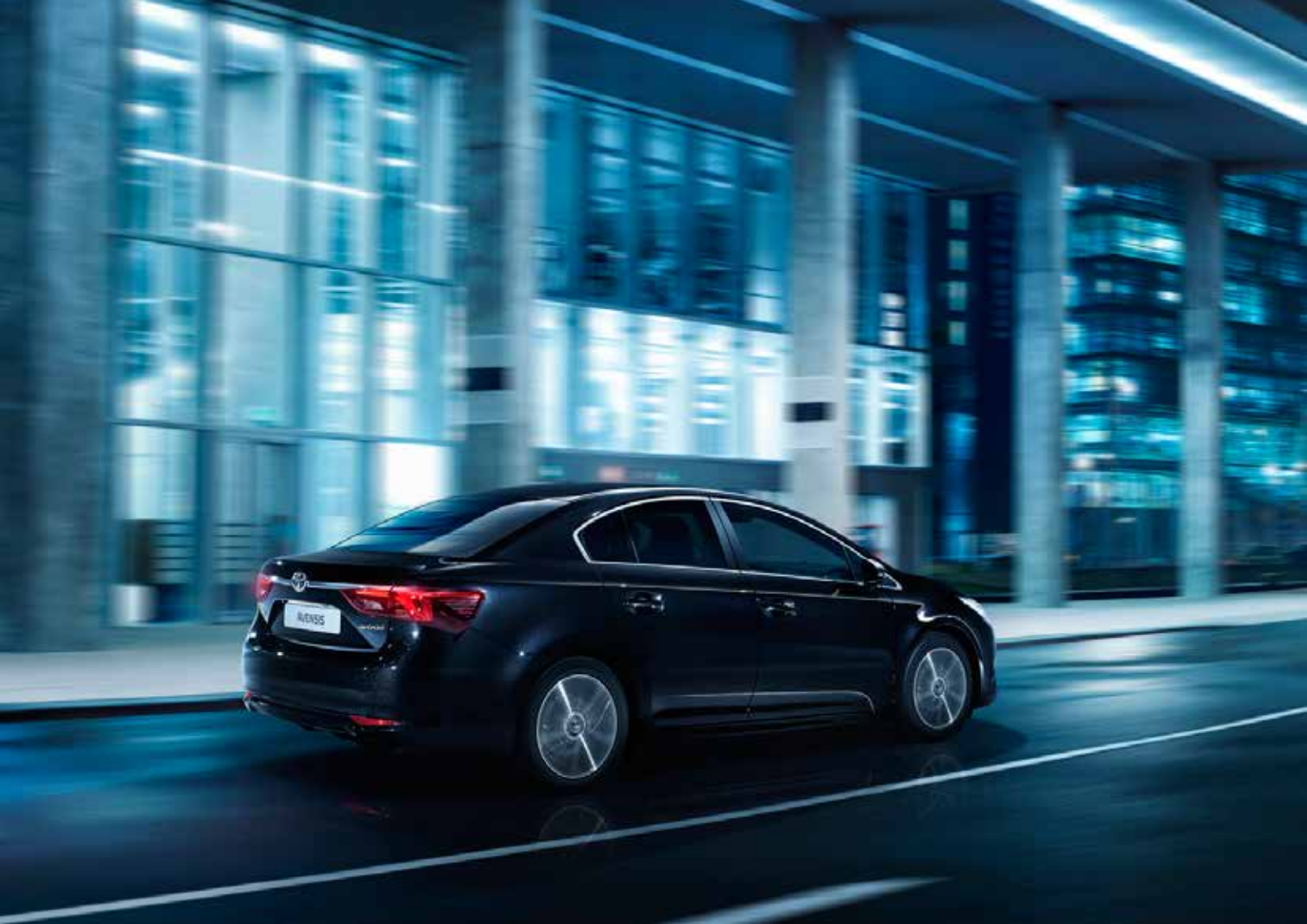
NEW AVENSIS

TOYOTA

ALWAYS A
BETTER WAY

JUNE **2015**


AVENSIS

NEW AVENSIS

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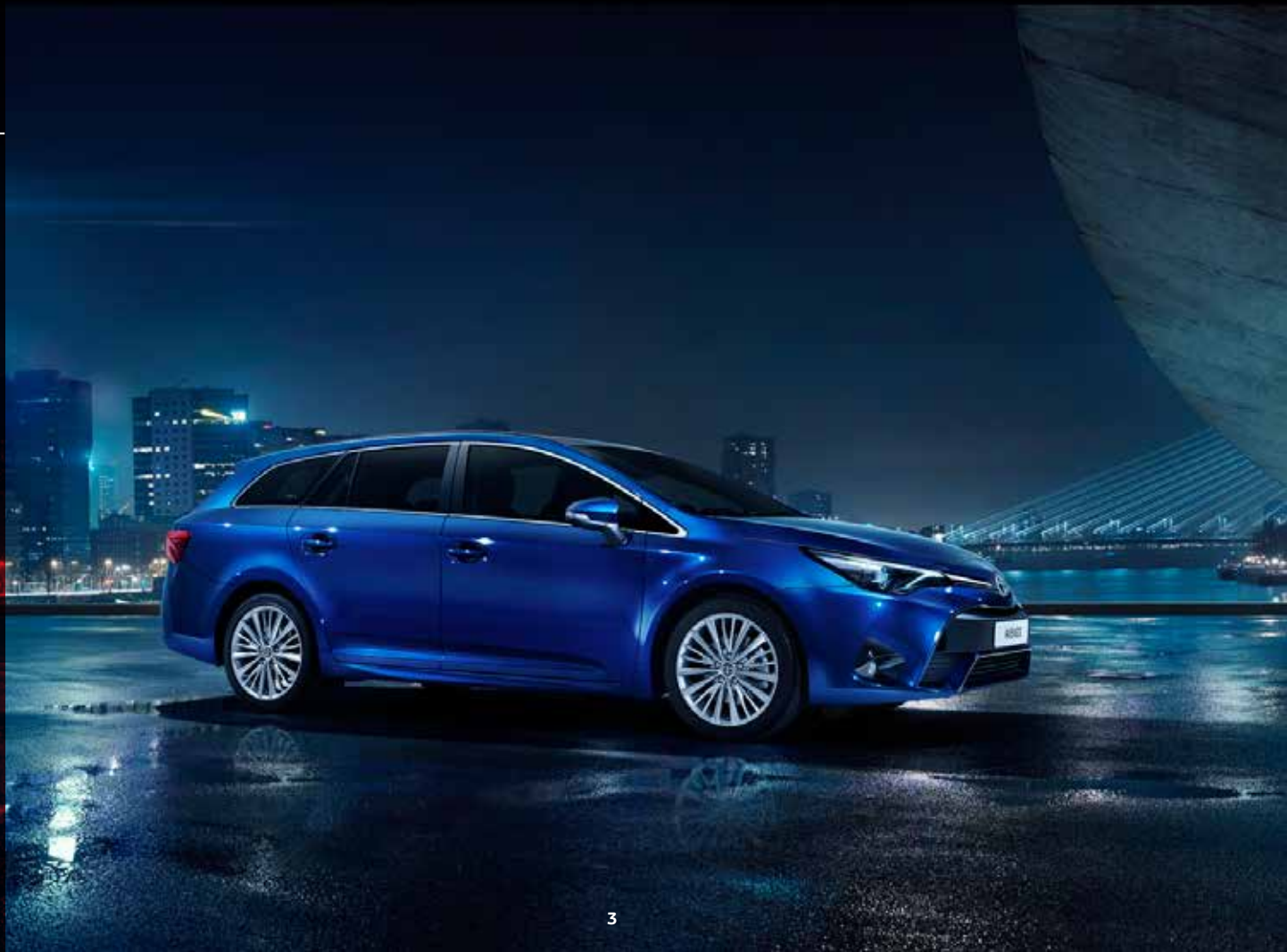
With its style, new engines and innovative technology, the new Avensis aims to make life easy for its customers. Regardless of version or grade, it is designed to be a prestigious, trustworthy, safe and comfortable companion.

PRESTIGE, COMFORT AND EFFICIENCY



Designed, engineered and built in Europe, more than 1,711,800 Avensis cars spanning three generations have appeared on European roads since its launch at the end of 1997.

Quality, Durability and Reliability has always been one of the Avensis' strongest suits. The current model is consistently highly rated in the D-segment for QDR, and in 2014 received the highest score in Germany's J.D.Power Vehicle Ownership Satisfaction Survey.

Though the Avensis has traditionally appealed to both private buyers and the fleet market, it is the latter, with a 75% share of total D-segment sales, which represents easily the largest sales base.

Responding, then, to both private buyers' demands for greater prestige, luxury and elegance and user-choosers' desires for increased sportiness, dynamism and chic, the new, 2015 Avensis has been designed to offer all its customers significant improvements in five key areas:

Styling – a new, more elegant, prestigious and dynamic exterior design with LED lamp technology.

Sensory Quality and Comfort - an all-new, more elegant and refined interior design prioritising significantly improved sensory quality, comfort, trim, finishes and colour schemes, and NVH.

