

Determining Enduring Comfort in A Railcar Seat Cushion: Is A First Impression Reliable?

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As you stroll from Messe hall to Messe hall at Innotrans, or wander outside to queues of rail enthusiasts and business professionals alike, waiting their turn to step into any one of a sea of updated, new and futuristic passenger coaches, the most prevalent and obvious fixture within any interior, rendering, brochure, or maze of booth exhibits is the seat or array of seats. The type of seat will vary from the most outrageously luxurious - slated for a VIP very high speed Oriental Express pod - to the simplest and ergonomic that allows for rows and rows of passengers in a configuration that would be suitable for the rush hour of London, Shanghai or Sao Paulo.

In addition, there will be a multitude of styles, reflecting the most recent trends, fashions and local preferences. It is only human that you will take a try and sit on one, two, or as many as possible of these seats. And in a matter of a few seconds, you will determine if that seat is comfortable or not! What has taken teams of engineers and designers months, if not years, to conceptualise, design, prototype, test (and re-test), will be given a judgment in less than ten seconds. So from that, one could wonder just how important is the *first impression* of a railcar seat? Of course, there is a play on this statement, which will be addressed in a bit.

Final designs, needless to say, are not only a function of style and comfort. Other variables and requirements must be considered if a seat is to be selected for service. Those that are most critical result from specifications such as the number

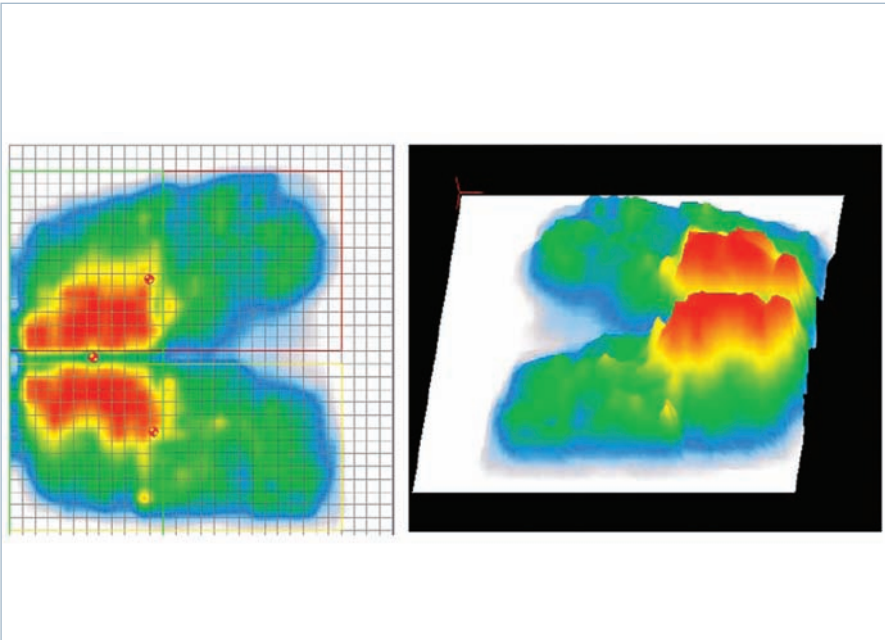


Rider comfort has a lot to do with a seat cushion's ability to "pushback" over the course of its service life

of seating positions per coach (as required by the transit authority), materials' standards for flame, smoke, and toxicity (FST), type of train service (urban metro system versus suburban commuter), and severity of usage. There are also new concerns of sustainability and end-of-life. This is being driven by questions related to the disposal of the seat: "What will become of a worn, damaged, or obsolete seat?" Will it be thrown into a land-fill? What are the decomposition ramifications of that seat in a land-fill? Transit authorities are becoming even more proactive with initiatives to reuse or recycle the components of the seat at end-of-life. Lastly, as with any publicly-funded programme, the overall cost of the seat

must be in agreement with the budget slated for the project at hand.

Regardless of the final product, however, and after all of these requirements have been factored in, the common feature among most all seats is the cushion. And while it is obvious that cushions have differences in profile, appearance and texture, it is not obvious that there are different types of materials used to fabricate the cushions. These materials are usually in the form of foam, such as a filled-polyurethane, silicone, and melamine. The foam which is specified for the fabrication of the cushion will have been tested to the various FST standards, ensuring the safety of the passengers. In addition, some of the foam materials may have been cycle



2-D & 3-D view of thin profile seat with loaded urethane

tested to simulate wear and usage, which brings us back to our earlier statement of first impressions. Often, seat cushion foam materials are tested and certified to a characteristic known as *indentation force deflection (IFD)*.

