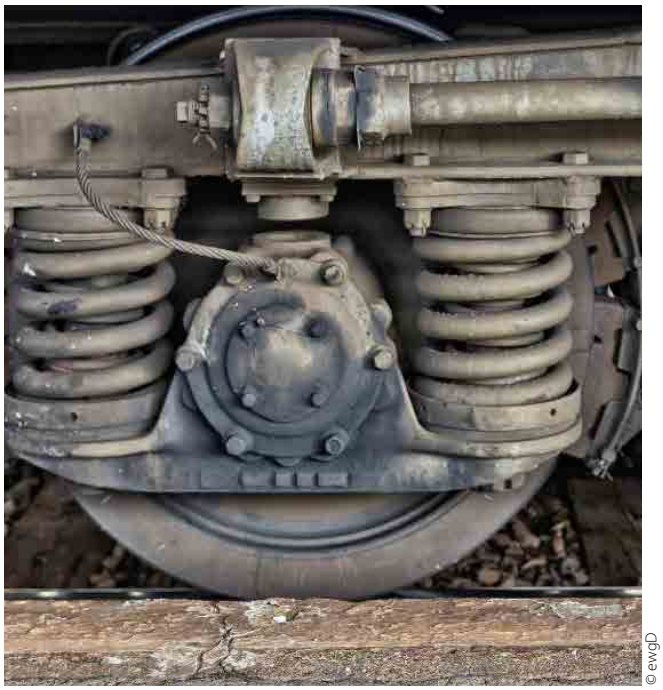
EasyDur Italiana, manufactures high load test machines for assessing the performance of springs used in the automotive and rail transport sectors. They are already preparing the hexapod for commercialisation to give their customers a reliable method for confirming test machine alignment and calibrations on an ongoing basis. For the first time it is now possible to reliably assess the effect of the side loading experienced by springs in service. As a result there is now a method for manufacturers of springs used in rail carriages and the train operators that provide a public service to rigorously demonstrate that their springs conform to European safety standards for suspension systems.

Many areas of civil engineering and transportation rely on spring loaded mechanisms to dampen movements. These will now be able to demonstrate that device and material performance meet the safety standards required by EU Directives so helping to sustain Europe's impressive safety record.

Improving accuracy for high load measurements for industry

Large-scale structures, from high-rise buildings to wind turbines, must often withstand considerable loads, with EU directives on structural integrity and construction material testing designed to ensure safety under all conditions. Large material testing machines use "build-up systems" for calibration at the highest loads. Extension to the operating range and performance investigation for transducers used in these transfer standards is needed to ensure accuracy at the meganewton loads used.

The EMRP project *Force traceability in the meganewton range* investigated various build-up systems – including a novel hexapod design – and their component transducers, enabling the introduction of calibration improvements and extending the loading range to 50 meganewtons. For industries subject to EU Directives on construction materials, users of high load material testing machines can now benefit from greater measurement accuracy when required to demonstrate compliance for safety.



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