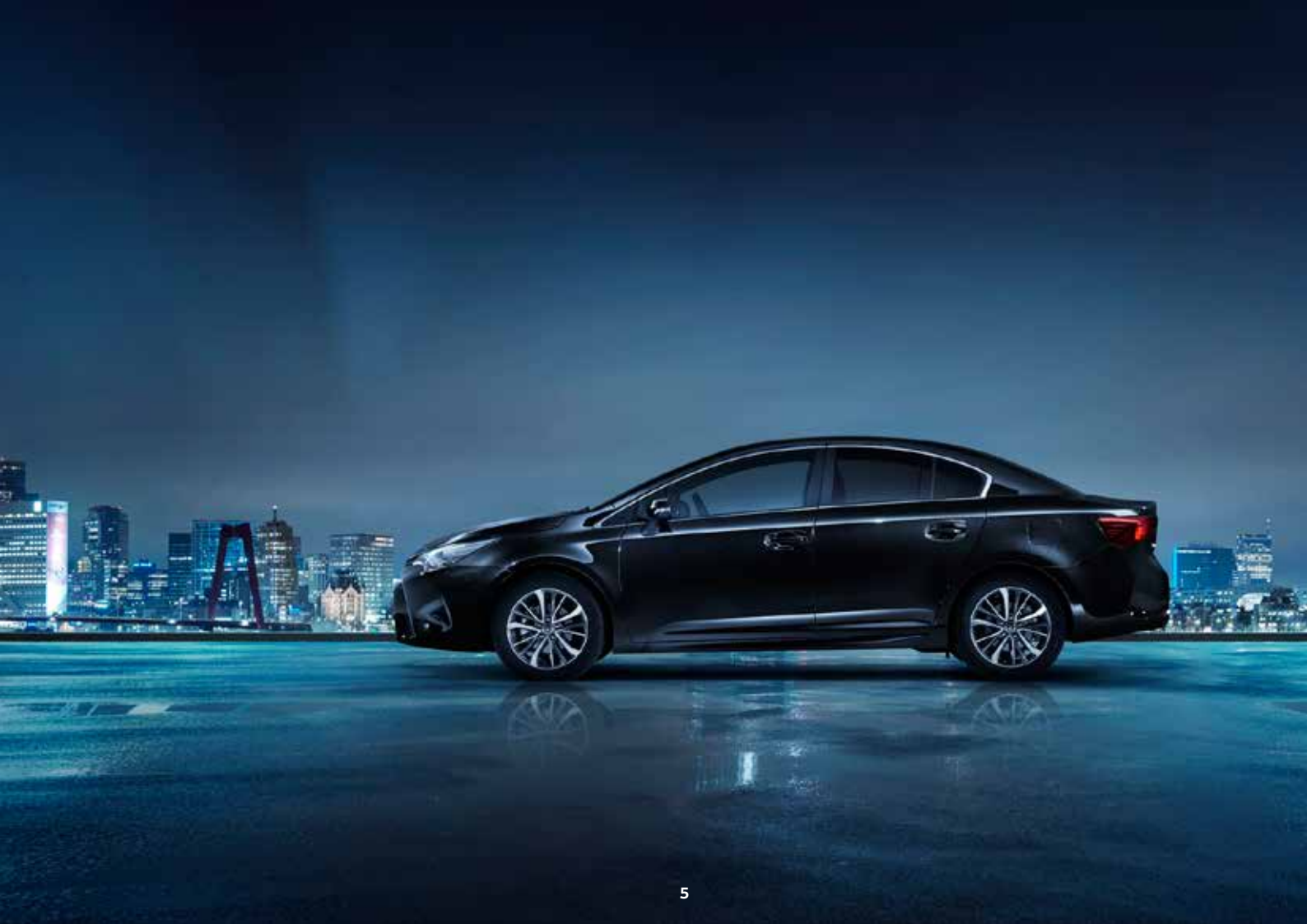
Safety - a comprehensive upgrading of safety systems designed to achieve a 5-Star Euro NCAP rating. A focus on active safety technology introduces the new Toyota Safety Sense system, fitted as standard across the model range.

Equipment and Value for Money - a new, more clearly differentiated grade structure with class-leading standard equipment levels and advanced technology such as the Toyota Touch 2 system and an 8" multimedia screen.

Driving Pleasure and Running Costs - two new diesel engines, lower CO_2 emissions across the entire range, larger service intervals and lower service costs, and chassis and steering refinements for improved ride and handling.

Toyota anticipates that these comprehensive enhancements will not only promote greater loyalty within the model's existing customer base, but also appeal to new customers who are attracted by the generous offer that the new Avensis represents.

DESIGNED, ENGINEERED AND BUILT IN EUROPE, MORE THAN 1,711,800 AVENSIS CARS HAVE APPEARED ON EUROPEAN ROADS SINCE 1997



Jon Corpe
TMUK Project Manager

Two weeks before the start of New Avensis production, we spoke to Jon Corpe from Toyota's Burnaston plant. He told us about the preparation required by the factory to simultaneously start production of the New Avensis and the New Auris

The simultaneous Start of Production (SOP) of two new models -Avensis and Auris- is a first for TMUK and, we think, a global first for Toyota. We don't have a dedicated Avensis line; we build it alongside the Auris on the same production line throughout -weld shop, paint shop and so on....

Normally, as the production of an outgoing model slows, the new model takes over on the line to compensate, and the number of cars leaving the plant remains fairly consistent. In this case, however, production of both old models stops at the same time and then both new models start. This simultaneous SOP means ramping up from zero to 800 vehicles per day over a period of just ten days.

To successfully achieve this involves two major challenges. The first is setting up the plant, and the second is meeting global demand for vehicles. Both models go to market immediately so we have to do this in a very short period of time. Even during production start-up we will be building up to 280 new Avensis per day.

The two new models mean we needed a significant update across the whole of our plant. Press, weld and paint shops have new tooling and jigs to support body manufacture and painting, and the substantial number of improvements to the vehicle, in such areas as handling and safety, require additional parts and processes.

But the greatest level of change is in the plastics and assembly shops. In Plastics the majority of processes are affected by the introduction of the new vehicles; new moulds and a great deal of new tooling and equipment.

In the assembly shop, over half the processes are new, and the introduction of Euro 6 has meant an update to our entire engine range across both models, plus, of course, 3 brand new engines.

Within Quality Assurance, the new engines and the introduction of Toyota Safety Sense creates a significant new dimension to the checks which ensure the quality of those vehicles and systems. For instance, we've had to install new road markings and road signage to our test track to fully confirm the real-world functionality of the lane-keeping, sign recognition and pre-crash systems.

This means our members -and TMUK has over 2,000 people operating on a rotating, day and night production shift- have had to train to build two different new models at once. Nothing remains the same; the Standardised Work – the foundation of our production method - has had to be rewritten. The specialist equipment has had to change, and the number of parts we have to manage has doubled.

It's a big challenge; a member must be equally skilled in building every variant of both models. Being built to customer order, they don't go down the production line in batches; it's just one production line with a huge variation of product.

Each process throughout the plant has what we call a Takt time. The Takt time we're currently operating means that a car will drive off the production line every 66 seconds, and everybody's process, wherever they work in the plant, is based around that 66 second time.

So, we have to redesign every process so that its work content is 66 seconds and then, before SOP, train every member to be able to complete their process on time, every time, without error. It's a huge task.

Obviously we have to manage two lots of equipment as well, including any new tooling. Plus, with two vehicles changing, the number of parts we have to change also doubles. A supplier's work can double too if they're supplying parts for both models.

TMUK has been involved in the new Avensis programme from the very early stages, influencing the design to ensure the quality of the finished product.

We call that first phase "Design and Development"; working alongside design and R&D, we study new designs and even build a 'digital' car using CAD to make sure the vehicle can be built and quality assured. Then we're involved in the confirmation assembly build of the very first vehicles to make sure quality can be built in. We assemble a number of vehicles with designers present and study the build process as we go. It's quite a long, intensive process, during which we're also writing and fine-tuning our standardised documentation of how to build the car.

During this phase, we look at the vehicle from four perspectives; we'll study each part -and the list for Avensis numbers around 3,000- make sure our tools and equipment are suitable, make sure the member can build it, and make sure the method of building is correct.

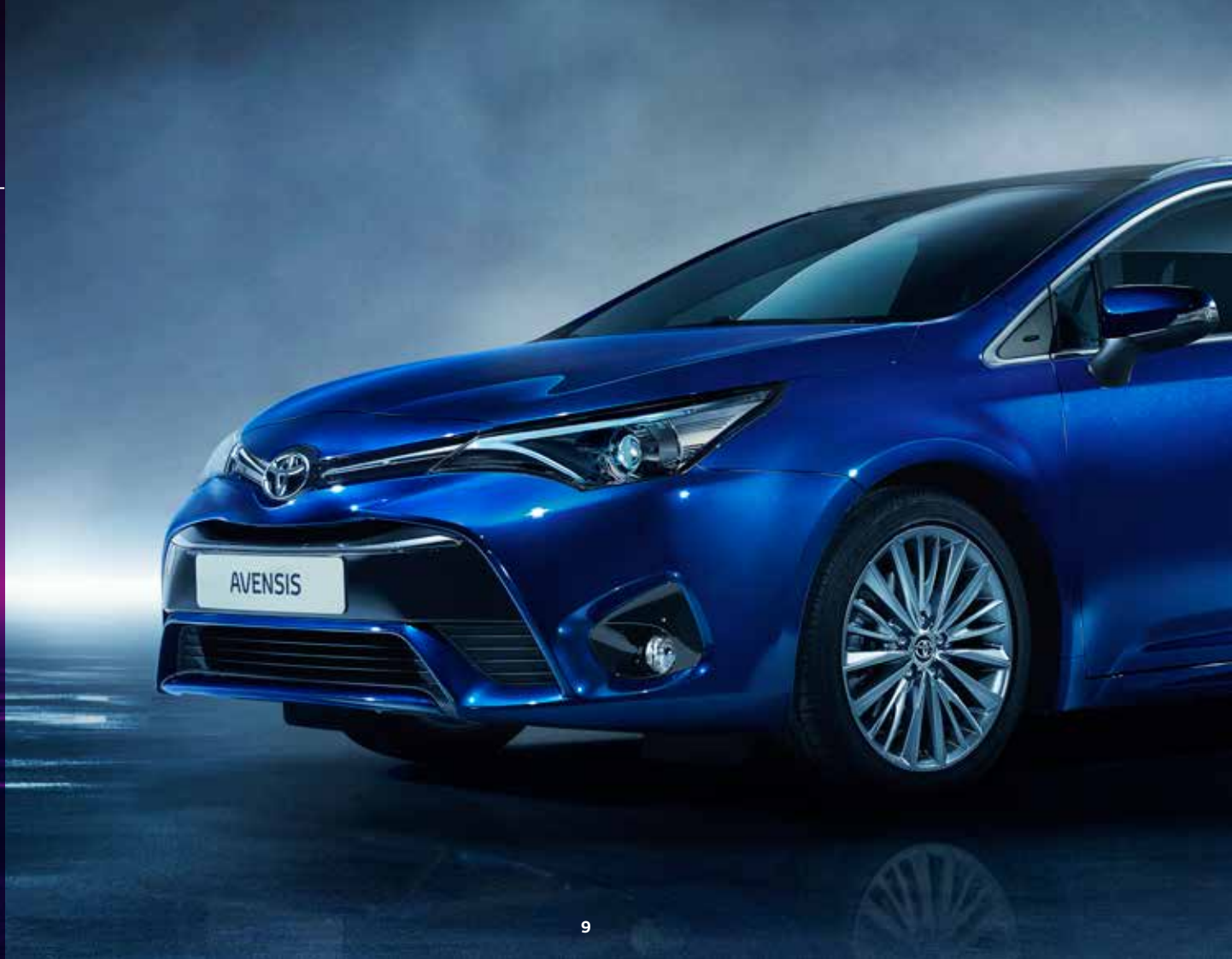
Because of our early involvement in the programme, we perfected many aspects of the assembly -the body build, the robot teaching and so on- early last year. Nonetheless, we still have a great deal to do.

