This press pack accompanied the UK launch of the third generation Supra in 1986. The model underwent some changes during its time on sale and these can be tracked using the Timeline feature on the third generation Supra archive web page. Additional assets and information relating to the Supra range can be obtained from the Toyota press office.

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SUPRA SUPREME

Toyota's 1986 flagship sets new standards

Toyota GB Ltd launches a new flagship today: the fastest, safest, most dramatically styled and lavishly equipped car ever put into production by Japan's largest motor manufacturer.

New from stem to stern, the 1986 Toyota Supra (unlike the Celica derivative which preceded it) is a unique model in its own right: a front-engined, rear driven, four-seat Grand Tourer with a 3-litre 201 bhp six-cylinder engine that provides blistering performance with the docility of a limousine.

Years of development and more than 200,000 miles of prototype testing have gone into a car which embodies state-of-the-art Toyota engineering in every department. The dohc 24-valve engine is one of the most advanced normally aspirated engines in the world, fitted with Toyota's acoustic control induction system; knock control; twin-nozzle fuel injection; and an electronic engine management system which

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not only ensures optimum efficiency but has its own self-diagnostic facility, capable of identifying a malfunction and either stopping the engine immediately or allowing the car to be driven safely to a garage.

The bare facts record a maximum speed of 138 mph and 0-60 mph acceleration in 8.0 seconds (manufacturer's figures). Yet the Supra owner in less haste can virtually ignore the gear lever, counting on more than 80 per cent of the enormous torque from a mere 1200 rpm to way beyond the 6000 rpm peak of the power curve.

Transmission options are a five-speed manual or four-speed electronic automatic (also equipped with a self-diagnostic system), offering a driver-selected choice of "normal" or "power" modes. A limited-slip differential is standard.

The suspension, researched to the nth degree, uses double wishbones and coil springs front and rear with ultra-low profile unidirectional Goodyear tyres developed from that company's Formula One rain tyre. Ventilated disc brakes all round are controlled by Toyota's version of the Bosch ABS anti-skid system. Rack and pinion steering is power assisted, with a high ratio for quick response and precise control.

A wind tunnel-developed (0.32Cd) body shell, made largely from high-tensile and galvannealed steel, encloses the kind of furnishings and equipment for which Supras have been known since the first model bore the name in 1978: air conditioning, multi-way adjustable seats, memory tilt-cum-telescopic adjustment for the steering column, cruise control, central locking, electric windows and a new electronically tuned stereo radio/cassette player with four speakers.

The Supra manual costs £15,299, the automatic £15,999. Hide upholstery, at £747, is the only optional extra.

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For further information please contact Simon Small,
Redhill (0737) 68585.

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INTRODUCTION

Background - the Supra story

It is important to stress from the start that the new Toyota Supra is a new model in its own right. It is not a derivative of any other Toyota model.

This was not the case of course with previous Supras, which were prefixed by "Celica" and were clearly related to Toyota's Celica models.

The first Toyota to carry the Supra (or Double X) tag evolved in 1978 from the second generation Celica model. The Supra was given a longer nose, aerodynamic liftback styling, rectangular headlights and a T-shaped grille. There was a choice of two EFI six cylinder engines of 1988 cc and 2563 cc - both considerably more powerful than the four cylinder units fitted to the Celica models.

1981 saw the introduction of the third generation Celica, followed in August 1982 by the all new Celica Supra. It featured more aggressive styling and more power than its Celica ST/XT stablemates. Flared wheel arches and wide low profile Pirelli P6 tyres on attractive dished, alloy wheels were added in 1983.

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Since the Celica Supra's introduction to the UK in August 1982, registrations have improved steadily to almost 1500 units:

1982 - 293

1983 - 1012

1984 - 1385

1985 - 1442

The sales target for 1986 is about 1,000 units comprising 200 of the old Celica Supra and 800 (split roughly equally between the manual and automatic) of the new Toyota Supra.

