



## THE CAR CAN PIVOT AROUND ITS OWN AXLE

# TATA TRIES 'SPIN ON THE SPOT' IN CITY CAR

A concept city car that can “spin on the spot” in tight parking places thanks to an innovative British transmission has been unveiled.

Originally designed for ride-on mowers, the prototype infinitely variable transmission (IVT) has been created by Torotrak for Tata Motors' Pixel four-seat urban car.

Although engineers at the Preston-based transmission innovator created the “clean sheet” design following a request from Tata, they incorporated basic principles from their IVT designed for outdoor power equipment.

As the power and torque of Pixel's three-cylinder 1.2-litre turbodiesel are in the region of 55kW and 180Nm respectively, engineers created a larger IVT than that used in 45kW ride-on mowers. Despite this the transmission remains compact.

One feature of the IVT is two full-toroidal cavities, each with two rollers. These allow infinite gear ratios from reverse through zero (neutral) to forward.

Also fundamental to this IVT are epicyclic gear trains. These are not mounted between the engine and the IVT but combine the transmission input speed with each toroidal output cavity speed. The epicyclic gear ratio is -0.67.

Torotrak, which has tested the prototype, claims that during normal driving the transmission provides a seamless change of ratio to deliver refinement, performance and economy.

When parking and during tight

manoeuvring, the transmission's ability to control each rear wheel independently allows these wheels to rotate in opposing directions.

By linking the vehicle's steering system with the IVT's controller the car can pivot around its own axle.

Torotrak is reticent to reveal details of the IVT transmission.

It is understood that the transmission has no clutch in the accepted sense of the word, although some type of “disconnect” is required between the engine and the transmission.

Among situations that the transmission would have to cope with are sudden braking, for example if a child ran out into the road, or the vehicle coming to rest having run out of fuel.

Here the transmission could be in overdrive. The variator returns to zero (neutral) only when the transmission is rotating. Typically it requires some four to six turns to travel from reverse through zero to



**Tight spot:** The Pixel's infinitely variable transmission could overcome parking problems

full overdrive. If the transmission does not return to zero then starting the engine without disconnect could be difficult.

IVTs require special traction fluids – elastohydrodynamic fluids that combine high shear stresses with very high traction coefficients – allowing the rollers to transmit drive in the toroidal cavities. Careful bearing design is required.

It is understood that Tata Motors, which has a European technical centre at Warwick University, contacted Torotrak only six months ago with a specification for the Pixel.

As such, the design has not been optimised for production, so a further redesign may be required. And, as the transmission and the

vehicle are at the concept stage, little attention has been given to optimising cost.

Tata is a Torotrak licensee, although it is understood that there is no exclusive agreement between the two. The design could have worldwide implications.

Torotrak claims the transmission is cheaper than standard automated clutch designs, and 10% more fuel-efficient.

Although Tata is an important new customer, Torotrak's principal activities lie with Allison in the US for commercial vehicle applications and an unnamed but important European truck and bus manufacturer. Details of progress on both are expected soon.



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