The plant will be empty over a very short period -just the weekend- during which time we'll complete a very quick change-over of all the equipment we weren't able to change during preparation, re-stock the plant with new parts and begin the ramping up process.

Then we'll have just ten days to accelerate our production from precisely zero to 800 cars per day.

- ‘Energetic Elegance’ design theme for a more distinctive and dynamic appearance
- Second generation evolution of Under Priority and Keen Look design language
- Confident, three-dimensional architecture appropriate to Toyota’s European flagship

STYLING


AVENSIS

DYNAMIC APPEARANCE WITH GREATER ELEGANCE

Both the sedan and Touring Sports versions of the new Avensis have been styled under the design theme of 'Energetic Elegance' to combine a more distinctive and dynamic appearance with greater elegance and prestige.

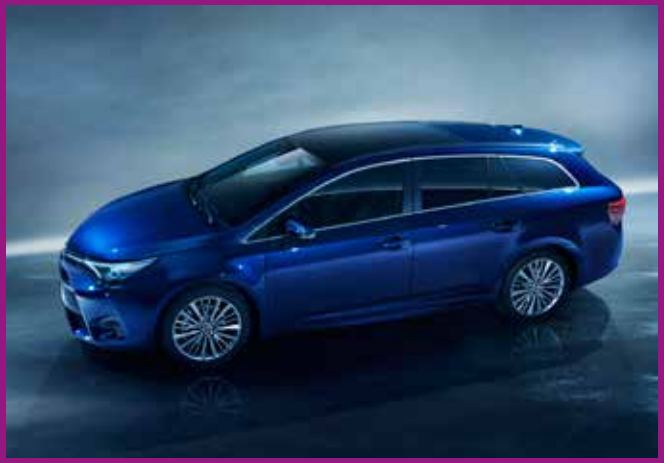
Extending overall vehicle length by 40 mm, the new front is a powerful, second generation evolution of Toyota's Under Priority and Keen Look design language. The design's strong, three-dimensional architecture gives the new Avensis the bold, confident D-segment presence appropriate to Toyota's European flagship.

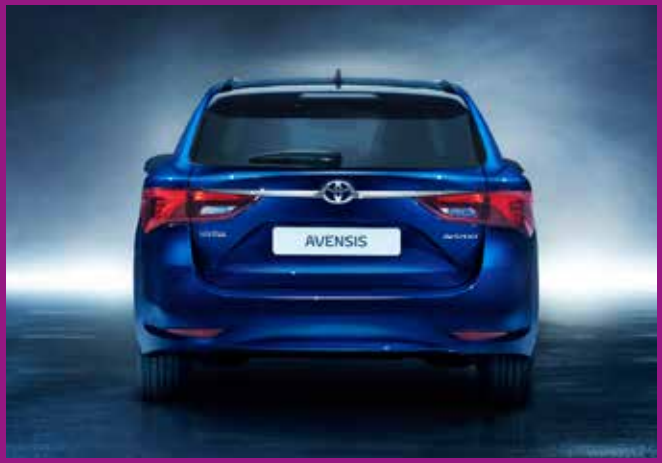
The Toyota logo is more prominently set within a smaller, more aggressively styled upper grille. The grille features a chrome trim bar which anchors new LED headlamp clusters. The headlamps incorporate LED Daytime Running Lights (DRL), giving the new Avensis a unique frontal signature.

Encompassing a gloss black-painted bumper centre, the lower grille has been significantly enlarged, reinforcing the new Avensis' solid front stance. In conjunction with the new grille's downward sweeping styling, foglamp housings pushed to the very extremities of the front bumper further increase the visual breadth of the vehicle.

To the side, a new rocker garnish places a more horizontal emphasis on the vehicle profile to visually lower its centre of gravity. This more elegant profile is further enhanced by a choice of new 17" and 18" alloy wheel designs.

The rear of the vehicle has also been designed for greater elegance, and to add further emphasis to its broad road stance. The rear lamp clusters incorporate LED light guide technology, giving the new Avensis a high-tech light signature.

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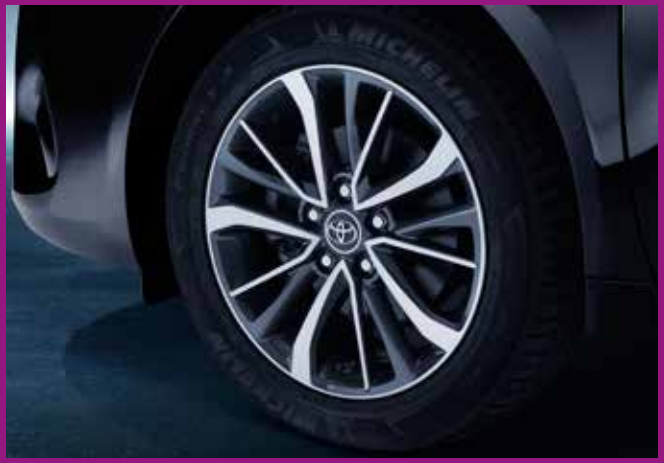


Eric Cornet
Senior Manager, Product Management Division

The role of European product planning is to ensure the smooth translation of market requirements into the work of the engineers and designers. By leading the Avensis project in Europe, with European development and European design, we ensure that European customer expectations are met.

Especially those of fleet customers. That's very important for this project, because fleet represents 75 % of the segment. Today, the decline in the D-segment is mostly attributed to private sales; fleet sales remain strong, so overall this is still an important segment in Europe.

So we researched fleet car drivers intensively -what we call the user/choosers, company car driver who have a say in the car they are provided with. We identified all their key requirements to ensure nothing is missing when they select their next company car.

Those requirements are strong exterior and interior style, value for money, sensory quality and equipment. But before that, it is the fleet manager of any given company who decides whether a car is added to the selection list in the first place. And for him, Total Cost of Ownership is also important, meaning low CO_2, low fuel consumption, high residual value, long service intervals and, of course, high Quality, Durability and Reliability.

We also know from our research that safety is a key requirement for fleet managers. So we must offer a car with a 5 Star Euro NCAP rating and with the very latest in active safety equipment. This is why the new Toyota Safety Sense system is standard on the new Avensis.

Within Toyota's fleet strategy, Avensis is a key product, because it enables us to offer a one-stop shop for fleet customers. Companies' fleet managers like to find one supplier offering a comprehensive range of products, both passenger cars and commercial vehicles, so having an offer in the D-segment is fundamental to that approach.

But there are other reasons why we have invested in this new Avensis:

we consider the car to be the Toyota brand flagship. It's not only an aspirational product amongst both existing and potential Toyota customers, but also a key profit contributor for the Toyota network, especially in regions such as Scandinavia.

On the other hand, Avensis is also a strong brand contributor in areas such as prestige. Moreover, it not only generates extremely strong customer loyalty, but also we find that when there is an Avensis in the family, there's a very high probability that the second car in that family will be another Toyota model.

So, in broad terms, Avensis customers are looking for more luxury, more comfort and more high-tech equipment. But we have to distinguish between the private and fleet customers...

Private customers are looking for a certain type of styling, which we've identified through our research as including elements of prestige, elegance and luxury. They are also looking for good value for money.

The fleet customers -who are, on average, younger and much less brand loyal- have different styling expectations. They want dynamism and sportiness. They too are looking at value for money, with a particular focus on high equipment levels.

So the design we gave to Avensis offers good balance between sportiness and elegance, as required by the differing tastes of the private and fleet markets. The new 'Keen Look' Toyota family face is important to ensure consistency with our other vehicles, but we also wanted Avensis to stand out, to be immediately noticeable as our flagship.

On board, for the first time in Toyota we have introduced what we call a Dual Ambient grade strategy. For Mid and Mid+ grades we offer two different executions; one is the more innovative Golden Copper interior designed to appeal to conquest user /choosers, the other a traditional yet stylish Lunar Grey targeting primarily our loyal private customers.

Knowing that fleet buyers often also have premium brands on their shopping list, we targeted new levels of sensory quality, to create what we call a 'One Grade Up' feeling. This we achieved through perfect consistency of colour, materials, character lines and backlighting. We use high tactility materials for the instrument and door panels, adding a new level of richness to the touch. And, unique to Toyota, we've introduced Alcantara to the seat upholstery as standard from Mid grade. In all, these measures help us achieve an interior which we feel offers one of the best perceived values in the class.

Equipment levels are also very important for European customers. We have best-in-class safety through the standard adoption of Toyota Safety Sense, and also in terms of HMI, with an 8" Toyota Touch 2 screen and a large, 4.2" colour TFT, multi-information display in the combi-meter, both standard from Mid grade.

The final element is dynamic improvement, where we focused on what we know is important for fleet customers who spend long hours at the wheel. So we have focused in particular on seat comfort -both overall comfort and holding performance- as well as NVH improvements for all diesel engines, and the petrol engines in combination with the CVT transmissions.

From the powertrain perspective, fleet is almost exclusively diesel, and that's why it was so important for us to update our offer; a new 1.6 and a new 2.0 litre which we know are really in the core of the segment and very competitive in terms of the relationship between CO_2 emissions and performance.

