

DRIVING DYNAMICS

ENGINES

In Brief:

There are two powerful, five-cylinder engines available for the XC70, a petrol and a diesel. Both are turbocharged and offer the flexibility of high levels of torque at lower engine speeds.

The 2.5T petrol engine boasts four valves per cylinder with a light pressure turbo and dual continuously variable valve timing to provide stirring performance with excellent mid-range torque.

Volvo's new D5 Euro IV turbodiesel is a refined, all aluminium unit, with 20 valves, and the latest common rail technology. It is available with a six-speed manual or a new six-speed Geartronic transmission.

In full:

At the heart of the Volvo XC70 are two powerful, five-cylinder, turbocharged engines that both deliver an impressive combination of performance and flexibility:

- 2.5T petrol: 210bhp, 320Nm of torque from 1,500rpm to 4,500 rpm; a max speed of 130mph, with 0-62mph in 8.1 seconds and emissions of 244 g/km.
- New D5 diesel: 185bhp, 400Nm of torque from 2,000rpm with Diesel Particulate Filter and Euro IV compliant; a max speed of 130mph, with 0-62mph possible in 9.5 seconds with emissions of 201g/km.

Engine	2.5T	D5 Euro IV
Type	2521cc, 5 cylinder, 20v, turbo (petrol)	2401cc, 5-cylinder, 20v, turbo (diesel)
Bhp	210	185
Torque Nm/rpm	320Nm at 1,500 rpm	400Nm at 2,000 rpm
CO2 g/km	244 manual/266 Geartronic	201 manual/224 Geartronic
Top Speed mph	130 mph	130 mph
0-62 mph seconds	8.1 manual/8.5 Geartronic	9.5 manual/10.0 Geartronic
Kerb* weight Kg	1667	1701
MPG: man/Geartronic		
Urban	20.0/18.1	27.7/25.2
Extra urban	35.8/33.2	46.3/40.9
Combined	27.7/25.4	37.2/33.2

Steering/tyres	Rack and pinion with 205 (16in) section tyres.
Turning circle, m (ft)	11.9 (39ft)
Transmission	5 speed manual (2.5T) 6 speed manual (D5) Auto: 5 speed Geartronic
Brakes: Front discs Rear discs	16in – 305mm 16in – 288mm
Fuel Tank litres (gallons)	68 (15.0)
<u>Load capacity:</u> litres (cu ft)	
Rear seats up	485 (17.1)
Rear seats down	745 (26.3)
Rear seats down (load to roof)	1641 (58.0)
Load length: rear seats up	1077mm
Load length: rear seats down	1848mm
<u>Dimensions:</u> (mm)	
Length	4733
Width (excluding mirrors)	1860
Unladen height	1562
Wheelbase	2763
Front track width	1611
Rear track width	1548
<u>Ground clearance:</u> (mm)	
Standard height	209
With 2 persons	193
Max towing weight braked (kg)	1800 (all models)
Max total weight (kg)	2220 (all models)
Max payload (kg)	541 (2.5T); 472 (D5)
Max roof load (kg)	100
Max trailer 'noseweight'	90

(Full technical data, prices and options information available at www.media.volvocars.co.uk)

2.5T

The 2.5T belongs to the RN range of five-cylinder, all-aluminium, in-line petrol engines. It features four valves per cylinder, a twin cam head, centrally mounted spark plugs and dual continuously variable valve timing (CVVT). The latter operates on both the exhaust and inlet cam and helps to minimise emissions, especially when the engine is cold, and maximise torque at low engine speeds.

Boasting a capacity of 2521cc, the 2.5T develops 210bhp and 320Nm of torque from as low as 1,500rpm up to 4,500rpm, and provides impressive mid-range flexibility.

Against the stopwatch, the manual Volvo XC70 2.5T achieves 0-62mph in 8.1 seconds and a maximum speed of 130mph. It is capable of 27.7mpg on the official Combined cycle with emissions of 244 g/km. The figures for the Geartronic (auto) version are 8.5sec, 130mph, 25.4mpg and 266 g/km, respectively.

