

An Investigation into the Causes of Wheel Detachment Accidents in Heavy Trucks

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Accidents involving wheel falling off in heavy-duty trucks continue to occur with alarming frequency. This study examines the causes of wheel bolt loosening based on the characteristics of the torque method (calibrated wrench method), and examines and proposes measures to prevent loosening. This study examines the causes of wheel bolt loosening based on the characteristics of the torque method (calibrated wrench method), and examines and proposes measures to prevent loosening.

The Ministry of Land, Infrastructure, Transport and Tourism and related organizations have issued guidelines emphasizing the importance of proper torque management and periodic retightening. Although the number of accidents appears to have decreased in fiscal year 2024, it remains at a high level.

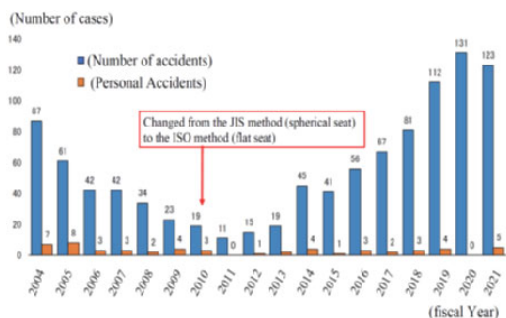


Fig. 1 Accidents of wheel falling off of heavy-duty trucks

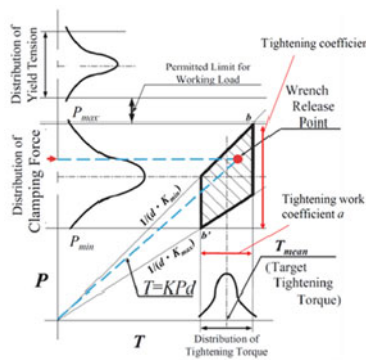


Fig. 2 Calibrated wrench method

The variation in axial force resulting from the torque method of tightening multiple bolts is influenced by the torque coefficient and the variation in tightening torque, as shown in the fundamental equation for the torque method.

$$T = KPd$$

Here, T : tightening torque, K : torque coefficient, P : bolt axial force, d : nominal thread diameter

This indicates that in bolting applications involving large number of bolts, some bolts achieve only few axial force. Low axial force increases the risk of bolt loosening and failure.

Using an axial force indicator bolt, as shown in Figure 3, appears to be an effective method for monitoring bolt loosening trends and estimating loosening life in actual equipment without the need for expensive measuring instruments.

Figure 4 shows the results of observations of bolts equipped with axial force indicators plotted on a logarithmic coordinates graph. A linear trend can be obtained that visualizes the loosening process. Loosening equation can be derived as shown in the figure. This analytical method appears to be effective for determining the causes of wheel detachment accidents. Based on the results, we examined fundamental countermeasures.



Fig. 3 Axial force indicator bolt

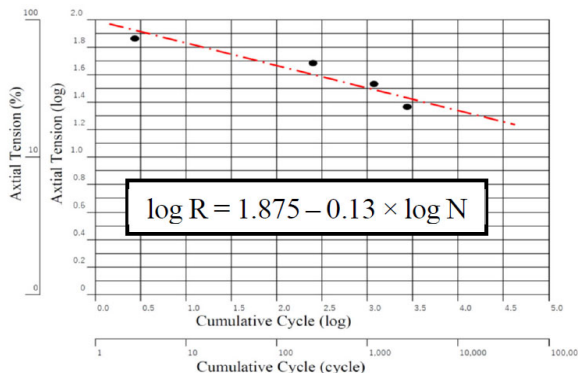


Fig. 4 Model of loosening test results