Managing speed breakers, water flooding and traffic on our roads

This monthly column is all about openly sharing expertise and knowhow with our readers, regardless of industry, product or service. The aim is to 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.

Speed breakers

Speed breakers are ubiquitous on our roads. Lamentably, there seem to be no standards when constructing one. Very often they damage vehicles because the unsuspecting driver is driving at high speed in darkness, jumps several feet in air (depending on the speed and the weight of the vehicle), damages its suspension, and, at times, even causing a breakdown. Often, there are no warning boards on either side of a speed breaker, nor reflective paint for night-time visibility.

Often, no permissions of the relevant authority are taken before installing a speed breaker; and most are local initiatives. Villagers, keen to protect themselves from speeding vehicles, are known to take matters into their own hand, and install speed breakers even on highways. A 27-km road from Khoni village to Badlapur on Pipeline Road had 40 speed breakers on both the sides and I had to write to the Prime Miinster's Office (PMO) highlighting this. Thankfully, most have now been removed.

Villagers living along State highways insist on installation of speed breakers at every junction. Their demand is valid. They must be provided speed breakers, but not on the highway. Two speed breakers should be provided to every road joining the highway. There is a need for speed breaker with a STOP sign, but it should be provided for the traffic joining the highway, while the highway traffic should be given unhindered priority of movement. The entrant to the highway needs to be careful. He should face a speed breaker and a STOP sign at the junction, and must stop at the junction, look on both sides and only then enter the highway safely.

Synchronisation of signals in the city

There are several situations in cities where moving traffic is held up on a red signal and when it moves on green, it only finds a red signal on the next junction. This problem may not be simple to resolve but needs to be dealt with. If the next signal can be red at a time when no traffic is reaching it and becomes green as soon as traffic from earlier signal approaches, traffic movement can be smooth. This can be done by monitoring traffic with satellites and turning the signal green or red as per the traffic density. The main traffic can be given priority over the secondary traffic. Where satellite monitoring is not possible, it can be done manually using cameras installed on the roads.

Use fibre optics for light transmission

Traffic lights are operated by electric bulbs. These bulbs have limited life and frequent turning on and off, shortens their life further. The lamps are installed at a height and can be changed only with proper equipment. These systems also need electrical connections. These can be wrong at times which leads to confusion due to red and green light glowing simultaneously.

All these problems can be solved by fibre optic transmission of light to the signals. A single light diffuser placed at the end of the cable can glow red, orange or green, thus removing all confusion. The light source would be placed on ground which would be serviceable by the traffic police. There would be only one intense source of light with filters placed in front of the cable end. The change of filters would change the colour of the diffuser.

Barcodes on top of all vehicles to be tracked by satellite

I have been wondering about tracking any vehicle by use of satellite. A bar code printed on top of the vehicle can be read from a long distance. Its movement can be tracked. It will be very easy to locate a stolen vehicle and erring vehicles on signals, involvement in accidents, riot, theft, etc.

Training for erring drivers

In India, there is no refreshing of training on rules of the road. Once a driver is always a driver. I was traveling by road from Indore to Mumbai. Both State governments had put a lot of effort into developing the roads and the surface was very good. We took about

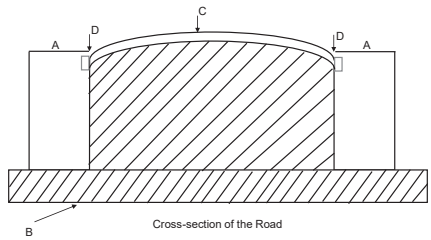
13 hours to cover about 600 km, in spite of the good condition of the road. The average distance covered was less than 50 km per hour.

The main cause of the delay was truck traffic. Most trucks were overloaded and not able to maintain the desired speed. While all trucks are required to use the second or third lanes, it appears only half the truck drivers follow this rule, and the other half drive in the first (right) fast lane reserved for cars. As a result, we have all three lanes occupied by trucks moving at different speeds. Smaller vehicles have to weave between two large vehicles. On our journey, we had to overtake roughly about 350 trucks from the left side.