There is little doubt that the Corolla GT and Coupe, MR2 and Celica GT have done much to reshape and enhance Toyota's image over the past 18 months. The new Supra can only further endorse the immense progress made by Toyota in their quest for the application of advanced technology into a range of performance cars, whilst at the same time never neglecting the motoring requirements of the mass market.

But the Toyota tradition of high powered sports cars goes back further than that. In 1967 Toyota unveiled the exotic 2000GT - their first "grand touring" car. It was powered by an in-line six-cylinder engine with double overhead cams and triple carburettors. The 2000GT had a five speed synchromesh manual transmission, four wheel disc brakes and magnesium alloy wheels. It also had front and rear double wishbone suspension. Nearly 20 years on, the new Supra continues the traditions of innovative, advanced engineering and high technology.

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New Supra - design and development objectives

In their quest for a sports grand touring car which employs the most advanced technology and yet is practical and viable to build in volume production, Toyota set the following objectives for the development of the Supra:

1. A high performance chassis with outstanding stability and precise handling
2. A smooth, powerful and responsive engine
3. A comfortable, high quality luxury interior
4. Aerodynamic and aggressive styling.

In response to these goals, the Toyota Supra boasts the following innovations and features:

* A rigid chassis with all-round fully independent double wishbone suspension, ventilated disc brakes and Toyota's anti-lock braking system.

* A new and advanced 3 litre straight six engine with twin cams, 24 valves, the new Accoustic Control Induction System and dual nozzle fuel injection.

* A luxurious and sporting interior with air conditioning, cruise control, memory tilt and telescopic steering column, eight-way adjustable sports seat, central locking and high performance audio system.

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* Styling developed through extensive wind tunnel testing with hidden pillars and flush panels contributing towards optimum high speed stability and minimal air resistance.

Toyota quality

Every Toyota is built to exacting standards of quality - and the Supra is no exception. Stringent pre-production testing takes in the most punishing conditions such as freezing winters, scorching summers and every kind of extreme situation.

High tensile steel is used extensively, resulting in a highly durable and strong body. The use of galvannealed steel and advanced plastics helps to prevent corrosion. The body goes through a full-dip phosphate process and then proceeds through an electro-deposition bath where a layer of protective primer is electro-deposited over the entire body and into every nook and cranny. All seams are sealed and adhesives keep out the moisture. Chip resistant undercoatings are used to give resistance to flying stones. The new Toyota Supra is covered by a six year anti-corrosion warranty.

In the factory, Toyota use computers and assembly experts to ensure that every Supra is assembled perfectly.

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SPECIFICATION: TOYOTA SUPRA

Engine

Model	7M-GE
Type	6 cylinder, twin cam, 24 valve, water cooled, longitudinal mounting
Bore and stroke	83 x 91 mm
Capacity	2954 cc
Compression ratio	9.2:1
Max power DIN	201 bhp
at	6000 rpm
Max torque DIN	187.4 lb ft
at	4800 rpm
Fuel system	Electronic fuel injection
Battery	16Ah
Alternator	70A + IC
Fuel capacity	15.4 gallons (70 litres)

Transmission	Manual	Automatic
Type	5-speed	4-speed
Ratios 1st	3.285	2.804
2nd	1.894	1.531
3rd	1.275	1.000
4th	1.000	0.705
5th	0.783	-
Reverse	3.768	2.393

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Clutch	Aisan, single dry plate
Diameter	206 mm (8.1 in)
Final drive	Helical gear
Ratio	3.909 (manual) 4.100 (automatic)

<u>Suspension</u>

Front	Independent, double wishbones, coil springs, anti-roll bar
Rear	Independent, double wishbones, coil springs, anti-roll bar
Shock absorbers	Gas filled, double acting hydraulic telescopic

<u>Steering</u>

Type	Rack and pinion, power assisted
Ratio	16.5:1

<u>Brakes</u>	Ventilated disc front and rear, dual circuit with servo. ABS anti-lock system
Diameters	Front 302 mm (11.9 in), Rear 291 mm (11.5 in)
<u>Wheels</u>	7JJ x 16 inch aluminium alloy with centre cap
<u>Tyres</u>	225/50 VR 16 Goodyear Eagle