A typical IFD test method will be comprised of a disk of a determined diameter that compresses the foam material a certain percentage of its thickness, and then measures the amount of “pushback” force the foam has. This is its indentation force deflection, and is directly related to the comfort of the seat. In production, the foam will be certified according to this test. If it is

within the IFD tolerance range, the foam will be qualified for seat cushion fabrication. The cushion eventually finds its way to an Innotrans exhibit or (ideally) put into service. The foam and seat are ready to be scrutinised by you, the user, and a determination is made - in just a matter of seconds - if it is comfortable. At that point, the first impression or first IFD is made, and objectively, the cushion, as evaluated by true data, should be comfortable. This is independent of the type of foam material, whether it is filled-polyurethane or silicone foam. However, subjectively, one may be considered more comfortable than another, but this

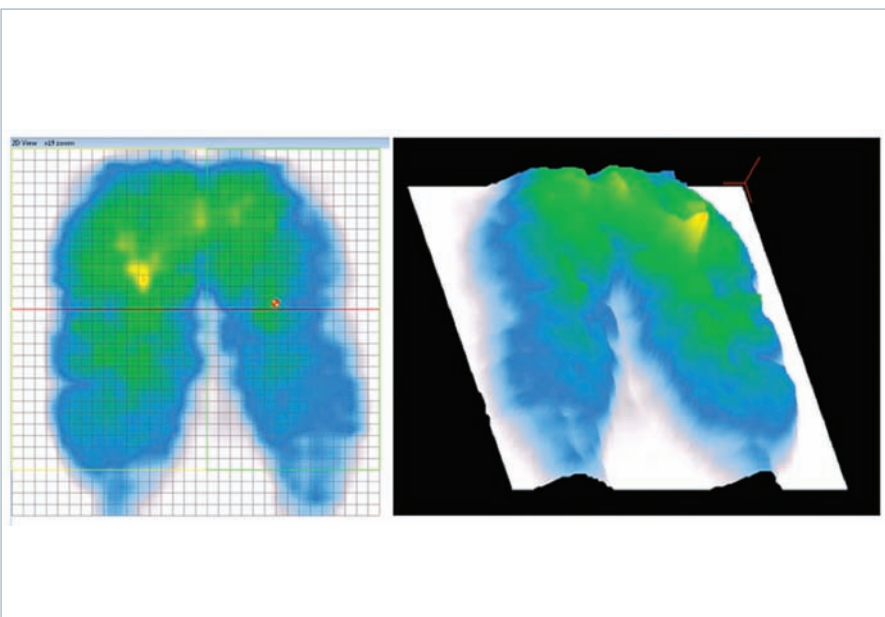
would be dependent on the overall seat design.

The real test is months later; after the cushion has been in service and cycled through thousands of IFDs. Is the seat cushion still reporting the same pushback force as it did on day one? The answer is different for each type of foam material. Silicone foam will only lose about five per cent of its original pushback force in as long as ten years. Filled polyurethane foam will take on a compression set over a relatively short period of time. Compression set is defined as the permanent loss of (push back) force over time. This can be easily observed. The upholstery of the seat will be loose; no longer tightly stretched over the foam. The cushion will seem flattened, and will not distribute the weight of the passenger evenly or in the same pattern, as it did on day one, or with its first IFD. The change in weight distribution is ultimately the cause to what is, both objectively and subjectively, defined as uncomfortable. On balance, an open cell silicone foam provides the best long-life solution for rail seating in all categories: compliance to FST standards, almost identical comfort performance throughout its entire service, and an overall savings in maintenance cost.

So we end as we started: Does it make sense to judge comfort with the first impression? A seating showroom in a venue like Innotrans would offer a more convincing story if it was not displaying and demonstrating brand new foam cushions, but rather cushions that have been in the field for years - because that's the real test for comfort after many, many impressions! ■

ABOUT AUTHOR

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2-D & 3-D view of thin profile seat with silicone foam