The erring drivers need a refresher on rules of the road. I have a suggestion. The RTO should install a residential schools along major State and National highways. The erring driver should be given a nine-hour refresher training on rules of the road. The school should have adequate facility for parking the truck, bedrooms for night stay, and a good eatery. The driver should be required to pay a fee ranging from Rs. 300-500 for the training and stay. The course should be repeated as many times as the person is found breaking the rules. This will ensure safe roads to all users, provide employment to trainers and revenue to RTO. About 30,000-50,000 such training schools are required in our country.

Waterlogging on roads

I have spent about 20 years of my life on UDCT campus as a student and as a professor. Till 1997, I never saw any flooding on R.A. Kidwai Road. In 1997, BMC started concreting the four-lane highway. In this exercise, they removed the earlier drain covers and replaced them with new better-looking ones. The frequency of the covers was reduced to well below 50%. As a result,



A = Storm Water Drain B = Hard soling
C = Tar or concrete layer D = Connections to drain

we saw serious floods in the next monsoon. As a responsible citizen and also as a warden of Hostel No 1, I wrote to Matunga office of the then Bombay Municipal Corporation (BMC) stating that in the new construction, waterways had been significantly reduced, and this was leading to flooding. Surprisingly, I received a reply from the engineer of BMC that they had calculated the drain rate for 25 mm per hour rainfall, and on some days there may be a problem for short time. Over a period of time, all roads of Mumbai have been concretized and as a result there is flooding in all low-lying areas. Part of it may be due to changing rain patterns, but I attribute most of it to reduced waterways to the drains. There are situations when an area is flooded, and the drains are running empty. All of us will remember the tragic death of Dr. Deepak Amrapurkar who was sucked in an open manhole on August 29, 2017. A person cannot be sucked inside a drain unless the drain is running under vacuum. That means the waterway has been reduced so much, that the area is flooded and when a manhole is opened for allowing the flood water to flow out, the drain is happy to oblige. If there was an adequate water way available, water would not have accumulated on the road. The solution to the problem of flooding in Mumbai lies here. If the frequency of the outlets to the storm water drains is increased three to five folds, adequate amount of rainwater will enter the drains, and flooding can be prevented. The drains will not run empty, and water will not accumulate on the roads.

Banking of highways

I find engineers are shy of banking the highways on turnings. This leads to several thousand accidents. Flat curves throw the vehicles away. Depending on the loading and speed the vehicle is thrown away, at times in the valley. The formula for calculation is simple ($v^2/r=g\cos\theta$ where v is the velocity, θ is the angle with horizontal, r is the radius of curvature of the road, and g is acceleration due to gravity) If permitted velocity is high, a higher slope may have to be provided like it happens in racing tracks. Motor bikers in circus drive on completely cylindrical surface at right angles to the ground and do not slip or fall down.

As the engineers do not provide adequate slopes, very low speeds have to be specified, like on JJ Flyover, the Mumbai-Pune Expressway Lonavala Bypass, or the connection of Mumbai-Pune Expressway with Pune-Bangalore highway where a pathetic 30 kmph speed limit is specified. The department has to protect the edge of the road with used tires to avoid jumping of vehicles outside the road. To reduce accidents at curvatures, the curves must be adequately banked to prevent skidding of the vehicles even at a high velocity.

A table of radius of the curve, velocity permitted, and the angle of inclination is as follows.

Velocity	Radius	θ
km/hr	*m*	*Theta*
10.0	10	85.5
15.0	20	84.9
30.0	30	76.3
45.0	40	66.5
60.0	50	55.5
80.0	60	33.0

Addition of anti-stripping agents to the tar

Tar is essentially a residue of petroleum refining. Some manufacturers

remove most possible liquids and do not produce tar at all. Their residue is petroleum coke. Those who do not distill hydrocarbons to the last drop, produce between 3-5% tar of the refined crude. We find the grog gets separated from the tar in the first rain. This happens due to poor wetting of the grog with tar. Lot of research has been done on this problem, and anti-stripping agents are recommended to be used in tar. This happened in India as far back as 1975 and anti-stripping agent has been specified since then. However, the contractors do not oblige, fearing very long life of the roads. It is difficult to monitor correct addition and use of right materials.