<u>Dimensions</u>

Wheelbase	102.2 in	2595 mm
Track, front	58.5 in	1485 mm
rear	58.3 in	1480 mm
Overall length	181.9 in	4620 mm
width	68.7 in	1745 mm
height	51.6 in	1310 mm

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Dimensions (cont)

Ground clearance	6.1 in	155 mm
Turning circle	36.7 ft	11.2 metres
Kerb weight (manual)	3307-3406 lb	1500-1545 kg
(auto)	3362-3461 lb	1525-1570 kg
Towing capacity		
braked trailer	3748 lb	1700 kg
unbraked	1323 lb	600 kg

Performance (manual)

Maximum speed	138 mph
Acceleration 0-60 mph	8.0 sec

DoE fuel consumption: mpg (litres/100 km)

	Manual	Auto
Urban cycle	21.6 (13.1),	20.8 (13.6)
Constant 56 mph	36.7 (7.7),	38.2 (7.4)
Constant 75 mph	29.7 (9.5),	31.4 (9.0)

Prices	Basic	Car Tax	VAT	Total
	£	£	£	£
Supra manual	12,280.00	1,023.33	1,995.50	15,298.83
Supra automatic	12,842.00	1,070.16	2,086.82	15,988.98
Hide upholstery				747.50

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For further information please contact Simon Small,
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STYLING AND INTERIOR

Styling

The new Toyota Supra was conceived as a sporty, high quality, luxury car - Toyota's premier, prestige model. In keeping with other development goals, the Supra needed a comfortable, functional and luxurious interior coupled to aerodynamic and muscular styling.

The Supra had to exude power and high performance but the styling had to be good looking as well as efficient. It has been styled for improved high speed stability, cross-wind stability, maximum speed, acceleration and fuel efficiency. The drag coefficient is Cd 0.32.

The rigid body of the Supra has been selectively reinforced and was designed as an integral part of the suspension system. The result is lower noise and vibration levels as well as handling and performance unmatched by most sports cars.

The front end of the Supra uses pinched corners and integral wrap-around side/indicator lamps which blend smoothly into the side protective mouldings. The large bumper has an integrated front air dam which balances the appearance and improves the aerodynamics.

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The rear end functions as an integral spoiler and has a transparent protective wrap-around moulding, chamfered corners and rectangular rear lamp clusters designed for clear visibility.

Rear pillars are integrated and hidden within the quarter glass and rear window. The fully retractable headlamps blend perfectly into the nose and serve a threefold purpose: sleek looks, minimal drag and minimal lift.

The Supra also has tinted glass, a rear window wash wipe, pop-up halogen headlights with electric water jet cleaners and low mounted front fog lamps. Even the door mirrors are heated for quick demisting, defrosting and clearance of moisture.

Interior

Another goal for the Supra was the creation of a comfortable interior which would be quiet, provide adequate space and incorporate feelings of luxury, quality and sportiness. The interior has been designed to keep the driver (and passengers) as comfortable as possible for better efficiency and less fatigue.

Careful consideration was given to the materials and design of the interior with special attention paid to the driving position, which may be tailored to the individual needs of drivers.

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The instrument panel is laid out logically, using analogue instruments for outstanding visibility and instant recognition. Positioning of all important switches ensures instant access.

The steering column is memory tilt-and-telescopic. This allows the steering wheel to tilt through six separate positions - the preferred position can then be memorised. The telescopic mechanism allows the wheel to be adjusted fore-and-aft over a range of 40 mm.

A cruise control system is standard on the Supra, enabling a preset speed to be automatically maintained for more comfortable cruising. For easy operation, the controls are mounted unobtrusively on the steering wheel spokes.

