

Food Packaging Technology
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Transport worthiness Test P2

Hello everybody. Welcome back. We are going to continue with the transport worthiness tests of the third module of the Food Packaging Technology course. In our last class, we talked about the different hazards that a transit package undergoes during a transition or shipment from one point to another. We looked at that in detail because I also mentioned that those are the hazards that we should withstand with our packages. So, when you say a transit package, the choice of the package whether it's a wooden crate or fiberboard box, whatever it is, that is decided by number one characteristic of the product, what kind of product it is.

We have discussed this. It also depends on the kind of handling and the transportation hazards that it might encounter during its transit. We talked about four main hazards of transport, the drops and the impacts, the compression forces, number three the vibration under stacking loads and the climatic variations. So, when you talk about a transport worthiness test, these are the tests like I told you which will simulate and see if the package is going to withstand all the hazards that it is going to face real time.

Okay, now let us divide into two types. One is mechanical and one is climatic. Under mechanical, you will have drop test, vibration test, compression test, incline impact, rolling test and drum test. These are the tests that we will be discussing in this module and the climatic ones are the rain test, the sand and dust test, salt spray and the fungus resistance. Let us start with the drop test.

So the drop test like the word suggests, you are going to drop the container and see how much it will withstand the impact. Okay, so it is a measure of the ability of the container to provide protection to its content and it also measures the ability of the container to withstand rough handling during the transit that it might be dropped. Person, the labourer who loads it and unloads it can drop it from his hand. What height it is dropped, from which angle it is dropped, all this will impact the condition of the product that it is storing. Now what is apparatus that you use in the laboratory? It is usually called a divided table top drop test apparatus.

There is another one which is called a hoist type. So, you have a divided table top and you have a hoist test. So, this in the table top drop test what they do is, the package is held in the desired position at a particular height from the ground and the trap door is opened. As soon as the trap door is opened, package falls to the ground. The height of the drop, the position of the fall and the type of flow will decide the damage that is going to happen to the package.

So what you will do is, you will just separate out the table, automatically the package drops, you will find out what are the impacts that happened on the drop. A second type of tester is the hoist type. In this what they have is, they have a release mechanism, the package will be suspended on a sling and you can adjust the height from which it is going to be dropped, you can adjust the type of flow on which it is going to be dropped and you will just drop it after hoisting. So, this can be divided into two procedures. You can measure the ability of the container to provide protection of the contents.

So in that case you will see the corner wise drop, edge wise drop and flat wise drop. You will also measure the ability of the container to withstand rough handling. Okay. That is mostly the corner wise drops because you can just throw it, you can just leave it from your hand. These are the corner wise impacts that you will check for.

So in conclusion the drop test will measure the adequacy of the packaging and it ascertains the ability to withstand hazards from the time it is packed till it is opened. And once you do this, you can reduce the cost of the package, you can also improve the design of the package and the interior cushioning if required. Okay. So, this is just a representative diagram, a picture of a drop test. You can see the hoist; you can adjust the height and the flow on which it is dropped.

We will now move on and see a video which demonstrates the drop test in our laboratory. This is the drop tester where we check the ability of the packaging containers or the corrugated fiber boats to withstand hazards of transportation when it is accidentally dropped. It is usually done from a height of 3 feet. The height can be adjusted accordingly in the machine so that it can be dropped from a desired height. The sequence of the drop is important.

These positions can again be adjusted in the machine itself. We can go for a corner wise drop or a flat drop and it is adjusted in the machine accordingly. Coming to the second transport worthiness test, the vibration test. Now where would you have a vibration when a package is transported? It can be on the rail, road, anywhere. So why is the vibration test done? It is done to one measure the ability of the container to find out the protection offered by the materials that are used as an interior packaging or as a cushioning material and also the strength of the closure.

You know that we use tapes to close it. So, during vibration we would like to see if the tape is removed, if the closure opens, anything that happens to it. So, all these are the impacts of a vibration and these vibration shocks will be measured in the laboratory. Another point where the package can experience vibration is on the conveyor belts. In the industry itself or in the factory itself, on the conveyor belts these impacts can happen.

So what happens or what are the effects of vibration? Number one, structural failure like we mentioned in the packaging material due to vibration. Number two, there might be a reduction in the rigidity of the container. Number three, there might be exterior and interior damage to abrasion. Abrasion is when two packages, it scratches against each

other. And fourth one is damage to the contents which is the most dangerous.

So in this you have an apparatus which is a vibrating table. This has a bed which has got two eccentrics at one end. It's connected in phase with one another. You keep your package on top of the vibrating bed which has a platform and you give a harmonic type of vibration when the equipment is running. So, the amplitude or the height at which it goes up and down, the amplitude of the vibration is fixed to one inch and the frequency, the rate at which it is vibrating, that is varied from 120 cycles per minute to 360 cycles per minute.

