

Basic Study on Vibration and Impact During Vehicle Operation and Transportation(Part 1)

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This paper addresses vibration and shock phenomena in both vehicle operation and logistics systems. Vehicles operate under diverse environmental conditions, making the analysis of vibration and impact essential for understanding damage mechanisms and ensuring reliability. These issues extend beyond transportation to broader fields such as aerospace, energy, electronics, and life sciences. Previous studies by the author examined damage to agricultural products during transport, linking cargo vibration to control methods and biological responses.

In this study, the discussion is newly developed from the theoretical perspective of shock. While vibration testing standards are well established, shock-related studies remain insufficient, particularly in logistics packaging. The necessity of load impact testing is emphasized for unit load systems, which dominate transport packaging. Experimental observations indicate that both load magnitude and drop height are critical factors influencing damage.

Frequent shock events in logistics environments highlight the need for appropriate safety factors based on load impact conditions. However, challenges remain in testing methods, equipment, and practical implementation. Although the automotive field has advanced knowledge in vibration and shock, its application to logistics and supply chains is still limited. Further research is expected to contribute broadly to industrial development.

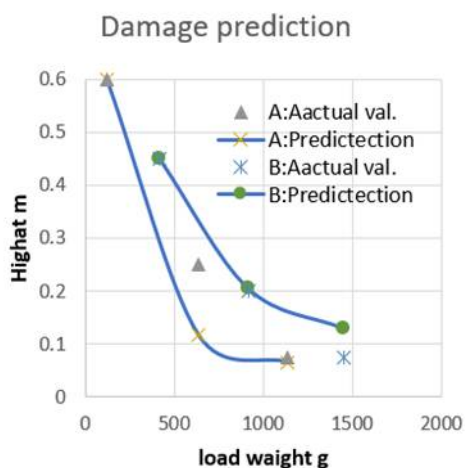


Fig1. Comparison of Predicted and Measured Heights as a Function of Product Weight

Table4.Comparison of Strength Degradation under Drop Impact for Different Packaging

Packaging Type	Applied Load (kN)	Drop Height (cm)	Strength Reduction (%)
Compressive Strength (kN)	Ratio		
Box A	0.7kN	1	5
Callot(10kg)	5.0-5.5kN		
Box A	0.7kN	3	40
	1/7		
Box A	0.kN	5	50
	1/7		
Box B Petbottle (6 x 2L)	0.6kN	1	5
	1/3		
Box B	0.3kN	Several cm	Decrease Ovserve