The sports driving seat is adjustable eight ways so that, together with the range of adjustment in the steering column, the majority of drivers should be able to find the ideal driving position. Seat adjustments include height, headrest fore-and-aft and up-and-down, full stepless reclining, quick reclining and power assisted lumbar and side support.

The rear seat will provide comfortable accommodation for two, but with the back rests folded forward luggage space can be increased.

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The Supra also features a new ventilation system. The ram air volume has been increased by 34 per cent over the previous Celica Supra model, from 142 cubic metres per hour to 190 cubic metres per hour (when the air conditioner is not in use).

Air conditioning is another standard feature providing automatic maintenance of the in-car atmosphere regardless of the weather conditions outside - all through the year. And because air conditioned air is dehumidified, it clears misted up windows very rapidly and helps prevent drowsiness.

Of course, the Supra has power windows and central locking. Customers may specify cloth or hide upholstery.

The Supra also has a new audio system with a high power amplifier and four bass-reflex speakers. The unit incorporates a stereo cassette player and electronic tune stereo radio.

No matter what the speed, the internal noise level of the Supra is probably lower than that of any of its competitors. A special engine fan mount, a dynamic damper on the drive shaft, a double layer exhaust pipe and an extra capacity silencer all contribute to reduced noise levels.

The engine for the new Toyota Supra is a natural development of the engines in the MR2 (16 valve 4A-GE) and the Celica (16 valve 3S-GE). Designated 7M-GE, the Supra uses a three litre, in-line six cylinder twin cam with 24 valves and is the latest example of Toyota's commitment to high output, high efficiency multi-valve engines.

Development goals for the 7M-GE included high power, a smooth and instant response, a free revving character, good fuel consumption, good driveability, low noise and outstanding reliability with low maintenance costs. The result is an engine with high performance, that's flexible and easy to use in cities or on the open road.

7M-GE engine

This latest version of Toyota's M series engines will accelerate the Supra from 0-60 mph in 8.0 seconds and will take the car to 138 mph. But the 7M-GE is not only about outright power. Performance is also about fuel efficiency and ease of use. Maximum power is 201 bhp at 6,000 rpm and maximum torque is 187.4 lb ft at 4,800 rpm. But the free revving nature of the six cylinder 24 valve twin cam provides a very broad and usable power band with more than 80 per cent of the maximum torque available at any point between 1,200 rpm and 6,400 rpm.

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The 7M-GE was designed as a three litre high performance engine for in-line mounting in front engine, rear wheel drive vehicles. The three litre, reliable M series engine, with a twin cam, multi-valve cylinder head and Toyota's Acoustic Control Induction System (ACIS) results in one of the most advanced normally aspirated engines available.

Cylinder head

Toyota are now the world's largest manufacturers of multi-valve engines. For the 7M-GE, the twin cam cylinder head is made of aluminium alloy which is strong, light and has outstanding thermal conductivity. The combustion chambers are pentroof designs with centrally placed spark plugs. The result is a fast and efficient burn.

The four valve per cylinder design uses two valves for intake and two for the exhaust, increasing the breathing areas of the valves and ports. This gives better volumetric efficiency at high engine speeds with low flow resistance. The cylinder head is of cross-flow configuration.

The angle between the intake and exhaust valves has been kept at a narrow 50°, helping to keep the engine compact.

Engine block

The 7M-GE uses a strong and reliable cast iron block based on the 5M-GE engine from the previous Celica Supra

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model. But the crankshaft and conrods have been redesigned to increase the stroke by 6 mm giving a displacememt 200 cc larger than the 5M-GE engine at 2954 cc. This has substantially increased power, bottom end torque and fuel efficiency.

The shape of the counterweight was changed to cope with the additional power from the larger engine. This has created a more rigid structure with minimal flex and twisting, resulting in even better reliability and less power and torque loss.

