
# Foam favourite



**Specifying interior floors is a complex task with conflicting requirements. Can silicone foams offer the necessary material qualities?**

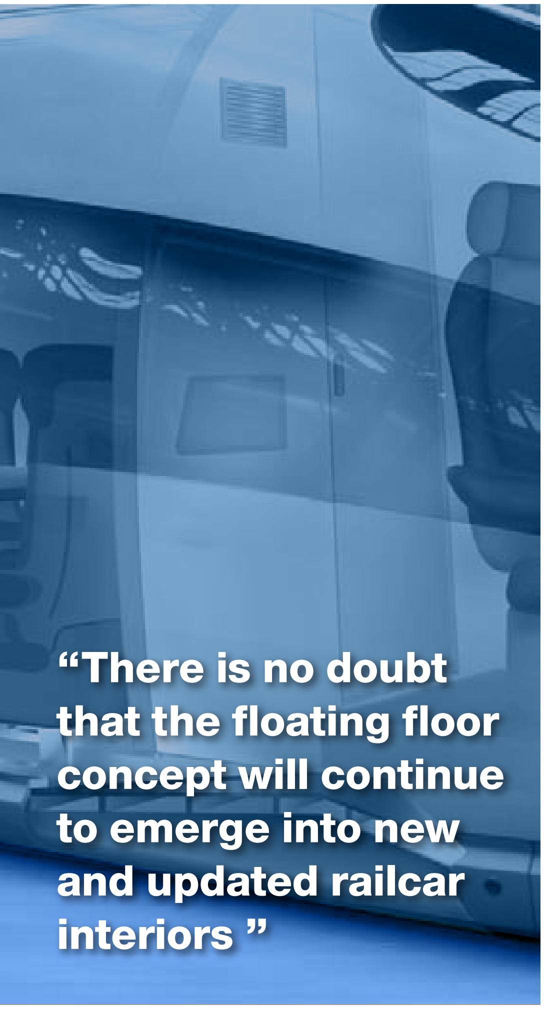
Acoustic engineers are presented with significant challenges with the design of railcar floating floors. The requirement to mitigate structural and airborne noises to provide a comfortable and quiet interior is only one element of a floating floor design.

Other factors include longevity and integrity of the construction, keeping in mind that the service life of a railcar is likely to be at least 25 years. In addition, a dynamic flooring system is expected not to degrade in performance for this time period or become a source of failure for other interior components. Although acoustic performance is the most significant driver, engineers must take into consideration the fabrication of their designs and how easily they can be assembled and replaced, if necessary, into and from the vehicle.

Now there is another trending requirement: all of the materials used throughout the floating floor panels must conform to specific flame, smoke, and toxicity (FST) standards.

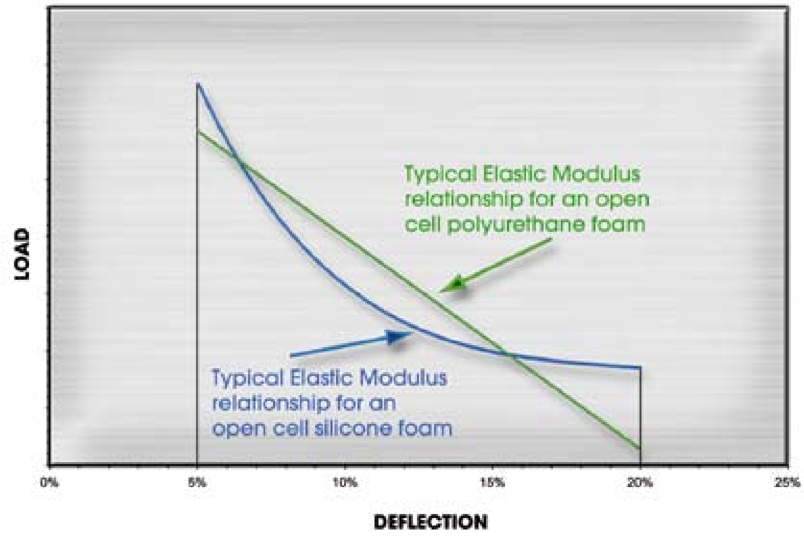
A typical floating floor design is comprised of a system of individual panels that are constructed from layered materials. Usually the construction will consist of a high-wearing carpet or laminate that is bonded to a flooring substrate. Anti-vibration pads are placed under (or onto) the flooring substrate, which are specifically designed to isolate the floor panels from the subfloor.

