

# Sound Package Technology in the Indian Automotive Industry

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The automotive industry in India may seem to be very recent, but is actually over 60 years old. In the past 15 years the industry has become mature and competitive. In the 1980s, with the entry of Japanese cars into the Indian market, cabin noise reduction became important. Shortly thereafter, the entry of other foreign cars and car manufacturing in India, sound package treatments have emphasized fit, finish, and acoustical performance. This article provides an overview of sound package technology in the Indian automotive industry. The evolution of a sound package material manufacturer from making die cut parts to modern day molded parts is discussed. Today's technology provides noise and vibration control from the engine compartment to the passenger compartment and luggage area. Manufactured parts include barriers, absorbers, and dampers.

The first automobile that traveled the roads of India was in 1897. Prior to the 1940s, cars were imported. In the late 1960s and early '70s the automotive industry in India primarily consisted of the Ambassador made by Hindustan Motors and the Premier made by Fiat. However, the automobile revolution in India really started in 1983 when Maruti Suzuki India Limited (formerly Maruti Udyog Limited) started manufacturing cars in India.<sup>1</sup> This eventually opened the doors to other foreign car manufacturers to build cars in India for the Indian market as well as exporting cars to other countries. Following economic liberalization in 1991, several leading car manufacturers started building their products in India. As of 2010, 40 million passenger vehicles are in service today in India.<sup>2</sup> A brief history of the Indian automotive industry's progress is shown in Figure 1.

Early NVH packages were practically absent except for a small amount of jute felt-based insulation and asphalt-based liquid sprayable underbody vibration dampers (see Figure 2). Present day asphalt-based vibration dampers were introduced by Maruti Suzuki in the 80s. Little attention was given to vehicle interior noise as the need from customers was nonexistent. This was perhaps the result of two separate situations – one being the absence of air-conditioners in the car which forced one to keep the windows open most of the time and the other being the generally high exterior noise of all types of vehicles on Indian roads.

Indian car manufacturers have since changed their vision of building vehicles (both passenger cars and commercial vehicles) in terms of design, functionality, durability, and performance. For trim and acoustical parts, this resulted in better fit, finish, form, and noise control. Figure 3 shows an illustration of vehicle interior reshaping over the last 30 years.

## NVH Development

**Early Days.** In the early days of auto manufacturing in India, interest in acoustics was minimal. Trim parts were only used to meet the aesthetic requirements. Traditional parts such as dash mat, floor carpet, and headliner were not utilized as they are today. In some vehicles there were card board pieces glued to the sheet metal to avoid excessive heat on the dash panel.<sup>4,5</sup> In some instances, one could even see the engine compartment from the vehicle interior; even after a passthrough accessory was installed on the dash panel. The floor carpet was merely a rubber mat laid on the floor to conceal the bare sheet metal panel (see Figure 2). The headliner was a fabric or a plastic material used to protect vehicle occupants from possible injuries caused by hitting the roof accidentally and also to provide some aesthetics to the vehicle interior. Table 1 summarizes sound package treatments in the early days of the automotive industry in India. The table also provides a history of sound package development over several decades.

**Transition Period.** Between the 1970s and 1990s, the sound package development process in India went through a transition from essentially no sound package treatment to what is common today. During this period the dash mat was upgraded to a die cut part made out of a thin bitumen layer with jute fiberpad backing. The floor treatment was also upgraded to a rubber pad with jute fiberpad backing. The headliner was replaced with "cut and sew" technology that included acoustical padding behind the face fabric or plastic vinyl. This was a significant improvement in vehicle sound quality for that era.

Table 1 also lists a summary of sound package treatments during the transition period of the automotive industry in India. Figure 4 shows the evolution of sound package materials that has taken place from the mid 1990s through to the present day. Figure 5 illustrates some typical parts from the 1990s to today.

**Present Trends.** With growing purchasing power among Indian consumers,<sup>2</sup> demands for more vehicle comfort have grown. Vehicle manufacturers have responded to these demands by conducting acoustics work in advance of production. Some of these involve:

- Benchmarking competitive vehicles and conducting customer surveys to understand consumers needs.
- Developing appropriate targets that can meet vehicle acoustic requirements.
- Developing component and material level targets.
- Conduct extensive material level, component level, and/or vehicle level acoustical measurements.

Initially some foreign car companies started to build vehicles in India with imported acoustical parts. Gradually local suppliers

Table 1. Sound package development history.

Parts	< 1960	1970s	1980s	> Late 1990s
Dash mat	None	Paper; hard board in patches	Flat die-cut jute felt; upholstery foam	Molded thermoplastic felt; heavy layer with felt or foam
Floor carpet	Rubber sheet	Rubber sheet	Rubber sheet; nonwoven fabric	Nonwoven fabric (carpet) with felt underlayment; carpet with heavy layer backing, underlayment; truck carpet: TPO + TPE with PU foam
Headliner	Plastic	Plastic; vinyl	Cloth; plastic; vinyl	Nonwoven-fabric faced PU foam substrate
Dash outer; hood insulator	None	None	None	Molded felt

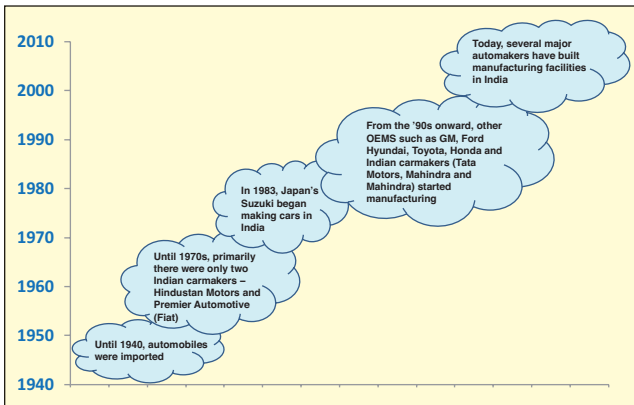


Figure 1. Brief historical time line of the Indian auto industry.

