

Transmission

New gearboxes maximise performance and economy

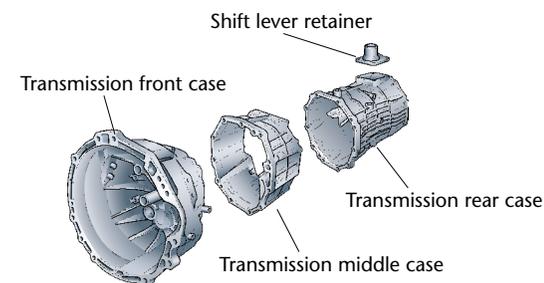
- New 6-speed manual transmission
 - Aluminium casing and input reduction gear reduce overall weight
 - Smaller shift gears and better synchronisers improve gearchange
 - Transmission can now operate with 18% less oil than before
 - Inclusion of a sound insulating cover reduces NVH
 - Improved clutch pedal feel and enhanced clutch durability
- New 5-speed automatic transmission
 - Adoption of linear solenoid valves allows for smoother gearchange
 - New flex lock-up system delivers more stable half-clutch operation, reducing fuel consumption
 - AI-SHIFT adapts gearchange schedule to changing road conditions and driving style

A whole new range of transmissions brings benefits in lightweight construction and smooth gear shifts to extract maximum performance and economy from the car. The introduction of extra ratios (from five-speed to six-speed manual and from four-speed to five-speed automatic) allows drivers to optimise use of the Land Cruiser's extraordinary power and torque.

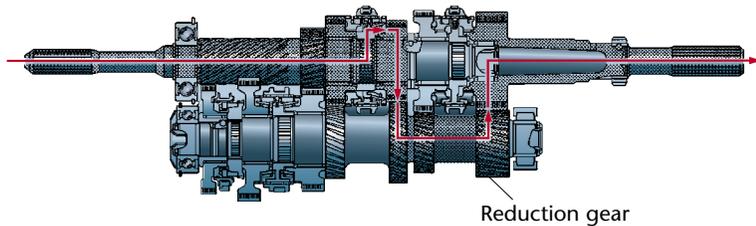
Six-speed manual

- Lightweight construction
- Smoother, more precise gearchange
- New insulating cover reduces NVH

The introduction of a new six-speed manual transmission as standard on the diesel model gives the Toyota Land Cruiser 3.0 D-4D extra benefits in performance and fuel efficiency. Designed from the outset to be both lightweight and compact, the transmission's **front, middle and rear cases, and shift lever retainer are made of aluminium alloy.**



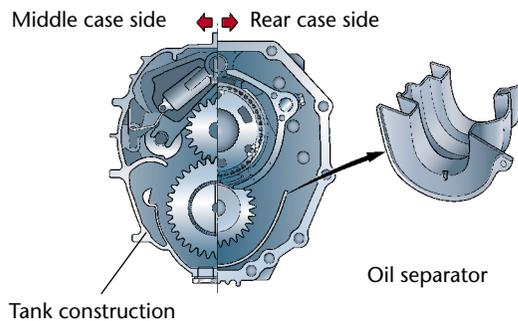
In designing the new transmission, the key to achieving both low weight and compact dimensions was the adoption by Toyota engineers of an intelligent solution – fitting a **final reduction gear** inside the gearbox itself. This means that each of the shift gears could be made both smaller and lighter than those under the input reduction system.



Output reduction gear (shifting into 3rd gear)

Significant efforts were also directed towards ensuring the optimum shift quality for this new transmission. The use of smaller and lighter shift gears in itself has a beneficial effect as the energy needed to produce each gearchange is reduced as a direct result. But, in addition, the **synchroniser hub sleeves** have been redesigned and are now fitted with two types of teeth to ensure improved synchronisation and, therefore, a smoother gearshift.

Furthermore, a **triple-cone synchroniser** is now adopted for first, second and third gears, while a **constant mesh synchroniser** is adopted for reverse gear.



Oil separator

An **oil separator**, made of aluminium alloy, is provided at the bottom of the transmission rear case. This prevents the sump oil from being directly mixed by the counter shaft and reduces mixing loss. **The oil volume has been reduced by 18%.**

Further detailed improvements include the fitment of a **sound insulating cover** to the left-hand side of the gearbox to reduce gear noise transmitted to the cabin and a new design of transmission case (with an oil tank structure) to improve lubrication.