So this test will help you to study the possible package failure like we said or the content damage and also help you to determine any weakness. Is there any loosening of the pouch? Is there loss of resilience in the cushioning material, etc. Anything that can happen through transit because of vibration can be determined in the laboratory before it actually happens. And here's a picture of a vibration testing machine where it's kept on the platform and the required vibrations given, frequency and the amplitude can be varied. Let's have a look at the video of the vibration tester that is being done in our laboratory.

This is a vibration tester to test transport worthiness of packages, especially shipping containers which experience vibration during transportation. Here we take the corrugated boxes containing small consumer packs with our product, say pickles and oils and thus we can check if it will withstand such vibrations. We can adjust the vibration cycle and time. We usually give 120 cycles per minute for one hour. At the end of one hour, we take out the consumer packs inside the shipping containers and check if there are any leaks.

Vibrations are usually high in air transportation and truck transportation by road. If there are no damages to the package, it means it has passed the test. And now coming to the third test which is another very important transport worthiness test, it is a compression test. Now this test is carried out on empty containers and it measures the ability of the container to resist external compression load. So, when you have an external compressive load, that is when you stack packages one on top of the other.

This stacking can either be a static condition or it can be a dynamic stress. Now the static condition is not moving, you know, it's a more not moving condition. That is when you superimpose weight of one over the other. You stack during storage or in the factories or in the trucks. When you stack packages one over the other, they experience a static compression.

When do they experience a dynamic condition? That is when they have an impact stress. Suppose you have a sudden break during the journey. So, one package can compress the other and that is called an impact stress and that also results in a compression. Like I said, while static compression is experienced in stacking, dynamic compression is usually because of impact shock in handling and transit. Now another thing we have to understand is, it is usually the bottom layer that is subjected to compression and so it has

to bear, you want to know in this test if the package is strong enough to bear the load of the package that is stacked over it.

If the container is not strong enough, the force is transmitted to the contents and the contents can be destroyed. It is especially possible in the case of fiber boats and bamboo baskets that they use for fruits and vegetables when you stack it. Thus, it is very important that the container should have enough strength to withstand any compression that it may experience and usually they use a machine known as a standard compression tester. So, the data that you get is actually an indication of the strength of the container for a short period. But if you want to check that for a long period what will be the strength, you need to take the compression strength as one third of the test value.

Whatever result you get, one third of that will be your compression strength for a long period. Now the same thing for a dynamic condition if you want to check, the test value multiplied by 3 by 2 in the vertical direction will give you the compression strength during transit. This is a pictographic representation of a compression test where you keep it between two platforms. Compression force is given. You will see what is the impact of the compression force on your packaging material.

Here again we will go on and see a video which demonstrates the compression test that is done in our laboratory. This is a compression strength tester to check the performance of the package, especially the shipping containers in terms of its strength and the protection it can offer to its contents when subjected to stacking, particularly in warehouses, storehouses and go-downs. The pack is placed on the compression tester and the top platon is lowered till it comes in contact with the top of the test specimen. Once the display shows 220N then tare it to zero. This ensures that it is tightly placed.

Now start with a speed of 12 mm per minute until the first buckling occurs. Results are expressed in Newtons which is the force required to compress the package. Okay. Now moving on to the fourth transport worthiness test, Inclined impact test. It is also known as contour test. If you look at this picture here, the platform will be inclined at a particular angle. And this is usually experienced in a ramp, when they unload from a truck; when they load it or unload, this what they experience during the loading; the inclined impact test. This test helps to study extend of crushing, breaking, cracking, distortion

during transport. Usually, it is because of the shunting shocks. When you have a sudden break, you can have one packet hitting on to the other or during unloading when you just leave the package on an inclined ramp from the truck, it goes and hits the ground. That is the shunting shock. The shunting shock what are the results to the packaging material. That is what is tested in the Inclined Impact test. It is usually carried out to determine the ability of a container or interior packing material or both to provide protection to contents when it is subjected to an impact stress.

Now this is especially valuable for very large, odd shaped packaging material that usually it would be impossible for other tests; you would go for inclined impact tests. This test usually is carried out in an inclined plane impact tester. There is a track which is inclined

at 10 degrees to the horizontal on which your package which is the dummy is placed and it is released. So, the impact to the wooden buffers that are placed at right angles at the end will be tested. Okay. So, you can change two things; you can change the distance of the incline from which the package is released. The farther the distance, the more will be

the impact. You can also modify the angle at which the plane is kept. With these two changes you can check what are the changes that takes place or what is the impact of these changes on the packages. What we test is the shunting shocks because of the impacts during transit. Here, it is possible to design suitable containers or improve the design of the existing containers or interior packing after doing these tests.

So, this pictographic representation also shows you, you have the package here. You can change the angle at which the ramp is inclined. You can also change the distance from which it is released. And you just test out what are the changes taking place to the sides and the corners and edges of the package just because of these shunting shocks.

So, I hope you have got an idea of some of the Transport Worthiness tests. We have only discussed for mechanical hazards and how do you test their effects on packages in this class. We will continue in the next class with mechanical as well as the climatic hazards and how these Transport worthiness tests are done. Thank you!