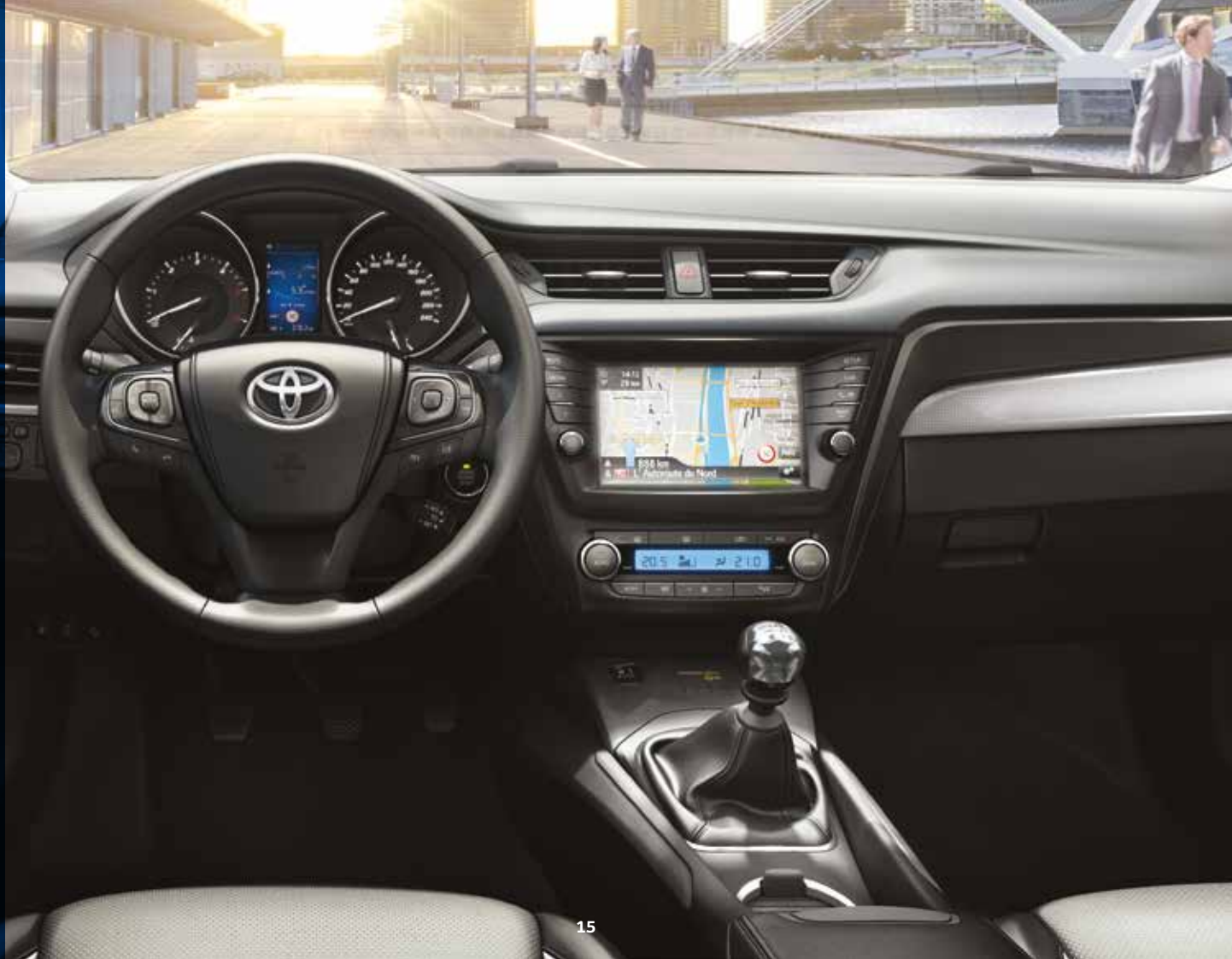
Compared to the previous generation engines, the 1.6D-4D reduces emissions by 11 grams, and the 2.0D-4D by 24 grams. That's significant improvement, not just fine tuning.

With the 1.6 diesel we're now entering the small engine sub-segment with Avensis, which is growing very rapidly due to CO_2-based taxation schemes -again very important for fleet. However, despite following this trend for downsizing, the 1.6D-4D is not an entry, eco version; our engineers have been able to maintain the high driveability and high comfort expected of a D-segment vehicle.

Private sales are more petrol biased in some markets. We have kept the same engines but significantly improved fuel efficiency, and the CVT transmission, both in terms of fuel efficiency and driveability, especially in city traffic.

- New, more elegant and luxurious, premium quality cabin with comprehensive sensory quality and NVH enhancements
- Improved shape and switchgear harmonisation, more consistent back-lit illumination, high quality trim and finishes, and matched colour schemes
- New, more supportive front seat design, ideally suited to long distance driving

SENSORY QUALITY, HARMONY AND COMFORT



One of the key aims of the new Avensis was to guarantee comfort and convenience across the entire range. The elegant and refined interior is an important contributor towards this goal.

Sensory quality and NVH levels have been lifted to the next level, and the cabin is further enhanced by improved shape consistency, premium quality trim and finishes, and carefully matched colour schemes.

The instrument panel is divided into two volumes. The sleek, full-width upper element showcases an instrument binnacle incorporating tubed tachometer and speedometer dials either side of a large 4.2" colour TFT multi-information screen (as of Mid grade).

The lower volume houses a centre console that is separated from the transmission tunnel and dominated by an 8" full colour touch-screen interface. An ergonomically superior steering wheel and gear lever design complete the cockpit.

The feel and operation of all switchgear has been improved, and sensory quality is further heightened by the careful harmonisation of text and symbols, and more consistent back-lit illumination.

Satin chrome highlighting to the instrument binnacle, steering wheel, centre console switchgear, air vents and gear lever has a crisper, higher quality appearance.

Fully described in the 'Equipment and Value for Money' chapter, a new range of more appealing interior finishes includes fabric and Alcantara seat upholstery, and a new, Dual Ambient colour scheme which gives customers a choice of Golden Copper or Lunar Grey interior finishes.

The new Avensis' more elegant and luxurious, premium quality cabin is further improved by a new front seat design, ideally suited to long distance driving.

The size of the upper backrest has been increased and the backrest bolsters redesigned, combining additional shoulder support with improved lateral holding performance. The seat suspension mat has been redesigned to improve pressure distribution and reduce long-haul fatigue. The cushion angle has been increased to offer better thigh support, and the cushion side bolsters reshaped to improve lateral hold.

NVH

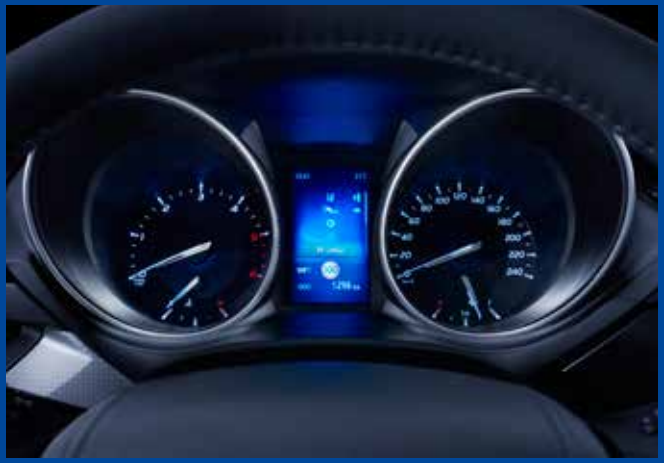
Noise, Vibration and Harshness (NVH) has been significantly reduced, ensuring that the increase in the new Avensis' interior quality and comfort is matched by a perceptible decrease in cabin noise.

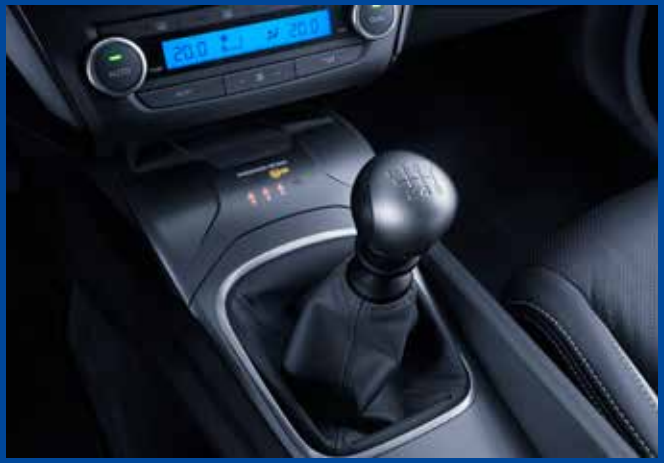
MORE ELEGANT, PREMIUM QUALITY CABIN

New and thicker materials provide additional sound absorption and insulation, and seal quantity, thickness and width have been increased throughout the bodyshell.

The hood insulator thickness and density, and engine under-cover insulator thickness and size have been increased, and an underbody damping sheet added for diesel variants. The upper instrument panel sound absorbing cushion and dash inner silencer at the front pillar have been enlarged, and a sound absorbing cushion added to the back side of the glove box. A polyurethane foam overmoulding has been incorporated within the fender protector.

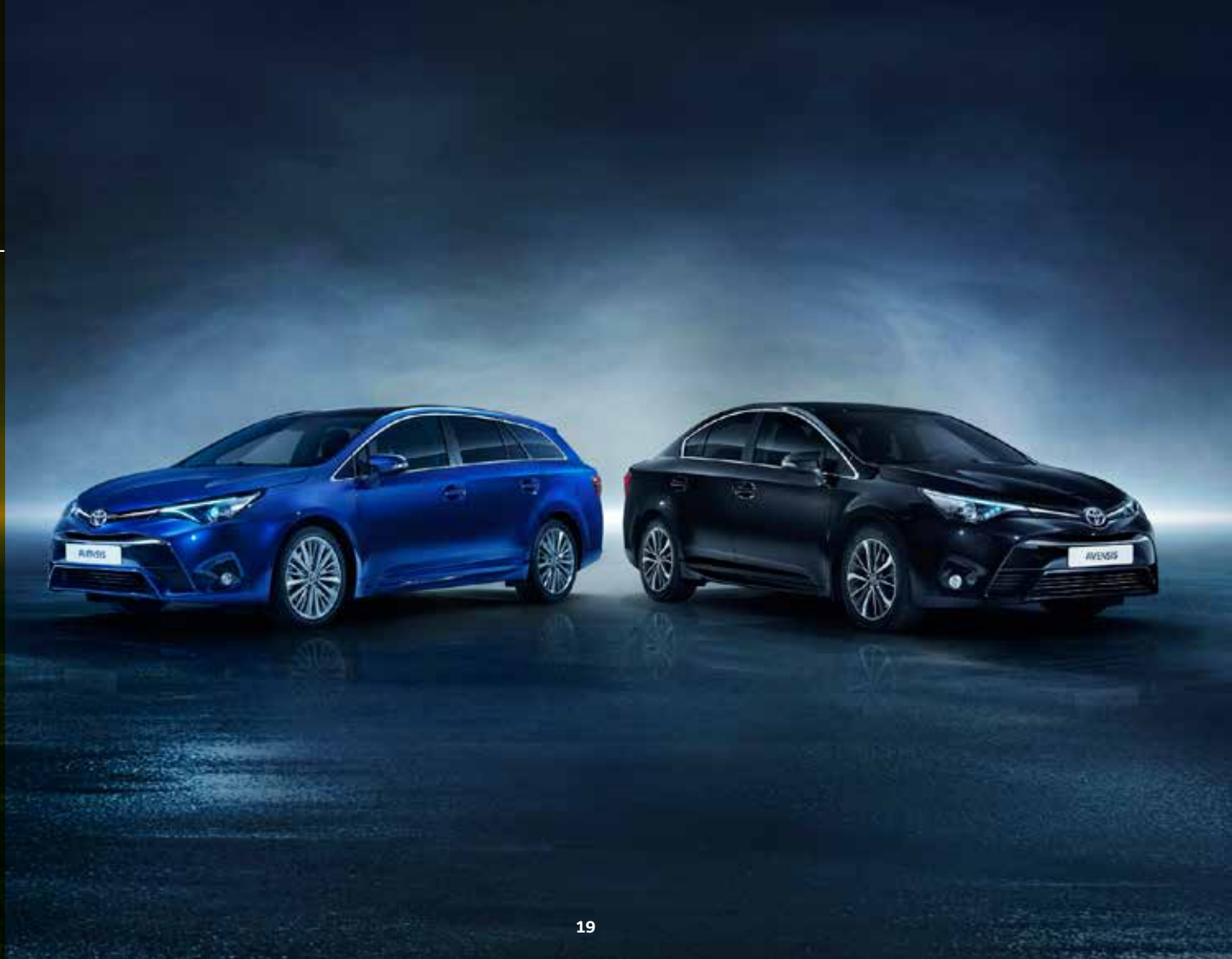
Air-conditioning noise has been reduced through improved heater air duct sealing, and versions equipped with a Skyview panoramic sunroof feature a roof-lining damping sheet.