D5

In the UK, the majority (at least 86 per cent in 2004) of Volvo XC70 customers choose the performance, flexibility and range of a diesel engine. And from the 2006 model year, Volvo

now offers a new, substantially updated version of Volvo's acclaimed and refined 2.4-litre, five-cylinder turbodiesel: the D5.

The new D5 engine offers a six-speed manual gearbox or the option of a new six-speed Geartronic (from October 2005).

These enhancements have been achieved as a result of customer feedback and achieved by the following technological developments and extensive changes to performance characteristics of the D5 diesel engine - see following details:

- New electronic glow plug system for faster starting.
- More advanced injection process with 7 spray holes (instead of 5) in each injector for complete fuel atomisation and more efficient combustion and enhanced performance.
- New, larger and more efficient turbocharger with electronic control for faster/more precise control of charge pressure; plus larger compressor wheel, new cambered vanes for improved response at all speeds, and reduced turbo lag.
- Turbo centre housing now water cooled to provide continued cooling after engine stops.
- Improved flow of air/exhaust gases for optimal flow and reduced drop of pressure.
- More powerful engine management system with more sensors to improve regulation.
- EGR (Exhaust Gas Recirculation) system modified for improved flow/regulation.
- New, more effective cooling system for EGR.
- New, faster, electronically controlled throttle moves EGR gases/ regulates temp better.
- Air swirl in combustion chamber is now infinitely variable for more efficient combustion.
- Increased volume for combustion chambers, and consequently a lower compression ratio.
- Larger catalytic converter with oxygen sensor for more precise emissions control.
- NOx emissions reduced by 50%
- Maintenance free, coated diesel particulate filter (Euro IV compliant) automatically burns off soot particulates approximately every 500 miles.
- Low emissions superior to Euro IV control standard requirements:

	<u>Euro IV requirement</u>	<u>D5 (S60 example)</u>
CO (Carbon monoxide)	0.500 g/km	0.207 g/km (58% better than required)
NOx (nitrogen oxide)	0.250 g/km	0.187 g/km (25% better than required)
Particulates	0.025 g/km	0.001 g/km (96% better than required)

As a result, the power and torque of the new D5 engine has significantly increased - from 163bhp to 185bhp, and 340Nm to 400Nm, respectively. With the high level of torque available from 2,000rpm, excellent mid-range flexibility is assured, with a top speed possible of 130mph and a 0-60mph time of 9.5 seconds (one second quicker than 10.5 seconds of the previous D5). Yet despite strong performance, the XC70 D5 achieves 46.3mpg on the extra-urban cycle, and 37.2 miles on a gallon of diesel on the Combined cycle. With the new,

coated diesel particulate filter particulate emissions are reduced by 96 per cent. The D5 has carbon dioxide emissions of 201g/km, while all other emissions are now substantially below the levels required by the Euro IV compliance.

CHASSIS

In Brief:

The all-wheel drive (AWD) Volvo XC70 combines the ability to traverse mixed terrain with a sophisticated load compensating suspension set-up, and the on-road dynamics and high torsional rigidity of the Volvo V70.

An increase in the ground clearance by 69mm compared with the Volvo V70, together with all-wheel drive with the latest AWD with Instant Traction™ and chunky Pirelli Scorpion STR tyres, mean the Volvo XC70 is surprisingly capable over rough terrain and poor surfaces.

More active drivers may be interested in the option of Volvo's active 'Four-C' (Continuously Controlled Chassis Concept) chassis, initially introduced on the high-performance V70 R, and subsequently available for the XC70 (standard SE Lux) with separate Sport and Comfort settings available at the touch of a button.

The Four-C chassis continuously monitors the car and road conditions up to 500 times per second and simultaneously adjusts each Monroe-Öhlins shock absorber and interacts dynamically with the DSTC system, brakes and steering for optimised ride and handling. The system also actively adjusts dampers to reduce roll during cornering, dive during braking and squat during acceleration.

In Full:

- AWD with Instant Traction™ for impressive all-terrain and on-road performance.
- Electronic Haldex coupling system maximises traction between front and rear axles.
- Volvo's TRACS anti-spin system also distributes power across the axle.
- Lower centre of gravity and weight than an SUV.
- 209mm Ground clearance (69mm more than V70, and 9mm less than XC90).
- Active 'Four-C' chassis with Sport and Comfort settings available (Std SE Lux).
- DSTC (Dynamic Stability and Traction Control) fitted as standard.
- High torsional rigidity benefits safety and chassis dynamics.
- Wider front track than Volvo V70 for improved stability in all conditions.

