

Module Masher Takes the Guesswork Out of Truck Scale Design

How well will your new truck scale be working 20 years from now? That is one of the toughest questions to answer when a new product is being designed. At METTLER TOLEDO, a unique module masher is helping to supply reliable answers for the engineers who design truck scales.

The module masher is an accelerated-life-cycle test stand for truck scale modules. It can simulate 20 years of weighing within a few months, providing valuable test data quickly. First used in 1992, the module masher was designed and built by the engineering and manufacturing staffs at the Industrial Heavy Capacity manufacturing facility in Columbus, Ohio.

The base of the module masher is constructed of steel I-beams, with two overhead beams bolted to it. The overhead beams support four hydraulically operated feet, which can apply forces up to 120,000 pounds. Attached to the bottom of each foot are two rubber pads spaced 8 inches apart. The pads allow each foot to apply a load as it would be applied by two tires mounted side by side on an axle.



The module masher is used to test the life cycle of a truck scale module.



Each foot is equipped with two rubber pads spaced like a pair of tires.

For a typical test, the feet are positioned to simulate the load applied by a dual tandem axle. That common arrangement consists of two axles spaced 4 feet apart, forming a rectangle measuring 8 feet by 4 feet. METTLER TOLEDO truck scales are designed with specific dual-tandem-axle ratings. If a truck scale is rated at 80,000 pounds, for example, it must be able to weigh a dual tandem axle that applies a load of 80,000 pounds.

Tests are performed on an individual truck scale module, which is positioned on the base of the module masher. To reproduce the conditions of an actual installation, the module is supported only at the four points where it would normally rest on load cells. The module masher's feet are then set to apply a force equal to the scale's dual-tandem-axle rating. The standard test procedure consists of two stages, stress testing and life-cycle testing.

Stress Testing

Stage one measures the amount of stress that a load places on the module. The engineers attach strain gages to the module at key locations on the deck plate, end plates, and ribs. Then with the load applied to the module, they take a reading from each strain gage. Loads can be applied in different locations to find out how the module reacts. Because the load does not need to be applied repeatedly, stress testing can be completed within two days.

Life-Cycle Testing

Stage two simulates the amount of traffic that would pass over a scale during its expected service life. This requires applying a load repeatedly to the same location on the module. The feet press down on the module and then are raised until there is no load on the module. This simulates the action of a loaded truck driving onto the scale to be weighed and then driving off the scale. The module masher can complete one load/unload cycle in 3 seconds. The length of time that the load is on the module does not matter because the stress is the same whether the load is applied for several seconds or several minutes. With the module masher running constantly, a test of 1.5 million cycles can be completed in 52 days. That means that the module can be subjected to the equivalent of 20 years of truck traffic in about 2 months.



The module masher simulates how a load is applied by a truck's dual tandem axle.

After the standard tests are done, the engineers can perform destructive testing. That involves increasing the force applied by the feet and continuing the life-cycle test to find out when the module will fail. Another option is to move the feet so that they apply the load at a specific location on the module. For example, the feet can be positioned at the end of a module to test the strength of its end plate.

Test Results

The test results help the engineers evaluate the design of the scale and determine the potential for failure caused by metal fatigue. The strain gage readings indicate how much stress is being placed on the module at various locations. If there is more than the allowable stress at any location, then that part of the module will need to be strengthened. On the other hand, if the stress level is significantly lower than the allowable stress, it might be possible to redesign the scale to reduce costs.



By repositioning the module masher's feet, we can test the strength of a module's end plate.

In extreme cases, the module could develop a crack during life-cycle testing. That would be a clear indication of a weak spot that needs to be strengthened. If the module meets all allowable stress requirements and shows no damage after life-cycle testing, there should be no need to change the scale design.

Because of the intense competition in the truck scale market, it is important to offer a range of products to meet the needs of customers in different market segments. By taking the guesswork out of weighbridge design, the module masher has helped METTLER TOLEDO develop a selection of distinct truck scale offerings that strike a balance between cost and durability.