Acoustic Control Induction System (ACIS)

In many four valve per cylinder engines, the broad valve area means low intake velocities at low-to-medium revs, causing rough idling, poor low speed torque and fuel consumption. The Toyota ACIS solves these problems by means of an intake air control valve inside the surge tank, optimising the effective length of the intake manifold. The result is ideal volumetric efficiency under any engine condition. The valve is activated by an electronic control unit which monitors engine speed and throttle valve angle.

Knock control system

Many high performance engines suffer from knocking caused by changes in atmospheric conditions and fuel grades. The Supra engine's knock sensor detects knocking when it occurs in

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the combustion chambers and retards the ignition until knocking no longer occurs.

To maintain ultimate performance, this system always keeps the timing at the ideal point just short of knocking.

Fuel Injection (EFI-L) system

An innovation on the Supra's engine is a new three-group electronic fuel injection system which precisely controls the fuel supply and the injection timing. The results are minimal hydrocarbon emissions and improved transient response during acceleration.

The system also features a newly developed two-hole fuel injection nozzle which simultaneously injects fuel into each of the two intake ports per cylinder. This ensures the best possible injection direction, for the most efficient combustion.

Toytoa Computer Controlled System (TCCS)

The Toyota Computer Controlled System of engine management uses a variety of sensors and a microcomputer to constantly monitor the Supra's running conditions. It controls the fuel injection, ignition, engine idle speed and the ACIS in optimum condition.

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The TCCS employs an ECU (electronic control unit) with a built-in microprocessor. The ECU stores data for fuel injection duration, ignition timing, engine idle speed etc. with this data being matched with various engine conditions and programs. The ECU then uses this data and the signals from various sensors to make calculations with the stored programs to determine the optimum operating conditions for the engine.

The TCCS performs the following functions on the Supra.

EFI - the ECU determines the fuel injection duration according to intake air volume, engine speed, coolant temperature and other signals and controls the fuel injection. The fuel injection timing is also based on this information.

ESA (electronic spark advance) - the ECU controls the igniter by using various sensors to determine the amount of ignition advance over the initial set timing of the distributor. Using the signals from the knock sensor, the ECU also controls the ignition timing in accordance with the octane value of the fuel.

ISC (idle speed control) - engine speed signals allow the ECU to control the ISC valve so that the actual idling speed is matched to the target idling speed stored in the ECU. While the engine is warming up, the ECU, based on coolant temperature information, signals the ISC valve to increase engine speed to fast idle.

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Intake air control - depending upon throttle opening and engine speed signals the ECU controls the intake air inertia in the intake manifold. With this system, the engine's output is improved in the medium speed range and fuel consumption is improved when the load on the engine is light.

Fuel pressure control - using signals on coolant temperature, intake air temperature and starting, the ECU controls the pressure regulator and raises fuel pressure. Re-starting when the engine is hot is greatly improved.

Fuel pump speed control - the ECU, based on intake air volume and engine speed signals, controls the fuel pump control relay regulating fuel pump speed. So, when the engine requires a large volume of fuel, the pump turns at higher speeds than when only a small volume of fuel is required.

Diagnosis - if trouble develops with any signals which are being constantly monitored by the ECU, the driver is notified by means of the Check Engine Lamp. The content of the trouble is stored in code so that a technician using the diagnostic check connector can quickly determine the trouble.

Fail safe - should the ECU, judging from sensor signals, detect a malfunction it will control the engine using its own data or it will stop the engine.

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Even in the unlikely event of a malfunction in the ECU, a back-up-system is included which allows the engine to run while maintaining correct injection and ignition.

Transmission

The Toyota Supra is available with a five speed manual transmission or with Toyota's advanced Electronically Controlled (ECT) automatic transmission.

To achieve the maximum performance from the combination of a four speed automatic transmission and the powerful new engine, the ECT electronically adjusts up and down shifts and locking up timing to match different driving conditions and driver preferences. It bases its decisions on vehicle speed, engine coolant temperature, the use of the accelerator, the shift lever position and the engine conditions. The driver can choose between normal and power modes. ECT features a built-in self diagnosis system that makes maintenance easy.