- Sophisticated multi-link rear suspension.
- Load compensating suspension fitted as standard.

The strength of the Volvo XC70 concept is its ability to combine the on-road dynamics of the critically acclaimed Volvo V70 with the mixed-terrain ability of an SUV.

The sophisticated suspension set-up and high torsional rigidity are shared with the Volvo V70, but the front track is wider for enhanced stability in all conditions.

A high level of torsional rigidity is crucial to providing a consistent ride and handling balance, and it also enhances a vehicle's crash performance. Volvo's engineers met their rigidity targets through the extensive use of High Strength Steel (HSS) and the application of bonding techniques in place of the more usual spot welding. Bonding, unlike spot-welding, produces a continuous join that increases the rigidity of the structure and also steals less space in, for example, the luggage area. The technique clearly works, as the Volvo XC70 is 50 per cent stiffer than its predecessor.

Suspension

The Volvo XC70 shares its basic suspension set-up with the Volvo V70, but with modified geometry and an extra-wide track. The MacPherson strut front suspension employs dampers and coil springs that are combined in a single unit and are positioned asymmetrically in relation to the strut. Beneath the spring struts are triangular lower links, with an anti-roll bar attached directly to the bottom of the struts themselves. Anti-lift and anti-dive technology also enhances the car's stability in all conditions.

At the rear, the Volvo XC70 employs a sophisticated multi-link system, mounted in a chill-cast aluminium subframe. This is attached to the body at four points via insulating rubber bushes to keep noise and vibration to a minimum. The use of aluminium helps keep the weight down, while the compact design ensures that there's no encroachment on passenger or luggage space.

Four links on each side – hence multi-link – comprised of two trailing arms, upper and lower links, a track rod and an anti-roll bar, control the movement of the wheels. As with the front suspension, the coil springs and dampers form a single unit. This system permits a small degree of passive rear wheel steer when cornering, to aid stability. In recognition of its role as a load carrying estate, the Volvo XC70 features load compensating suspension as standard.

The revised suspension geometry and the introduction of chunky 215/65 R16 Pirelli Scorpion STR tyres have resulted in a change in the track widths when compared with the Volvo V70. The Volvo XC70 has a front track of 1611mm, compared with 1560mm for the Volvo V70, which promotes extra stability in rough conditions.

These changes also incorporate an increase in ride height, to help the Volvo XC70 cope with rough terrain. It has a total ground clearance of 209mm, which is 69mm more than a Volvo V70 and compares well with rivals such as the Audi Allroad and even some SUVs.

AWD with Instant Traction™

The Volvo XC70's all-wheel drive system has the latest electronic system developed in conjunction with the Swedish specialist, Haldex. It operates independently of driver input, distributing torque automatically between the front and rear wheels for the best possible grip in all conditions.

For 2006 model year, a new 'pre-charged' function uses a non-return valve within the coupling making 80Nm of torque instantly available to the rear wheels if the sensors detect any slippage. It feeds more power to the rear wheels as the car pulls away to improve acceleration. Once moving, power is balanced between front and rear, reducing drive to rear wheels when not needed, and reducing fuel consumption.

The intelligent AWD system uses a variety of sensors to monitor the road surface and the steering wheel, brake and accelerator pedal positions. In normal driving conditions on dry roads, almost all the power is distributed to the front wheels. However, for off-road work, or if the sensors detect slippage, torque is diverted to the rear wheels to maximise traction.

The XC70 further benefits from Volvo's TRACS anti-spin system and DSTC (Dynamic Stability and Traction Control). TRACS prevents wheel spin by transferring power across the axle if it detects a wheel is losing grip on one side.

In addition, the DSTC system increases driving safety on twisty roads and in slippery conditions by using sensors to detect if one of the driven wheels shows any sign of losing traction and cutting the power to it at lightening speed so it can quickly regain grip. And if the car shows any tendency to skid, the system steps in to automatically brake the relevant wheels to help maintain smooth control.

