Modular to the max

A two-speed highway model from Meritor exemplifies the fact that, for the world's largest independent supplier of heavy duty axles, bringing a new design to market simply means putting together components it already has in a new configuration.

It's the most appropriate technology for fuel-saving in the vast majority of applications in Indian cargo transport – platform trucks, tippers, and tank trucks of the 4×2 and 6×2 variety – and, equally, heavier applications on the rapidly proliferating 8×2 type that's already been outselling the other two by 60–70 percent over the last two quarters.

From a drivetrain perspective, Meritor's two-speed axle bridges the gap between the six-speed transmissions that dominate the scene and the significantly more expensive nine-speed gearboxes which, with their closer ratios, allow driveability in specific applications to be better matched to the engine map for greater fuel-efficiency.

With the MS 13-245, drivers of the chronically underpowered trucks on Indian roads will no longer need to downshift frequently, which means their trucks will burn less fuel by running at slower revs for longer periods.

When driving light or on a level road, the engine torque is delivered to the wheels via the primary hypoid reduction, but when the truck is loaded and/or has to negotiate a grade, the driver can select a "deeper" ratio – on the fly – by pulling a switch that engages an additional planetary reduction built into the differential.

The carriers on regular single-speed axles are dimensioned for the "worst case", which means the engine is actually revving harder than necessary for a given speed profile. A two-speed axle for the same application will typically have a primary ratio that is "faster" than the single-reduction axle's, and a slower ratio that is invariably 1.36 times that because of the use of a standard planetary gearset for the entire range.

Raghunathan with Meritor India MD Chris Villavarayan – and the hybrid 1495 HR axle.

The MS 23-245 is an option on Volvo's VM (left) and standard on VW's Constellation 6×2 chassis in Brazil.

The technology has proved itself in Brazil for the last 10 years, where operators of Volvo's VM, Volkswagen's Constellation, and Iveco's Tector and Eurocargo 4×2 (16/17 tonne) and 6×2 (23/24/25 tonne) trucks across that vast nation's highly undulating landscape have seen significant savings in both fuel costs and journey times. Its importance, though, is now declining as that market shifts to larger articulated trucks with 10 and 16 speeds.

A must-have axle

"The two-speed axle's unique value proposition is that it gives you two modes for a given configuration — effectively you're operating with two different drive axles," S. Raghunathan, vice-president, Meritor HVS India, told this correspondent.

Compared to a single-reduction axle it offers a significant fuel efficiency gains on routes with steep gradients, such as ghat sections, and in "one-way" applications — where the truck is typically empty on the backhaul and needs lower traction, and hence less power. In trials over the last couple of years Raghunathan says, Meritor has measured fuel savings of "5–12 percent" — even more, "depending on route profile and load".

What OEMs get is the advantage of a nine-speed transmission for about half the incremental cost over that of a six-speed. According to Ashok Leyland's executive director (product development) R.R.G. Menon, even a "fully indigenised" nine-speed costs between Rs 80,000 and 90,000, almost double the price of a six-speed, and using one entails a lot of application work to fine-tune the ratios for the application.

Keeping the rest of the existing powertrain the same, a two-speed axle

can deliver essentially the same benefits as a 9-speed gearbox for only Rs 30,000 more than the conventional axle, Raghunathan points out. He says Meritor is "ready" with three sets of ratios (spanning from 3.23:1 to 7.17:1), and has already begun shipping axles to OEMs for customer trials.

Tata Motors will have 120 of them by the end of this month, and Ashok Leyland is only a "few weeks" behind. India's second-largest truckmaker has seen good results on its 2516 model so far and, Menon admits, will also try it out on tractors. Raghunathan revealed that all the the other OEMs, including a global one that's preparing to launch its first truck, is at some stage of testing and validating the product.

How they choose to market it as a feature will be interesting to watch, he agreed, suggesting that the safe thing to do would be to introduce it on the smallest application segment – tankers – first before moving to platform trucks for container transport and then tippers, which make up the largest segment.

At the beginning, he imagines, each OEMs will specify the two-speed option with a single ratio set optimised for both, the application and the most heavily trafficked route profile for that application, such as Mumbai–Pune for container trucks. They could then progressively add other ratio sets for individual routes on which they see demand growing, before, finally, all their trucks have the two-speed axle on them.

The big market opportunity, he admitted one major OEM told him, will last five years, though he expects the product will live for "at least" 10. "Volumes will surge very quickly and last for five years, before tapering off." The nine-speed transmissions will eventually enter the mainstream as higher-powered vehicles grow in demand, but the dire shortage of drivers with the adequate skills is making that an ever more distant prospect day by day.

The two-speed axle will boost the appeal of presently niche applications such as this 8×2 construction tipper by Black Diamond Motors on Tata 3118 chassis.

The Indian MS 13-245 shares components with Meritor axles used in a wide variety of heavy duty applications and extreme environments worldwide.

That's because the nine-speed requires a higher level of skill to operate. While drivers of tippers used in mines are by and large used to the technology, all others will have to undergo intensive training, Raghunathan pointed out. "Shifting to a nine-speed becomes inevitable when power levels cross 300 hp, but the two-speed lets them continue to operate comfortably with engines up to 260 hp using the six-speed configuration they're familiar with."

In Menon's view the only drawback (a significant one) is that, being a mechanical system, it leaves the choice of when to switch ratios entirely to the driver. "With electronic engines now available that are capable of sensing the load, this can easily be done automatically. If this option were available, optimal use of the feature would then not be dependent on driver skill any more."

Components designed for Meritor's existing portfolio can be mixed and matched to come up with completely new products in next to no time.

Versatility unlimited

The two-speed axle was first considered for India at a board-level product planning meeting at Meritor HQ in Troy, Michigan, three or four years ago, the company's communications director for Europe and Australasia Malte Raddatz told this correspondent.

The managers responsible soon realised that it would not do to simply transfer the Brazilian design and change the "customer-specific interfaces", and that, moreover, new sets of ratios might need to be developed for the peculiar operating environment in India. The engineers at Meritor's Bangalore tech centre were initially inclined to do a clean-sheet design, but then decided to "check what is available" for parts they could carry over.

Not surprisingly, they found they already had most of the crucial parts they needed — the 17-inch 1495 carrier, 13 tonne housing, and driveshafts were already available in India. "The box section and track is the same [as the MS 13-1495 single-reduction axle]; all the engineers had to do is design a new carrier interface to the housing," Raghunathan explained. "Adaptation to the local customer interface is now a simple job."

An all-new hybrid axle for off-road that combines the same robust carrier, housing, and driveshafts from the single-reduction and two-speed axles with the planetary wheel-ends from the MT 32-610 hub-reduction model is emblematic of the modularity of Meritor designs that Raddatz admits the company is itself in the process of "discovering" — the possibilities arising from the fact that components designed for its existing portfolio can be mixed and matched to come up with completely new products in next to no time.

Developed "in three weeks" for a Tractors India mobile crane, the versatile "1495 HR" has also been supplied in prototype to Sonalika for a "heavy haul" ag tractor and, Raghunathan pointed out, makes for an attractive alternative to Meritor's own MT 32-610 and other hub reduction axles for extreme-duty on-road applications, "where ground clearance is not a constraint" — such as heavy-duty pullers and terminal tractors.

Available in a wide range of ratios from 3.46:1 to 23.6:1, Meritor can deliver the 1495 HR with load and torque ratings for almost any conceivable requirement — by simply changing the carrier and the driveshaft spline configuration.