The Supra transmission features a new high performance torque converter which was developed specially for use with the 7M-GE engine, thus improving the torque ratio for better acceleration and performance.

The shift control systems for both manual and ECT transmissions have been developed to provide smooth changes. The Supra rear wheel drive has a limited slip differential.

CHASSIS AND SUSPENSION

Background

The new Supra employs four-wheel double wishbone suspension in order to effectively transfer the high power output of the 7M-GE engine onto the road, and to achieve excellent handling and stability. Although this type of suspension system allows freedom of design, it has not often been seen in volume production cars because of high manufacturing costs and its less efficient utilisation of space compared with some other systems such as MacPherson strut front/semi trailing arm rear suspensions. The Supra is not the first Toyota to have four-wheel double wishbones though - the first was the 2000GT, introduced in 1967.

The chassis itself has been engineered for low noise, vibration and better handling, but before settling on this suspension system, the Toyota development team conducted painstaking tests in Japan. Given the knowledge gained during development of the high performance suspension systems for the MR2 and recent Toyota front wheel drive models, it was decided that four wheel double wishbone suspension would be ideal in exploiting the power of the 7M-GE engine and the high adhesion, ultra-low profile tyres planned for the Supra.

This choice was reinforced by the decision to separate the Celica and Supra model lines which, until now, have shared both suspension and major body components. By limiting the Celica to 2 litres and switching to front wheel drive, the

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Supra could be given a powerful 3 litre engine and left with rear wheel drive. This gave the Supra development team greater flexibility in chassis design and increased the budget for development and production.

The development objectives for the new Supra suspension were:

1 Improved high speed straight line stability
2 Improved high speed cornering
3 Improved controllability at the limits of adhesion
4 Lowest possible vibration and noise
5 Improved ride and comfort

The concept

The new 7M-GE engine promised a very high power output and the Goodyear 225/50 VR 16 tyres excellent road holding - a combination sure to encourage higher maximum speeds and faster cornering. This in turn would call for very high stability. This then, was the major goal in designing the Supra suspension.

By building in this stability from the start, the suspension could easily be adjusted to cope with increased power from (perhaps) turbocharging, or increased road holding from even wider tyres. Specifically, it was intended to minimise toe, track and camber changes during movement of the wheels when cornering, braking, acceleration, or hitting crosswinds and uneven road surfaces. Such minimisation

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eliminates unintended variance in direction. The resulting stability provided excellent control during and after lane changes and swerving to avoid obstacles.

The anti-roll bar is connected to the lower arms by rods and ball joints offering high roll resistance because even the slightest suspension arm movement is transferred direct to the roll bar.

Rubber bushes with inter-rings show less torsional resistance and double wishbone systems have more bushes than other types of suspension, so they have more resistance to suspension stroke. In fact, a prototype Supra fitted with bushes without inter-rings demonstrated this by showing torsion resistance so strong that the bushes almost supported the body without the aid of springs. It was as if the 16 bushes at the anchor points, front and rear, were small torsion bars. The prototype handled well over smooth surfaces but the overall ride and tyre contact over uneven surfaces were poor. Obviously the spring characteristics of 16 small torsion bars were far from ideal.

As well as using rubber bushes with inter-rings, suspension friction was reduced with resin linings for the ball joints connecting the tips of the suspension arms to the axle carrier. Together with low friction dampers, the Supra displays less friction than its predecessor or its competitors - regardless of the suspension systems employed.

Tie-rods are almost the same length and positioned at virtually the same height as the lower arms to minimise toe change during bump/rebound and to avoid instability from bump steer. The tie-rods were also designed to move parallel to the lower arm during fore-and-aft wheel movement, preventing compliance steer while allowing the wheels to move slightly aft to absorb bumps.

The lower arms pivot rearwards on their front anchor points to achieve the proper degree of compliance. At the same time, the tie-rods move in unison with the lower arms, preventing toe change as a result of fore-and-aft movement of the front wheels. With the front subframe cradling the engine, the bushes at the mounts between the body and the subframe are principally designed to absorb vibrations from the engine and suspension.

