Joints on roads and bridges: How to fix the problems

This column (to appear in the fourth issue of every month) is all about openly sharing expertise and knowhow with our readers, regardless of industry, product or service. The aim is plant the seeds of inspiration, strengthen the knowledge base, and hopefully, lead to new opportunities and innovations.

While the column is being rolled out with the ideas of Prof. V.C. Malshe, an academician, researcher, innovator, consultant and businessman, it is open to one all. Simply write to editorial@chemicalweekly.com. (If you would rather speak informally, that too can be arranged).

All travelers on roads and bridges have experienced a regular thud while driving at high speeds. It is felt more on bridges. I once heard our honorable minister, Mr. Nitin Gadkari telling some interviewer if there was a way to avoid it, he could implement it.

Roads

Concrete roads make commercial sense because of their long service life and low maintenance cost. The initial cost is high. The time required to start using the road is also long due to long curing time. But all this is acceptable for economic reasons. The problem is the expansion joints. Concrete has a finite coefficient of thermal expansion. The temperature variation across seasons in different parts of the country demands the use of an expansion joint at certain distance. Even though these joints are filled with an elastic material, it wears out, expands, contracts and projects out of the surface when the slab expands and fills up the gap. In colder climate, the slab shrinks, and the elastic filler depresses between the joint. In either case, a passing four-wheeler experiences a periodic "thud". Depending on the speed of the vehicle, this frequency is high and irritating to the driver and occupants alike. It also leads to damage of the suspension of the vehicle.

Bridges

Bridges also have expansion joints. At times, the joints are unsupported. Whenever a heavy vehicle passes over the bridge, there is a very loud noise and jerk to the vehicle. The noise on bridges is much louder compared to road joints. The reason is the cantilever joint gets slightly depressed when the front wheels of the four-wheeler reach the end of the arch. The other side of the arch after the joint remains slightly higher and the speeding wheels strike this raised surface. Depending on the speed and load of the vehicle, the intensity of the sound can change. For large trucks with 20-24 tonnes load, this impact may be too harsh for even the tires to sustain the shock. The primary cause of the noise is two impacts of the pair of tires on the joint and it is separated by few milliseconds depending on the speed of the vehicle. This also poses a risk of damage to tires.

A note from the author

I recently read about a book by Todd Henry. The title was 'Die Empty.' There was no need to buy and read the book. Just one statement was enough to understand what was meant. It was something that made me think and seriously consider writing this column.

I have been an innovator all my life. I have put several ideas in practice in my industrial career. But there were several that could not be implemented because I was not in the relevant industry, or I was ahead of the times. I filed several patents, got them, maintained them for their full life with my own resources.

As I approach my 78th birthday, I thought of penning down some ideas that could be used by companies, governments, individuals, alike. I have no financial expectations because patents have either expired or have not been maintained.

I present these to the world to make use of. Several have been communicated to senior government officials but seem to have been filtered out by the administration. Hopefully, thiss will change.

V.C. Malshe

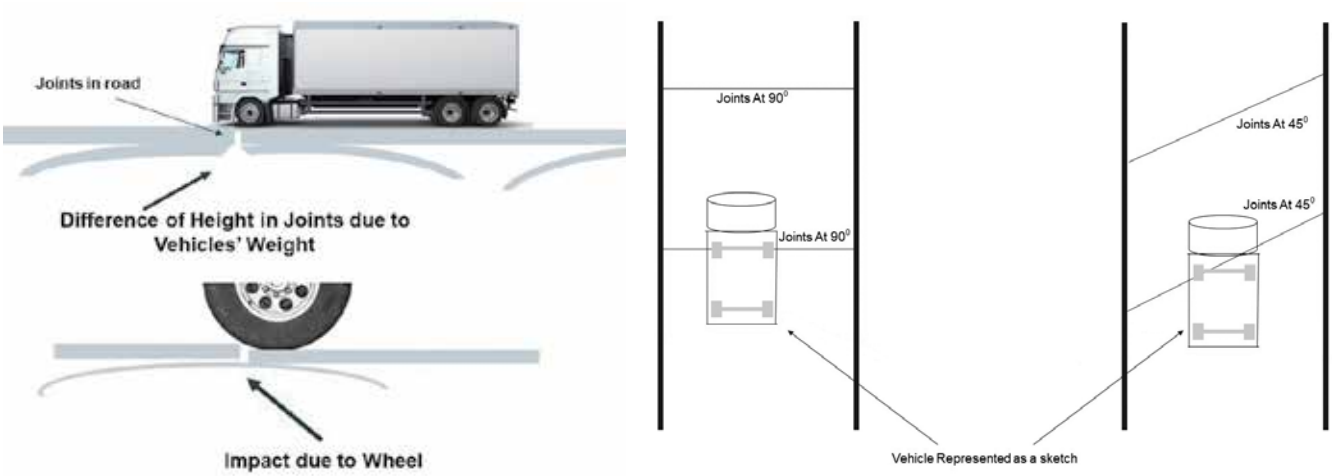

Image Courtesy: Mr. C.D.Khandekar

The solution

The solution to both these problems is the same. The intensity of the jerk can be considerably reduced by allowing one wheel to cross the joint at one time. This can be done by changing the direction of the joint, preferably to 45° to the direction of travel. As a result, the intensity of jerk will reduce to one-fourth because one tire would cross the line at a time. In addition, the transition would take place at an angle, so it is smoother. This can be included as a part of specifications of the design.

Roads are cast as a continuous slab. For expansion joints, it is cut with a diamond saw and the gap is filled with an elastomer. The same procedure can continue except that the cut would be at an angle of 15° to 45° to the direction of traverse. By doing this, the intensity of the noise will reduce below 10%, causing no damage to the vehicle and passengers.

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