- New grade structure targets fleet customers with class-leading standard equipment levels and advanced technology
- Mid grade business user specification includes segment-unique Alcantara upholstery and a new, Dual Ambient colour scheme
- New Toyota Safety Sense system fitted as standard across the range

EQUIPMENT AND VALUE FOR MONEY


AVENSIS
AVENSIS

Designed not only to appeal to private buyers but also fulfil every requirement of exacting fleet customers, the new Avensis features a clearly differentiated grade structure.

New **Entry**, **Mid**, **Mid+** and **High** grades combine higher standard equipment levels with improved refinement and sensory quality, and advanced technology such as the Toyota Touch 2 range of multimedia systems.

In addition to class-leading standard equipment levels, all **Mid** grades further offer the segment-unique appeal of partial Alcantara upholstery fitted as standard, and a new, Dual Ambient colour scheme which gives customers a choice of Golden Copper or Lunar Grey interior finishes.

Further bolstered by the availability of several equipment-enhancing option packs and a new Toyota Safety Sense system fitted as standard across the range, the new Avensis offers key equipment for fleet customers, outstanding value for money, and no compromise on safety at every level of the new grade structure.

Entry grade models feature a black and grey interior finish. They are equipped, as standard, with manual air-conditioning, cruise control with speed limiter, LED Daytime Running Lights (DRL), a radio/CD player with Bluetooth and USB connectivity, and the Toyota Safety Sense system.

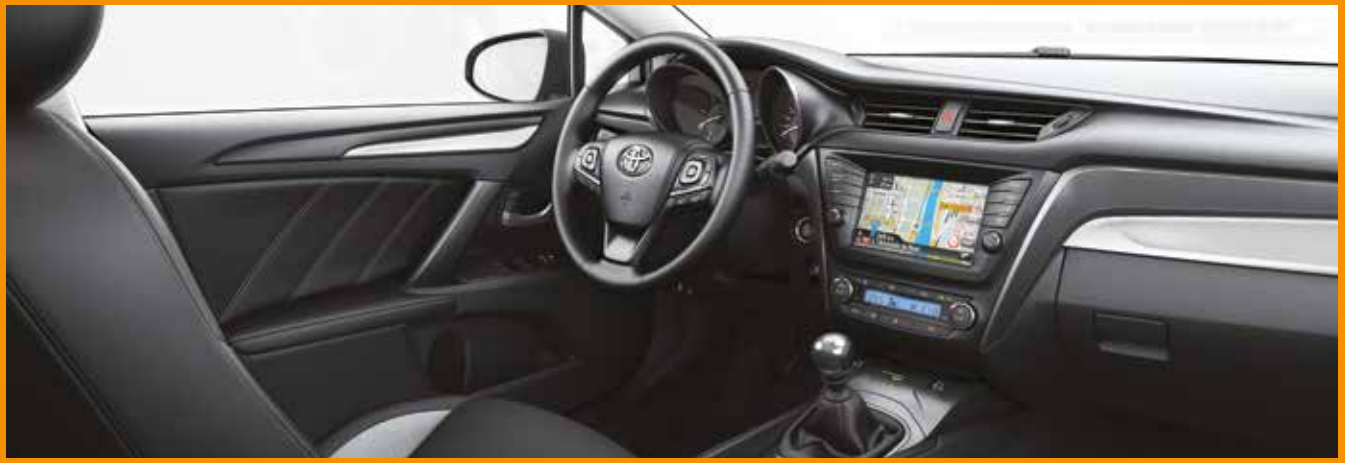
Mid grade showcases the Avensis' new, Dual Ambient interior colour scheme: a choice of Golden Copper or Lunar Grey finishes. It builds on the **Entry** grade specification with automatic air-conditioning, a 4.2-inch colour TFT multi-information screen, rain and dusk sensors, 17-inch alloy wheels, foglamps, fabric and Alcantara seat upholstery, rear privacy glass, the Toyota Touch 2 multimedia system incorporating a rear view camera.

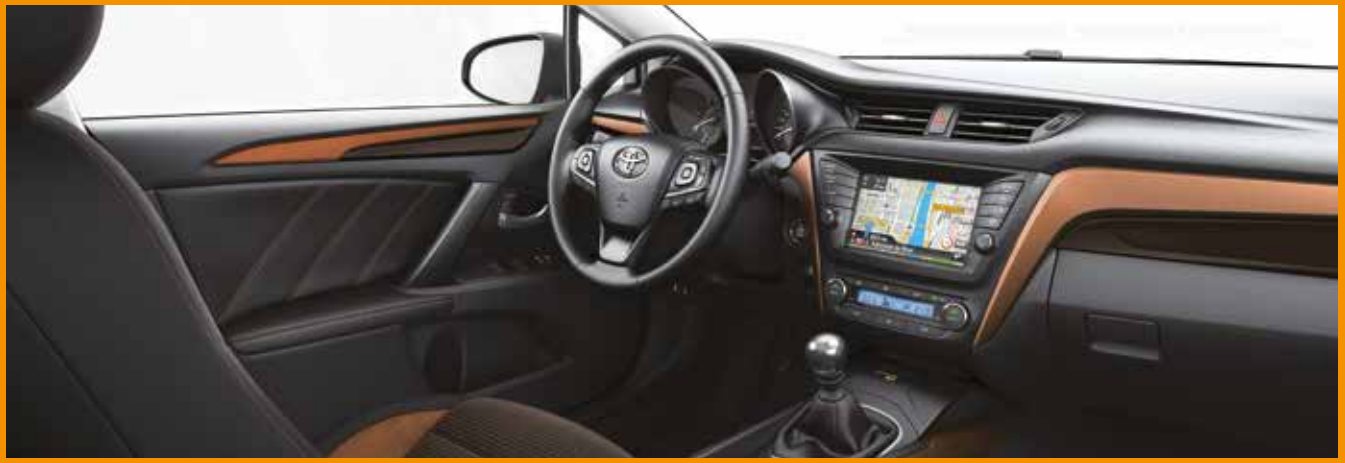
Specifically tailored to the requirements of fleet customers, **Mid+** grade enhances this core, business-user specification with the addition of LED headlamps and LED DRL lightguides with a unique signature, cornering foglamps, leather and Alcantara upholstery, rear privacy glass and 17-inch, machine-faced alloy wheels.

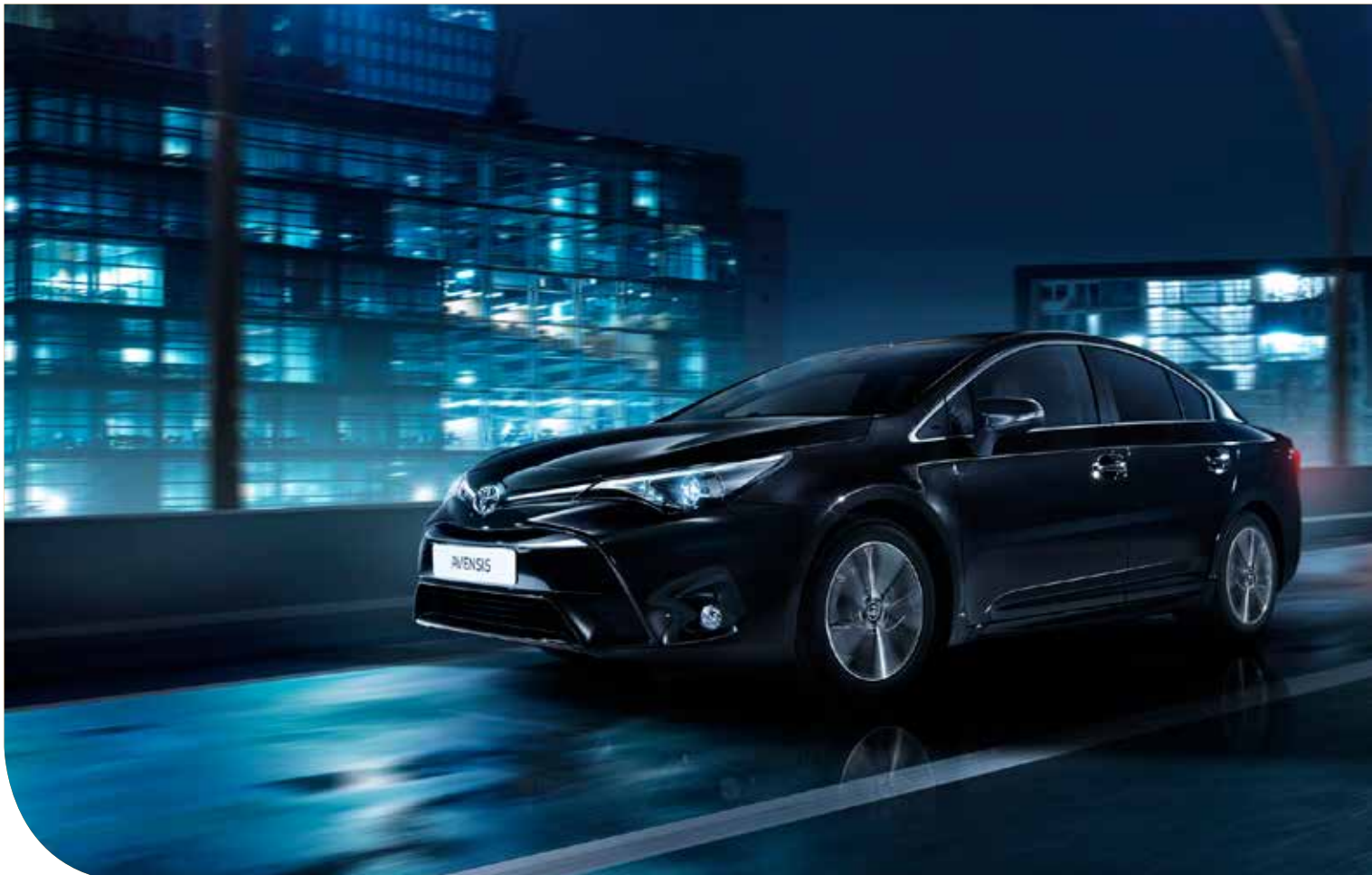
High grade offers customers the most comprehensive standard equipment. It builds on the **Mid+** grade with smart entry, full black leather upholstery, wood-style inserts and Toyota Touch 2 with Go Plus, incorporating a full map navigation system.