Changes in track on the Supra are minimised by the use of long lower arms which scribe large arcs so that the wheels move almost in a vertical plane during bump and rebound.

To determine the roll centres, the Toyota designers first chose the spring rate which they felt would give the right degree of comfort. They then tested innumerable front/rear roll centre combinations before finding a setting which gives the optimum roll resistance coupled to neutral handling. The front and rear roll centre heights of the Supra are 25 mm and 72 mm respectively.

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But the Supra suspension encompasses much more than stability alone. The designers also worked towards the quick and natural response to steering input preferred by sporting drivers. This involved extensive computer simulation during which toe, track and camber changes - together with deformation of suspension parts - from tyre movement and other exterior forces were studied.

Suspension development continued on the test bench using actual suspension assemblies. Wheel alignment, geometry, and degree of compliance and deformation of suspension components were measured and evaluated under simulated load conditions. Resulting data was cross-checked with the data from the computer analysis.

But the final geometry was not fixed during these initial design stages; that was left until road testing was completed. Several prototypes were built, each with a number of anchorage points. Together with length-adjustable suspension arms, this allowed the testing of various geometries. An almost infinite variety of combinations was tried involving roll centre height, anti-dive/anti-squat ratios, caster angles, trail, steering angles and kingpin offsets.

Subjective data from road testing was checked against computer and simulated date and adjustments made before the next road test. And so on; repeated trial and error until the ultimate in confidence-inspiring control and driveability was achieved.

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Prototypes were tested not only at Toyota proving grounds, but also in Europe, providing a variety of road surfaces and traffic conditions. The prototypes were driven more than 330,000 km outside of Japan.

Front suspension

The Supra front suspension configuration consists of an upper A-arm, a lower L-arm and an anti-roll bar. Both arms have rubber bushes at the anchor points connecting them to a rigid subframe cradling the engine.

Shock absorber/coil spring units join the tip of the lower arm to the inner side of the front wing, preventing wheel forces from acting on the subframe alone and ensuring sufficient shock absorber stroke. Low pressure gas filled dampers are used with teflon-coated piston rod guide bushes to reduce friction.

Unlike the previous Supra model, the rack and pinion steering assembly is positioned ahead of the axle line, giving a slight toe out underside force which provides additional stability during cornering. The difference in lateral rigidity between the tie-rods and the lower arms makes a slight toe change - or compliance steer - inevitable.

When the lower arms are subjected to lateral forces, the rubber bushes at the anchor points allow inward movement while

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the tie-rods have no bushes and receive none of the lateral force, therefore staying in place. So there is a choice: toe out when the tie-rods are ahead of the axle, toe in when they are aft. A steering assembly placed in front of the axle also allowed more freedom in the design of that system and its location.

Light unsprung weight and rigidity were built into the suspension from the start. The lower L-arm, which takes the brunt of the force from lateral and fore-and-aft movement of the wheels, is of heavy gauge steel sheet, much the same as in recent front wheel drive Toyotas.

Unitised L-arms are more rigid than an I-arm/trailing arm combination. The L-arm forward anchor points are located near the axis of the wheels and lateral forces on the wheels transfer almost directly to the subframe via these forward points. This reduces the vector of force trying to bend the lower arm forward, helping to maintain rigidity.

These anchor points have rubber bushes equipped with steel inter-rings which allow the bushes to resist lateral deformation even with softer rubber, yet they maintain fore-and-aft compliance. The rear anchor points, which are subject to very little lateral force, have hollow, soft rubber bushes. Forged aluminium upper A-arms have rubber bushes in front and rear anchor points, fitted with steel inter-rings.

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Rear suspension

The Supra rear suspension consists of upper A-arms, four lower arms and two trailing arms mounted on a sub-frame with rubber bushes at each anchor point. The damper/coil spring units are mounted on the axle carrier and the inside of the rear wings. The upper A-arms are of forged aluminium and inter-rings supplement the bushes where they are mounted on the subframe.