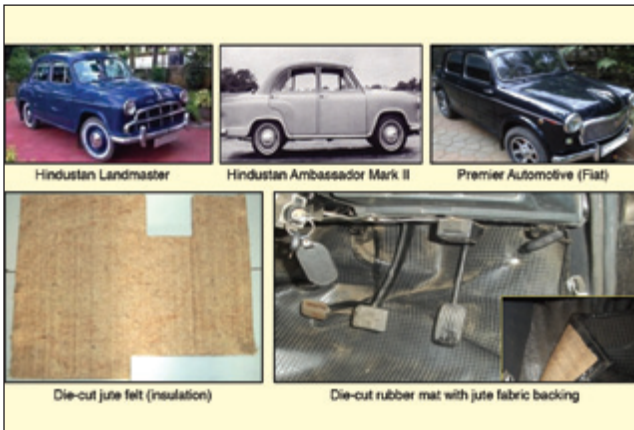


Figure 2. Noise control treatments in the early days of the Indian automotive industry (1960s-1970s).



Figure 3. Reshaping of Indian vehicle interiors over the last 30 years.

were developed with foreign joint venture or technical assistance. Later, foreign sound package manufacturers also started their operations in India. There has been a significant opportunity and challenge for Indian sound package suppliers to rise to the occasion to meet the consumer demand and expectation to build a quality vehicle with the right acoustics.

Originally, sound package materials were limited to flat non-molded parts. These were mainly made of jute fiber (natural fiber) products and were used in the passenger compartment. Later flat non-molded die cut felts such as needle punched felt or resin felts were introduced. Presently, molded resin felts, thermoplastic felts and polyurethane foam with or without heavy layers are used. EVA and EPDM plastics are mainly used as base materials.

Asphalt based anti-vibration pads such as heat fusible, self adhesive and magnetic materials are primarily used for sheet metal vibration damping. Butyl based dampers are also used for certain applications. In recent years light weight asphalt based vibration dampers have also been developed.

Sound package materials are now installed in locations that were not previously considered. These include sound package materials in the luggage compartment, acoustic treatments in the door cavity between the door inner and the door trim panel, and in the glazing system.

In addition, there are also pass-by noise requirement regulations. Heavy vehicles introduced noise shield to meet the requirement and passenger car segment introduced sound package treatments for engine compartments. These treatments include hoodliner, en-

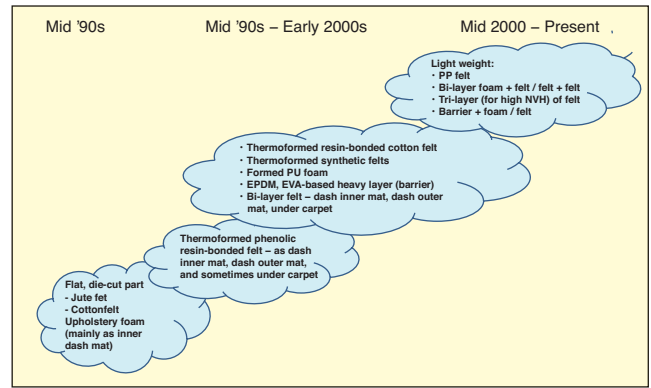


Figure 4. Evolution of sound package materials from the transition period up to the present day.

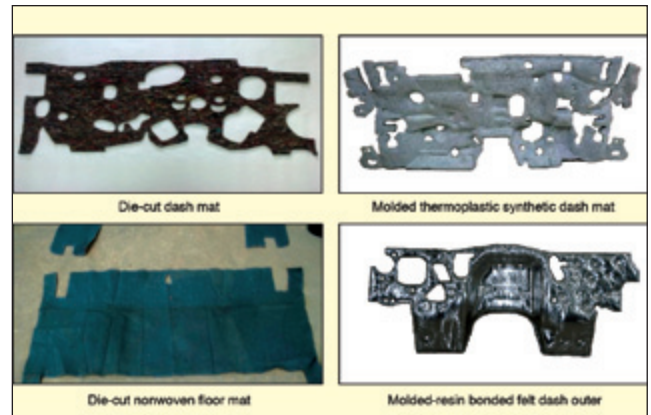


Figure 5. Typical parts used by Indian automotive industries.

gine compartment dash outer, and engine compartment underbody panel or also called belly pan.

Currently, there is a lot of emphasis on weight reduction of sound package materials. Suppliers today are working on developing effective solutions such as lightweight vibration dampers and fine synthetic fibers.

### Supplement to Sound Package Treatments

In parallel with the development of effective sound package treatments, supplier groups as well as OEMs are developing ways to come up with effective sound control solutions. Appropriate teams in the automotive sound and vibration community are engaged in:<sup>3</sup>

- Advanced noise and vibration work
- Simulation work
- Sound quality work

There is also a lot of activity in developing acoustical test facilities for conducting sound and vibration measurements, numerical models, and predictive analyses.

### Conclusions

Sound package industries in the Indian automotive market have come a long way in the past 50 years. With all the global OEMs manufacturing vehicles in India, it is only appropriate that sound package industries should grow as well to meet consumer expectations and demands.

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