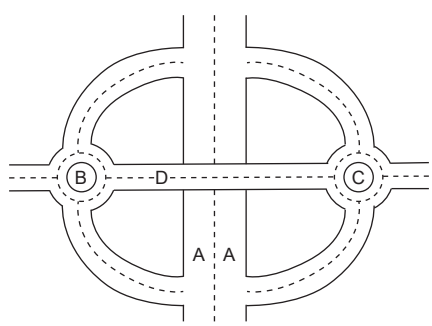
Government can force the refineries to add antistripping agents to the tar to improve compliance. Once added, it cannot be removed.

There are other options too.

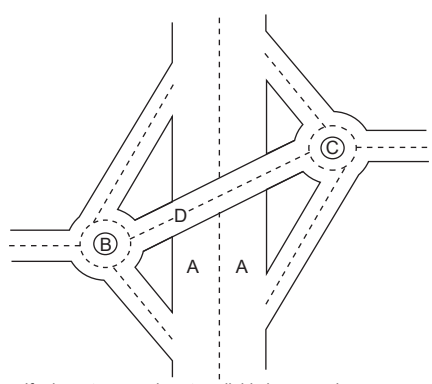
- Refineries can also add 2% natural rubber latex to the tar in hot condition before it is packed. This has made a huge difference to roads in Kerala.
- I have also studied the possibility of placing a thin layer of dry Ordinary Portland Cement (OPC) on the tar road. For this, cement powder should be spread on freshly prepared road and then rolled over. This layer can be just about 1-mm thick. Thus, cement consumption would be about 2-3 kg per m^2 of road. This layer should be applied only in winter or summer season. Over a period, the cement gets embedded in the tar. Whenever it rains or the cement comes in contact with water, it hardens and provides a very long life to the road surface because of its very high abrasion resistance. Refineries can also consider a special grade of tar enriched with grey cement to provide improved life to roads for the top-coats of the road, probably at no extra cost as grey cement costs only 10% of the price of the tar.

Overbridges on main roads of cities

Of late there is a trend to construct overbridges on all major intersections of cities. Currently, what is being done is construction of very strong bridges to carry heavy traffic and allow small vehicles to pass under it. The bridge is required to handle large vehicles like 28 toner trucks, heavy earth moving equipment, industrial equipment, windmills and its components, heavy machinery (mainly imported), etc. The bridge is required to be strong enough to handle these. Once the bridge is in place, there is not much space left for heavy objects to move under the bridge. Theoretically, there is nothing wrong with this model. But it causes a lot of inconvenience to users who have to continuously go up and come down. This hampers speed. In a city like Mumbai, which has strictly north south movement, the cost of construction and the time taken for construction is unreasonable. I understand, Mumbai city's 55 flyovers costed over Rs. 3,500-crore. All small and large vehicle owners paid heavy toll for over 25 years.



Plan for changing direction on highways
A, A' – Highway
B & C are circles for cross over, may have signals for monitoring
D – Overbridge for light traffic

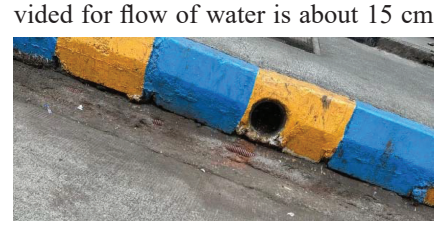


If adequate space is not available in some places, over bridges can be constructed at an angle

A simpler idea is to create roundabouts on both sides of the highway as shown in the image. The main traffic should be 'VIP' traffic and given preference, just like in railways. It should not be diverted in any direction. For example, all bridges from Dadar to Thane – particularly the ones at a simple crossings like Ghatkopar, Vikhroli, Bhandup and Mulund – should not be rebuilt whenever they go out of service. Instead, an overhead bridge should be provided with two roundabouts on both sides. Additional space should be bought from residents if required. An action like this will need long-term planning, even extending to 100 or 200 years. But such a plan has to be in place.

Flow of water should be the highest priority

At times I am surprised to see the skills of artisans engaged in the job of road construction. They seem to be completely devoid of common sense. If a person working on the construction of a drain notices that the hole provided for flow of water is about 15 cm



above the level of the road, why does he continue his work? It reminds me of a story of two workmen. One was digging a hole in the ground and other was filling the holes. Amused, a passerby asked the reason. He was shocked to hear the answer that they were supposed to be a team of three persons and were to plant trees in the holes. But as the second workman had not reported on duty, they were doing their job without planting the trees. This is an example of mindless working! **V.C. Malshe**