Dossier: Transport simulation

A transport simulation is a uniform and repeatable test method to evaluate packaging. It simulates the effects that a packaging can encounter throughout the entire distribution chain. This involves not only the simulation of the transport itself (road transport, air transport, overseas, ...), but also the manipulations before and after transport as well as the storage conditions are taken into account.

By using standard methods and standard equipment, a repeatable test program can be designed. Any packaging system can then be subject to this test program, as well loose packaging (f.i. boxes, drums, IBC's) as palletised loads can be tested. Herewith not only the packaging system itself, but also the manner of transport, the weight of the package and the packed product itself must be taken into account while setting up a test protocol.

A simulation test not only contributes to reducing damage, but can also be used to assess any 'over-packaging'. The ultimate goal is to obtain an optimal and efficient packaging system that protects the goods throughout the transport stream.

During a transport simulation test the packaging will be subjected to possible dangers and this by using standardized equipment in the test lab. The possible hazards during distribution can be divided into four categories:

- Atmospheric influences
- Shock
- Vibration
- Compression

Atmospheric influences may have an impact on the integrity of a packaging: moisture, temperature and condensation can weaken a packaging. It can also cause damage to the product itself.

By subjecting the shipping system to a climatic treatment prior to the simulation testing, any problematic situation that can have an effect on the performance of the package can be detected. The effects of lower pressure during air transport can also be checked, this by altitude simulation in a vacuum chamber.

Figure 1: A palletized load is submitted in climate room to specific climatic conditions such as 40 °C and 90% RH
**Shock testing** includes drop and impact tests. Vertical drop tests on shipping units simulate the effect of a free fall during distribution. For the test the drop height depends on the weight of the unit. Shock tests on palletised load can be conducted in several ways: flat and edge drop testing and even corner drops are possible. These drop tests simulates the hazards that can occur during loading and unloading the goods.

![Figure 2: bagged goods ready for a vertical drop test.](image)

Horizontal impact tests on this type of load gives us an idea of the stability of the load during, for example, a sudden stop (braking) of the truck.

![Figure 3: horizontal impact test effectuated on the swing](image)

**Vibration testing** consists as well of loose load vibration tests as of random vibration tests. The random vibration test is an accelerated simulation test of the vibrations that occur during transport by truck, boat, plane... Each type of transport has its own typical vibration profile which can be programmed in the laboratory equipment to simulate this. This kind of vibration testing also gives us an idea of the strength of a stacked load because it can be seen as a dynamic load compression. This dynamic test also reveals the fatigue of the shipping unit itself, for example stacked cardboard boxes. The loose load vibration simulates repeated shocks as the load comes always off the platform.

![Figure 4: High frequency vibration table](image)
As already mentioned above, a random vibration test can be seen as a dynamic compression test. A regular compression test, on the other hand, is a static load compression test and by using certain formulas, stacking during transport or stacking in the warehouse can be simulated. These formulations use safety factors, which are necessary to take certain influences during distribution into account. The resistance of the packaged goods to stacking and the strength of the shipping unit or pallet load will be tested with a compression test.

Figure 5: Compression of a box

According to the most common standards for each distribution chain a series of tests are defined.
ASTM and ISTA are, in framework of transport simulation, the most used standards, but other standards (f.i. ISO) can be followed to define the right test protocol. IBE-BVI can help you with choosing the most appropriate standard and the right test set-up for your packaging system.

Figure 6: IBE-BVI can test all kind of packaging systems

Don’t hesitate to contact us for more information or for the elaboration of an appropriate test protocol for your packaging. Performing such testing can reveal a number of weaknesses on your packaging system so that you can optimize it in order to deliver your packaged product in optimal conditions to your customer.

On May 9th, 2017 IBE-BVI organizes the seminar "Shocks, drops, vibrations: it happens to all your packed products during transport" in which transport simulations will be studied extended. This seminar is organised in Dutch. If you are interested in following this seminar in English, please let us know (Marleen Calcoen). Program and info: click here

Contact: An Van Geite

Info and test request: visit our website