The **High** grade specification may be further upgraded with a Premium Pack, which features newly-designed 18-inch alloy wheels, LED headlamps incorporating an Adaptive Front Lighting system (AFS), power-operated front seats with a memory function and a Skyview panoramic sunroof.

MID GRADE SHOWCASES THE AVENSIS' NEW, DUAL AMBIENT INTERIOR COLOUR SCHEME: A CHOICE OF GOLDEN COPPER OR LUNAR GREY FINISHES



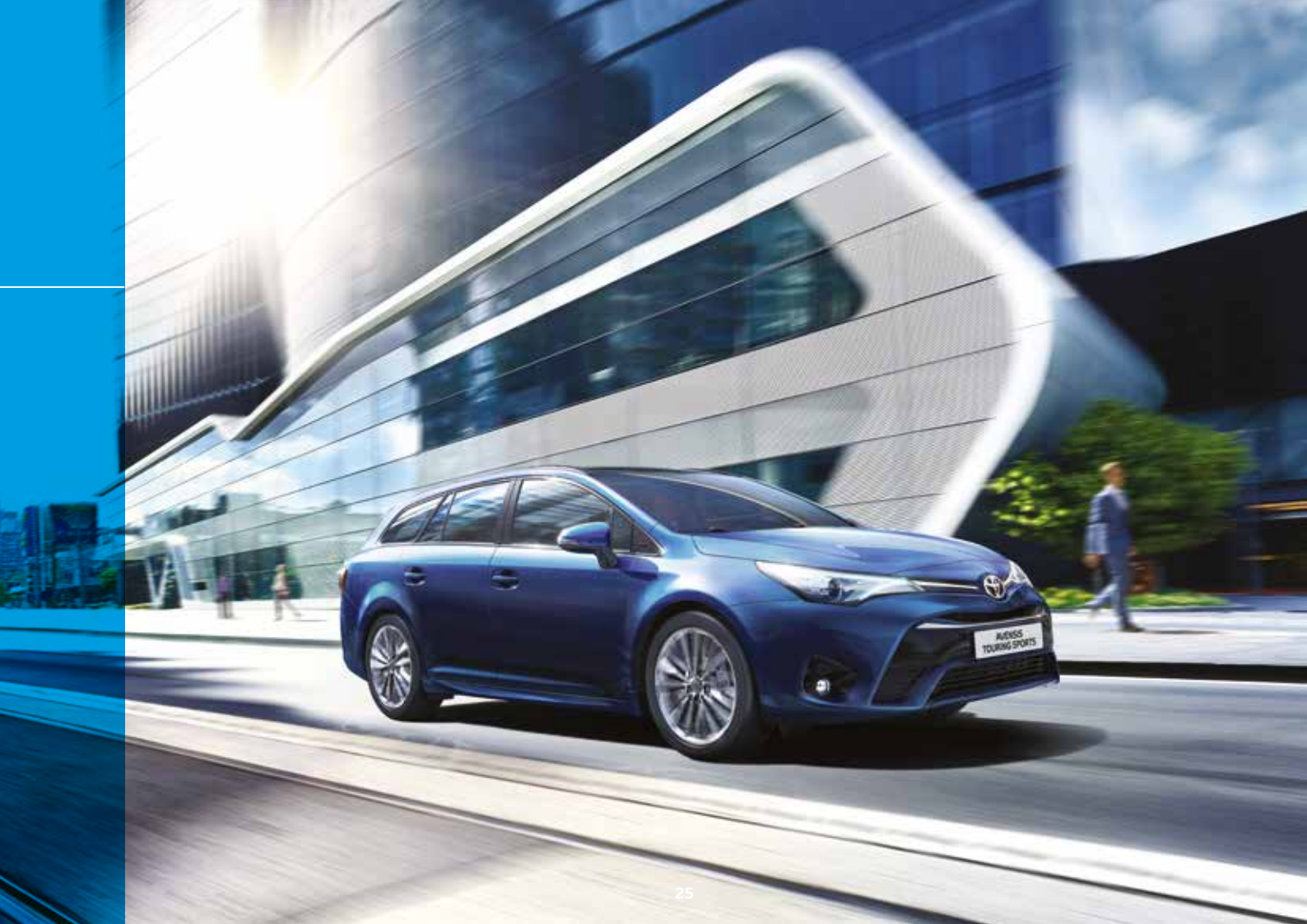



AVENSIS

DESIGNED NOT ONLY TO APPEAL TO PRIVATE BUYERS BUT ALSO FULFIL EVERY REQUIREMENT OF EXACTING FLEET CUSTOMERS

- New 1.6D-4D and 2.0D-4D diesel engines for improved fuel efficiency and CO_2 reductions of 11 g/km and 24 g/km respectively
- CVT transmission extensively revised for quieter operation, improved driveability and a 4 % reduction in fuel consumption
- Enhanced front and rear suspension, and improved steering feel and response for greater ride comfort and more engaging driving dynamics

DRIVING PLEASURE AND RUNNING COSTS


AVENSIS
TOURING SPORTS

The new Avensis powertrain line-up has been comprehensively revised, building on the durability and reliability for which it is already renowned to offer customers reductions in fuel consumption, emissions and cost of ownership.

In addition, body structure, suspension and power steering enhancements offer ride comfort and handling improvements across the model range.

DIESEL ENGINES

The five-strong engine range features two diesels, both new: a 112 hp/82 kW 1.6 litre D-4D and -making its first appearance in a Toyota- a 143 hp/ 105 kW 2.0 litre D-4D unit.

The 1.6D-4D generates CO_2 emissions of just 108 g/km, 11 g/km less than the 2.0 litre unit it replaces, whilst the 119 g/km of the new 2.0 litre engine represents a significant, 24 g/km reduction over the emissions of the outgoing 2.2 litre unit.

Diesel running costs have also been lowered for both units by approx 20 % over 90,000 km/3 year period.

NEW 1.6D-4D

Reflecting the current downsizing of powerplants to achieve better fuel economy, lower emissions and improved driving dynamics, a new 1.6D-4D engine replaces the existing 2.0D-4D.

Euro 6 compliant, the 4-cylinder, 1,598cc, 16 valve, DOHC turbodiesel is 20 kg lighter than its 2.0 litre predecessor. Mated to a 6-speed manual transmission, the engine develops 112 DIN hp/82 kW at 4,000 rpm and 270 Nm of torque from 1,750 to 2,250 rpm. It accelerates the Avensis from 0-100 km/h in 11.4 seconds, and on to a top speed of 180 km/h.

The new engine delivers a 9 % improvement in fuel efficiency over the outgoing 2.0D-4D unit, equating to fuel consumption of 4.2 l/100 km in the combined homologation cycle. Simultaneously, CO_2 emissions have reduced from 119 to only 108 g/km.

The engine has been tuned to deliver a fast throttle response throughout the rev range. It generates good initial response at low rpm, and then, as turbo boost develops, provides a linear torque build-up. The availability of torque has also been stretched, so the engine will rev freely beyond 3,000 rpm without running out of breath.

2 NEW DIESEL ENGINES

NEW 2.0D-4D

The new, Euro 6 compliant 2.0 litre D-4D engine shares its 1.6 litre sister unit's focus on low fuel consumption and emissions efficiency but, also mated to a 6-speed manual transmission, has been tuned to offer drivers a stronger focus on performance.

Developing a maximum 143 DIN hp/105 kW at 4,000 rpm and a generous 320 Nm of torque from 1,750 to 2,500 rpm, the new 1,995 cc, 16 valve, DOHC engine's linear torque build-up and willingness to rev gives the new Avensis particularly strong in-gear responsiveness and acceleration. It will accelerate from 0-100 km/h in 9.5 seconds and has a top speed of 200 km/h.

Numerous developments ensure the engine runs particularly quietly at all speeds, whilst Toyota's Stop and Start technology coupled with a tall 6th gear for motorway cruising enable the new 2.0D-4D to return an average fuel consumption of just 4.5 l/100 km and generate CO_2 emissions of only 119 g/km.

KEY DIESEL ENGINE FEATURES AND FUNCTIONAL BENEFITS

Both the new 1.6 and 2.0 litre D-4D engines incorporate numerous advanced technologies designed to minimise fuel consumption and emissions without detriment to engine performance and driving pleasure.

A Fuel Injection Control System with Digital Diesel Electronics controls fuel injection in accordance with engine speed, load and temperature for a more precise control of pressure, timing and volume than that offered by conventional common rail technology.