Not only is the new transmission smoother and more efficient than before; the extra gear also results in a **significant improvement in acceleration**, with 0-100 km/h coming up in 11.5 seconds, 10% quicker than before.

Fuel consumption and CO₂ emissions are also improved – with the combined cycle consumption dropping from 9.4 to 9.0 litres/100 km for the three door.

As a complement to the new manual gearbox, **clutch performance and clutch pedal operation feel** have been optimised, along with the increased clamp load in the clutch cover. In addition, the durability of the clutch disc damper has been improved.

Five-speed automatic

- Linear solenoids achieve smoother gearchange
- Adoption of AI-SHIFT system
- 13% reduction in fuel consumption

The new five-speed automatic gearbox is one of the most technically advanced transmissions on the market – adopting both linear solenoid valve technology and artificial intelligence to manage shift patterns.

The new gearbox is standard equipment on the 4.0-litre V6 Land Cruiser and optional on the 3.0-litre D-4D diesel, allowing owners to choose the gearbox and engine combination that best suits their needs. Its construction is light and compact, **weighing only one per cent more than the four-speed transmission it replaces** (in the case of the 4.0 V6 version).

Gear changes are smoother and more efficient than before thanks to the adoption of **linear solenoid valves in the valve body of the transmission**, replacing the more conventional step control of the valves.

This makes it possible to generate a more gradual increase in the line pressure when responding to ECU inputs, and results in reduced shock when shifting gears.

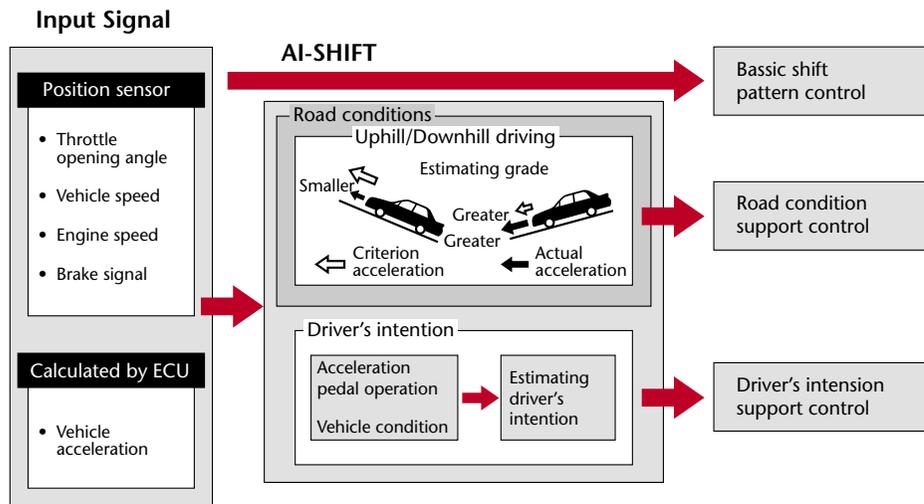
Cloud Forest Trail

A new flex lock-up system has been added to the torque converter. It allows the lock-up clutch to maintain a stable half-clutch condition, thus increasing the range of the lock-up clutch operation, which improves fuel efficiency.

Another significant development is the adoption of **AI-SHIFT** control for the transmission control unit. This employs artificial intelligence (AI) to adapt the gearshift schedule according to both road conditions and driver inputs.

AI-SHIFT gathers data such as throttle opening angle, vehicle speed, engine speed, brake operation and vehicle acceleration and adapts the shift pattern accordingly.

It is sophisticated enough to assess the driver's intentions from the vehicle's dynamic behaviour and the accelerator pedal position. And, in addition, it recognises when the vehicle is travelling either uphill or downhill and modifies the shift pattern to allow increased power or engine braking, as appropriate.



Structure and operation of AI-SHIFT

Matching this advanced technology to the improvements in the Land Cruiser engines has produced some impressive results.

For instance, when mated to the 3.0-litre D-4D engine, Toyota's new five-speed automatic transmission brings a **12.5% improvement in acceleration** and, at the same time, a **13% improvement in fuel economy**, compared with the current four-speed automatic (for the 5-door