All XC70 models benefit from ABS brakes with EBD (Electronic Brake Distribution) and EBA (Electronic Brake Assist) which senses an emergency stop and automatically brings the car to a halt in as short a distance as possible.

Active 'Four-C' Chassis

The advanced electronics of Volvo's active 'Four-C' (Continuously Controlled Chassis Concept) technology allow all of the car's dynamic systems to communicate and work in unison and has now been specifically optimised for the variety of UK road conditions.

The car's speed, wheel movement and steering are continuously monitored via Multiplexed control systems that update the suspension settings 500 times per second.

The advanced electronics allow the driver to choose between different suspension settings at the touch of a button on the dashboard for maximum driver choice, control and enjoyment. The system is designed to help counteract the cars natural dynamic tendencies:

- TAKE OFF: When accelerating away from standing start, the rear dampers are set to maximum stiffness to help prevent acceleration squat and optimise front wheel traction.
- BRAKING: When braking the front dampers are stiffened to reduce 'brake dive'. This allows greater rear end grip so more rear braking effort can be used.
- CORNERING: When cornering the outside dampers are stiffened to reduce roll and provide extra grip and traction.

The Four-C system, standard on SE Lux models, offers the choice of Sport or Comfort chassis settings, and both settings are programmed to compensate the suspension to account for heavy loads or if the XC70 is towing.

STEERING, BRAKES AND TRANSMISSION

In Brief:

The Volvo XC70's steering and braking systems have been tuned to maximise driver enjoyment and safety, both on and off-road. The rack and pinion steering provides a linear response and plenty of feedback, while the anti-lock brakes are boosted by Electronic Brakeforce Distribution (EBD), plus Dynamic Stability and Traction Control (DSTC) with Electronic Brake Assist (EBA).

There is also an optional speed dependent system available that provides additional assistance at low speeds and more steering feel as speed increases.

A five-speed manual gearbox is standard on the petrol powered XC70, and a six-speed manual for the diesel. For those who prefer to let a computer take the strain, Volvo also offers five and six-speed Geartronic automatic transmissions. This system adapts its shift points to individual driving styles and also benefits from a sequential, manual shift facility for added control.

In Full:

- Power-assisted, ZF rack and pinion steering optimised for feedback/response.
- Anti-lock brakes with Electronic Brakeforce Distribution (EBD).
- Dynamic Stability and Traction Control with Electronic Brake Assistance (EBA).
- Speed dependent steering available (optional).
- Five-speed manual transmission for 2.5T petrol engine or five-speed Geartronic transmission available.
- Six-speed manual transmission for D5 turbodiesel or new six-speed Geartronic
- Optional Geartronic automatic transmission adapts its shift patterns to suit individual driving styles and includes a sequential, manual shift facility for added control .

The Volvo XC70 uses a power-assisted rack and pinion steering system that has been developed to optimise driver feedback and response, both on and off road. The steering feel has been improved through careful tuning of the torque build-up during cornering, which helps the driver to place the car accurately on the road.

Large disc brakes, which are ventilated at the front, deliver a firm and consistent response, whatever the payload. As you'd expect from Volvo, an anti-lock braking system is fitted as standard assisted by Electronic Brake Force Distribution (EBD). EBD constantly distributes braking power between the front and rear wheels to ensure maximum retardation regardless of the road conditions.

In addition, Dynamic Stability and Traction Control (DSTC) are standard on all XC70 models with EBA (Emergency Brake Assist). This senses when an emergency stop is required and automatically applies maximum braking performance.

The 2.5T engine model is supplied with the 'M56' five-speed manual gearbox. This compact unit uses a three shaft (one input/two layshaft) system in place of the more traditional two shaft design, which contributes to the smooth, positive shift quality.

The D5 turbodiesel is available with a six-speed manual gearbox as standard, but for 2006, a new six-speed Geartronic automatic transmission is offered when production starts in October

2005 (and for any customers wanting automatic transmission but unable to wait until then, a 2.4D Euro III engine is available).

The Geartronic transmission automatically adjusts its shift points to reflect the driver's style and also offers a manual, sequential-shift facility where the driver is able to choose gears individually by tipping the lever forwards to change up and backwards to change down.