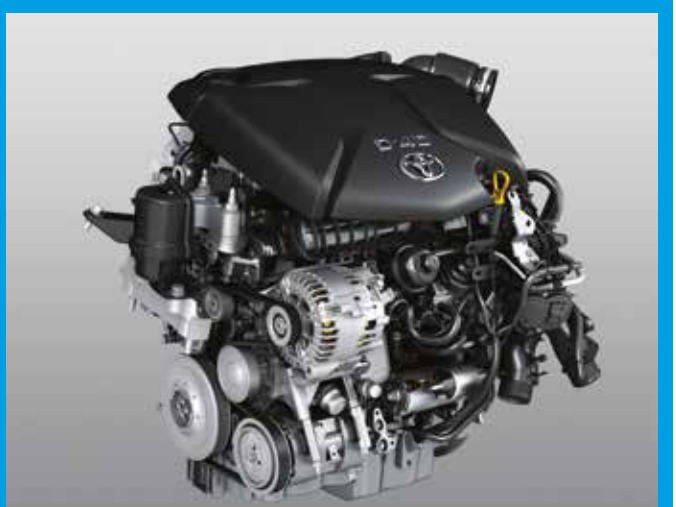
This allows for enhanced fuel efficiency and compliance with stricter emissions regulations without detriment to engine performance.

A combination of swirl and tangential intake ports creates an ideal swirl pattern in the intake air/fuel mixture, resulting in greater engine efficiency through a more complete combustion.

The built-up type camshaft is comprised of individually manufactured cams, gears and shaft, with a carefully selected combination of materials for each component. This reduces overall weight by some 40 %, contributing to improved fuel efficiency.

A Hydraulic Valve Clearance Compensation (HVCC) System features hydraulic pistons that continuously adjust individual intake and exhaust valve clearance according to engine speed and load, optimising intake and exhaust airflow for enhanced engine performance and fuel efficiency.

A cross-flow cooling system channels engine coolant flow from the hotter exhaust side to the cooler intake side for a more even heat distribution over the cylinder head. This reduces pressure losses and enhances fuel efficiency.



Along with its sound absorbing properties, the use of a resin cylinder head cover allows for a more complex inner structure due to ease of manufacture. Hence, an oil separator and Pressure Control Valve (PCV) have been built into the cover to separate the oil from the blow-by gas. This reduces the amount of oil burned during re-combustion, reducing emission impurities.

The Variable Nozzle Turbocharger (VNT) system adjusts intake volume according to engine speed and load for enhanced fuel efficiency and engine performance.

A new Charging Control System automatically regulates the amount of electricity generated by the alternator, which affects the amount of load on the engine, according to driving conditions. Contributing to fuel efficiency, the system not only increases alternator load under deceleration and decreases it under acceleration, but can also balance between fuel efficiency and electricity needed during idling or cruising.

Finally, Toyota's Stop and Start system combines with a high performance Diesel Particulate Filter (DPF) to further lower particulate and CO_2 emissions.

PETROL ENGINES

Comprehensive enhancements have also been made to the existing 1.6, 1.8 and 2.0 VALVEMATIC petrol engine line-up. Each unit is now Euro 6 compliant, and benefits from improved driving performance, greater fuel efficiency and lower emissions.

Average fuel consumption has been lowered across the engine range by between 0.4 and 0.8 l/100 km, and CO_2 emissions have simultaneously been reduced by between 8 and 19 g/km.

1.6 VALVEMATIC

The 4-cylinder, 1,598 cc, 16 valve, DOHC VALVEMATIC petrol engine develops 132 hp/97 kW at 6400 rpm and 160 Nm of torque at 4,400 rpm. Mated to a 6-speed manual transmission, it equips the new Avensis with a 0-100 km/h acceleration time of 10.4 seconds, and a top speed of 200 km/h.

Average fuel consumption has been lowered from 6.5 to 6.1 l/100 km, and CO_2 emissions reduced by 8 g/km to 142 g/km.

1.8 VALVEMATIC

Mated to a 6-speed manual gearbox or a substantially enhanced CVT transmission, the 4-cylinder, 1798 cc, 16 valve, DOHC VALVEMATIC unit develops 147 hp/108 kW at 6,400 rpm and 180 Nm of torque at 4,000 rpm. It will accelerate the Avensis from 0-100 km/h in 9.4 seconds (10.4 CVT) and on to a maximum speed of 200 km/h.

Average fuel consumption falls by 0.5 l/100 km to 6.0 l/100 km, and CO_2 emissions have been lowered by 13 g/km to 140 g/km.

2.0 VALVEMATIC

Via the revised CVT transmission, the 4-cylinder, 1,986 cc, 16 valve, DOHC VALVEMATIC engine develops 152 hp/112 kW at 6,200 rpm and 189 Nm of torque at 4,400 rpm. It equips the Avensis with per-

formance figures of 0-100 km/h in 10.0 seconds and a top speed of 205 km/h.

Average fuel consumption has been lowered from 6.9 to 6.1 l/100 km, and CO_2 emissions reduced by a substantial 18 g/km to 142 g/km.

PETROL ENGINE ENHANCEMENTS AND BENEFITS

The 1.6 VALVEMATIC unit features revisions to various engine control elements such as the ignition timing and air/fuel ratio, which have been optimised to lower emissions. And, as described above, a Charging Control System which regulates alternator electricity generation in accordance with driving conditions has been installed, contributing to improved fuel efficiency.

Comprehensive revisions to both the 1.8 and 2.0 VALVEMATIC engines include the following performance, fuel efficiency and emissions lowering enhancements:

The VALVEMATIC and VVT-i operation angle has been increased to optimise valve lift angle and timing across the driving range. As a result, power output has been increased, and mechanical losses reduced, thus improving fuel efficiency.

Continuous optimal throttle control in accordance with VALVEMATIC and VVT-i operation further improves both fuel efficiency and driveability. And the addition of an oil temperature sensor enhances VVT-i performance for a further improvement in fuel economy.

The compression ratio of the 1.8 VALVEMATIC has been increased to 10.7:1, and that of the 2.0 VALVEMATIC to 10.5:1, enhancing thermal efficiency and contributing to improved fuel economy.

Contributing to lowered emissions, the fuel system has been enhanced through the optimisation of fuel injection and timing to reduce fuel loss to the exhaust side under injection.

Friction has been significantly reduced throughout both engines through the installation of a tension-reducing ribbed V belt auto-tensioner, and a low-friction timing chain and chain damper; the adoption of Teflon coatings to front and rear oil seals, and resin coatings to the sliding surface of the crankshaft, camshaft and thrust bearing; and the reduction of both oil pump flow and vacuum pump drive torque.

Engine warming performance has been improved by the installation of a shell-type exhaust manifold and the optimisation of valve timing and fuel injection quantities. This accelerates exhaust gas temperature increase, warming the catalyst quickly to reduce emissions from cold starts.

The cooling system has been improved through the installation of a high response thermostat and optimised electric fan control. These measures enhance anti-knock performance and, hence, fuel efficiency.

Compatibility with high sulphur fuels has been achieved through nitriding treatment on the Positive Crankcase Ventilation (PCV) valve

PETROL ENGINES BENEFIT FROM IMPROVED DRIVING PERFORMANCE, GREATER FUEL EFFICIENCY AND LOWER EMISSIONS

and a height change to the piston rings.

And, finally, both units also benefit from the previously described Charging Control System.

REVISED CVT TRANSMISSIONS

Alone accounting for a 4% reduction in fuel consumption, the 1.8 and 2.0 litre VALVEMATIC petrol engines' CVT transmissions have been extensively revised, not only improving fuel efficiency, but also offering customers quieter operation, enhanced accelerator response and shift feel, and improved driveability.

They feature a newly developed torque converter, continuously variable unit, oil pump, reduction and differential gears, hydraulic control unit, and CVT fluid and fluid warmer.

The CVT control logic has been revised to reduce engine revving at medium throttle settings, more closely matching engine speed to throttle inputs in the manner of a conventional automatic transmission for a more engaging driving experience.

A 'Sports' mode features G AI (Artificial Intelligence) -SHIFT control, which limits the shift control area, restricting shift changes to maintain higher revs, both generating engine brake force on entering a corner and offering stronger re-acceleration response at the corner exit.

The 2.0 litre VALVEMATIC engine's CVT transmission further benefits from a preload differential. Integrated within the transaxle, the preload mechanism is designed to limit torque on the differential motion by applying preload under certain driving conditions.

This ensures a smooth transfer of torque to the driven wheels, making standing starts easier and smoother, improving manoeuvrability and enhancing straight-line stability on even un-surfaced roads.

IMPROVED DRIVING DYNAMICS

The bodyshell of the new, 2015 Avensis features additional spot welding points and a high-strength urethane windscreen bonding material to improve body rigidity, promoting greater handling stability.

The Avensis retains the same, proven, front McPherson strut and rear double wishbone suspension layout of its predecessor. However, both front and rear suspension systems feature significant improvements to enhance both ride comfort and handling performance.

The front suspension benefits from a new upper support and a steel ball strut bearing. Changing the bearing material from resin to steel reduces friction in the system during steering, thus improving steer-

REVISED CVT IMPROVING FUEL EFFICIENCY, OFFERING CUSTOMERS QUIETER OPERATION

ing feel and feedback.

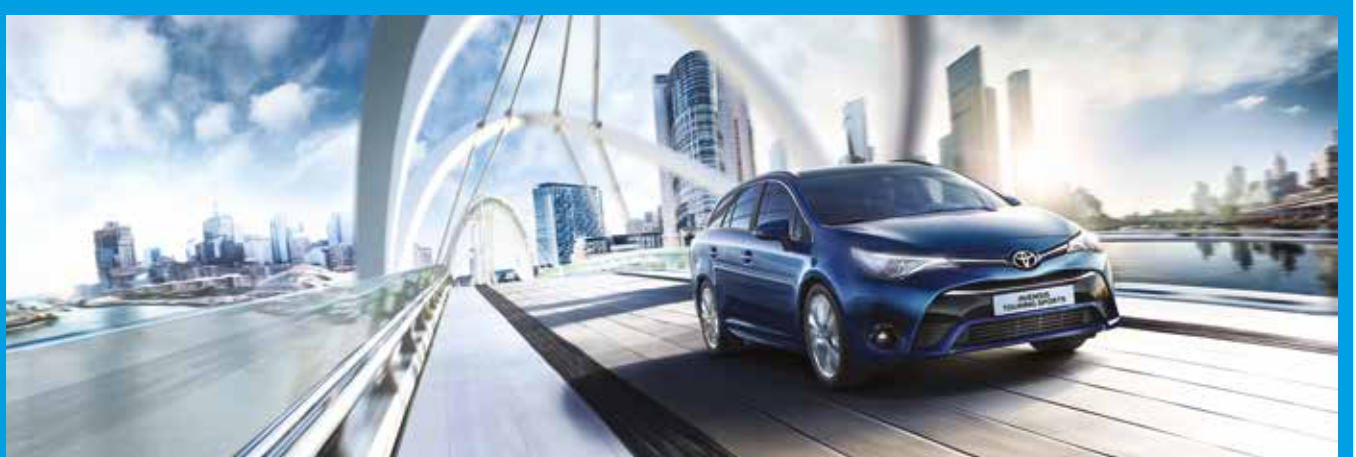
Shock absorber damper force has been optimised to enhance steering feel and ride comfort. On both diesel engined models and the 2.0 litre petrol variant, the coil spring shape has been changed and spring rates have been reduced to increase ride comfort. Lateral force-reducing coil springs reduce friction in the suspension, further enhancing ride comfort.