The lower arms are of hollow pipe at the front and heavy gauge steel sheet at the rear. This dual lower arm arrangement is similar to the dual link systems found on the rear of Toyota's front wheel drive cars. Slight toe-in is created against lateral forces by positioning the forward link closer to the axis of the wheels than the rear links so that the front link takes most of the force. The forward and rear links attach to the axle carrier equidistant from the wheel axis, dividing the lateral forces almost equally between the two arms, thereby assuring high lateral rigidity. The rear anti-roll bar is connected to the lower front arms by ball joints and rods.

Toe change in the rear suspension of the Supra is virtually eliminated in a number of ways. The forward lower arms are shorter than the rear lower arms preventing a toe change - or compliance steer - caused when braking by creating a slight toe-in, cancelling toe-out occurring as a result of the compression of the rubber bushes on the lower arms. The compliance allowing the aftward movement of the wheel necessary for a smooth ride is retained.

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The softer rubber bushes in the forward lower arm also help to minimise toe change caused by lateral forces. In semi-trailing arm rear suspension, the entire subframe tends to toe-out during hard cornering, but the new Supra offers advantages here, as it has six mounts compared to the four of semi-trailing arm systems. However, it does steer a little because the rubber mounts between subframe and body are designed with some compliance to complement that of the rear suspension itself. This slight toe-out is cancelled by toe-in generated by the larger deflection of the forward arm anchor point bushes.

Toe change is unavoidable because the forward lower arm is shorter than the rear. But the amount of toe change and its effect on stability are held to a minimum by using a long trailing arm. The lower arms are as long as possible to minimise changes in track caused by bump and rebound.

During investigations into roll centre heights, the rear suspension geometry was modified so that the rear roll centre moves lower and closer to the inside wheel as the body rolls. In other words, the Supra's rear end is designed to squat as it rolls, maintaining tyre grip on the road.

To reduce pitching when braking or accelerating, a 17 per cent anti-lift and a 37 per cent anti-squat ratio have been designed into the rear suspension which is combined with a 20 per cent anti-dive ratio.

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Wheels and tyres

Jointly developed by Toyota and Goodyear, the 225/50 VR 16 Eagle tyres are designed to complement the Supra's suspension system to give outstanding handling, braking and ride characteristics.

Wheels and tyres are "unidirectional" - that means that they work best when the tread elements are "pointing" in the direction of travel. Goodyear Eagle tyres have been developed directly from the company's successful Formula One racing rain tyres.

The tread pattern gives trapped surface water a natural path, sweeping it away from the centreline and squeezing it out - not just from the back. The result is improved wet road contact. The tread and heat resisting compounds also had their origins in Grand Prix racing.

These 50 per cent aspect ratio tyres are mounted on 7JJ-16 alloy disc wheels.

Brakes

An unsurpassed braking performance was a development objective for the Supra and so it features ventilated disc brakes on all four wheels with the Toyota anti-lock brake system (ABS) as standard equipment.

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Servo assisted 11.89 in at the front and 11.46 in rear ventilated discs work in tandem with the Supra's advanced suspension system to optimise performance under all conditions. A modified version of the Bosch ABS system, the Toyota ABS controls wheel lock-up in the event of emergency braking on dry and, in particular, wet and icy road surfaces.

Speed sensors at each front wheel monitor the speed of the left and right front wheels independently while another sensor on the transmission measures the average speed of both rear wheels together.

The information from each speed sensor is transmitted to a main microprocessor. If the microprocessor detects any discrepancy in the speed of a wheel as compared with the speed of the vehicle, it will automatically control the brake fluid pressure to that wheel's brake cylinder to ensure the most efficient and safe braking.

Steering

The Toyota Supra has power assisted steering with a ratio of 16.5:1 giving quicker steering response. The rigidity of the steering column has been increased, resulting in less vibration while retaining adequate "feel".

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