Traditionally, the pads are cut from various open-cell foam materials, including polyurethane and neoprene. Non-foam materials, such as EPDM rubbers, are also used in railcar flooring constructions that are not categorised as floating. In general, however, industry experience borrowed from other flooring applications has proven that open cell foams provide the best isolation performance against impact. Although all of these materials are able to offer high performance levels as viable anti-vibration pads, they are limited. This is most evident in three areas: first, conformity to

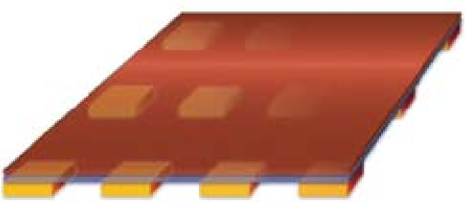


**"There is no doubt that the floating floor concept will continue to emerge into new and updated railcar interiors"**

Typical Elastic Modulus Differences between Silicone and Polyurethane open cell foams




BELOW: Floor panel with distributed pads



FST requirements, such as BS 6853 Cat 1a, NFF 16 101 M1F1, UNI CEI 11170 Class 1a F1, and EN 45545 R9; secondly, extreme temperature ranges (up to 225°C); and finally permanent compression degradation over the life of the floor.

As authorities, responding to government mandates and customer demands and preferences, continue to increase their requirements for fire and toxicity safety in combination with lower dB noise budgets, designers are evaluating other open cell polymers for floating floor pads. Silicone open cell foams are quickly becoming the material of choice. Unlike carbon-based polymers, silicone, with added fillers and chemical blowing agents and catalysts, can be manufactured into open cell foams that meet the toughest FST standards in industry. For example, any foam that is used in the aircraft industry is based on silicone. Yet, the benefits of silicone foams go beyond the fire characteristics. Due to their intrinsic properties, silicone foams are highly resistant to degradation (will not take on compression set, lose compression force, or deteriorate with continuous dynamic load changes) over the life of the vehicle.

There are challenges, however, when specifying silicone foams to either replace existing polyurethane pads or in completely new designs. Interestingly, the challenges are not in reference to the proven performance capabilities of silicone pads, but to the paradigm shift that designers must undergo when comparing urethane or neoprene foams to silicone foams. Except for the fact that all three of these materials can be categorised as open cell foams, few values can be absolutely transferred to silicone.

For instance, if a current floating floor design has polyurethane pad values respective to dynamic modulus, natural frequency or elastic modulus, the values need to be re-established based on the nature of how silicone open cell foams deflect, relax and respond to loads, compression, temperature and fatigue.

The most significant difference between silicone foams and polyurethane foams is the non-linear modulus of elasticity throughout the compression of the foam's thickness. However, this can be used to the designer's advantage, once the paradigm shift occurs. On the basis of the different elastic modulus modes, and dependent on the degree of compression – 10%, 20%, or 50% – the designer is able to reach precise isolation values and optimise a solution specific to the application. For instance, a pad for a very high-speed rolling stock car will have different requirements from a pad for a commuter rail project.

As with any flooring project and material options, once the designer becomes familiar with the expanded capabilities that silicone foams offer, various pad lay-outs can be considered to meet manufacturing, cost and sustainability objectives. There is no doubt that the floating floor concept will continue to emerge into new and updated railcar interiors – and until all governing standards move to the stringent requirements for FST, designs will consider all of the open cell foams available. In instances when safety must not be compromised, or when acoustic performance cannot be degraded over time, silicone foams will offer the best solutions.

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