The double wishbone rear suspension has been tuned to improve ride comfort, steering and durability, as well a reducing the transmission of noise and vibration. It also features a coil spring rate reduction, damper force reduction and spring set load tuning for diesel and 2.0 litre petrol variants, whilst a new piston valve design offers a perceptible increase in ride comfort.

The feel and responsiveness of the Electric Power Steering (EPS) has been improved by the adoption of a new, 2-ball spline intermediate shaft which combines high torsional rigidity with a more direct transmission of road input to the driver; a stabiliser bar diameter change; and an increase in bodyshell rigidity through the use of a high-strength urethane to bond the windscreen.

EPS assistance characteristics have also been optimised. The neutral position is now more accurate for improved high speed straight line driving, and steering torque delivery has been fine-tuned to better match linearity with lateral acceleration and yaw response.

New Avensis customers will also benefit from the convenience of Hill-start Assist Control. By applying brake pressure to all four wheels for a maximum of two seconds when the driver releases the brake pedal in order to apply the throttle, the system prevents the vehicle from rolling backwards when starting off on a steep or slippery incline.



Kristof Muylle
Senior Project Manager European R&D

From the European R&D perspective, this was a milestone project. Avensis is a European-unique vehicle, built in Europe. We already had a lot of previous involvement with the model, and we knew that we could further develop and perfect it, particularly in the context of fulfilling the requirements of fleet customers. So our management in Japan said 'you make the business case, you decide what you can do, and you will have to take the majority of the workload from day one'.

That means that TME was involved in a number of activities we had no previous experience of. So, to adapt to that new position, we also had to develop our organisation in parallel with the project itself.

From a resource point of view we didn't have certain elements in place. For instance, this was the first time we worked with an external company to help us out on the engineering side. This was an important step for us, showcasing the fact that we can have the flexibility in developing projects even if we don't have the resources there, ready from day one. So people joined and then left as the project was running, helping us with electronics, body design, engineering and other key development areas.

I started planning the project at the beginning of 2012, spending the first 6 months simply deciding what we wanted to achieve and how to get there.

By August we had a scenario and business case ready for the changes we wished to make. If you look at the new model, you'll see that a lot of change content is of the type we usually only do for an all-new vehicle, such as a full interior and combi-meter development. These don't fit in our typical minor change schedules, so we were quite challenged to work within the short timescale that we had set for ourselves.

This is the first time we've carried out such a major content change in such a short time. We're talking a plant investment of 36 million Euros, 368,000 man-hours and over 1,000 parts on the vehicle changed...

Some percentage of Avensis production is for what we call general export, and we also import this vehicle into Japan. It very much appeals to the Japanese as a 'European style' vehicle, and they're prepared to pay a premium for some specification that's not available in their market. The European specification vehicle takes the lead in style, sensory quality, grade structure and safety; every other specification for other markets is a derivative of that.

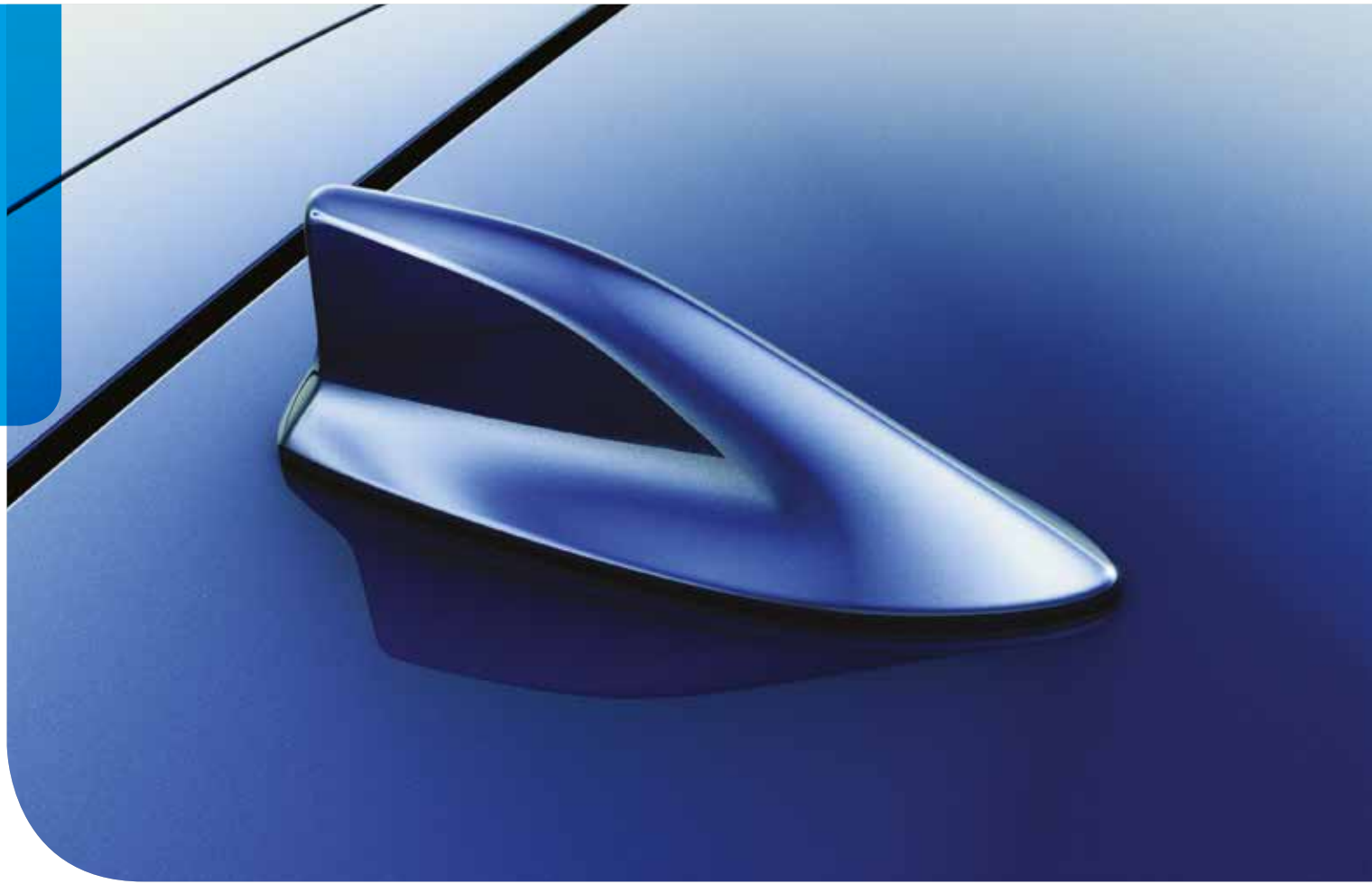
At the start of the project we decided upon a number of focus items. We had the luxury of already having the vehicle in the market, so we could talk to our network of national importers, dealers and customers, and make a short list of items we should focus on.

We were asked for improved sensory quality and comfort, more dynamic styling, a more flexible equipment line-up -especially in the fleet context- and, of course, safety. That's a big one because, in order to tackle the fleet market, we had to ensure the Avensis has a 5 Star Euro NCAP rating. This meant redeveloping the vehicle to meet the 2015 requirements, which was quite a big challenge.

The European Sensory Quality Division was involved in the planning from day one. Previously we were just making sure we had the same surface finish, colour quality and so one. On this project we looked in far greater depth, for instance, at shape and symbol consistency. During the early styling reviews, the SQ team was already giving feedback on shapes and materials to ensure we didn't use too many or have any mismatches.

The exterior styling was also a first for TME because we changed the sheet metal, and, on board, we took responsibility for developing the new instrument panel; the first time we've tackled an interior at this level.

A LOT OF CHANGE CONTENT IS OF THE TYPE WE USUALLY ONLY DO FOR AN ALL-NEW VEHICLE



From the equipment perspective, one of our major focuses was its better integration into the vehicle, because some customer feedback suggested it currently came across as lacking in overall coordination. So we have ensured that the display-audio, HVAC, combi-meter and other systems such as pre-crash all talk to each other and are a fully integrated solution, not just a box-by-box installation.

Previously, the engineers for each of these elements were working with different colours and symbols, so we also designed a master to ensure that all symbols, fonts and new blue illumination matched on each element, from steering wheel to centre console, and so on.

Although everyone talks about the new diesel engines supplied by BMW, I should point out that both the combi-meter and the pre-crash system, as well as quite a number of critical safety items, were also sourced from European suppliers.

Of course, the 1.6D-4D engine was first installed in Verso, and that was when we had to overcome all the main installation challenges. With Avensis, we were more focused on driveability and comfort, especially from the fleet perspective, and BMW collaborated closely with us on our driving events to help fine-tune these performance aspects.

We did have some heat management issues, but the bigger challenge was the installation of the 2.0 litre diesel unit in a Toyota for the first time. We were very focused on the driveability of the engine. We still wanted it to have the Toyota family feel, but also for there to be a clear differentiation between it and the 1.6, so people could clearly recognise the different merits of the two units.

We developed the Avensis to win 5 Euro NCAP Stars. Because of the big changes in regulations, the engineering challenge to achieve that was quite significant, especially on the pedestrian side.

For driving pleasure and comfort, we focused both on NVH intrusion into the cabin and seat comfort. We redeveloped the seat to ensure that fleet customers who spend a long time behind the wheel don't get uncomfortable or tired over long distances.

From the driving dynamics perspective, we have a new shock absorber supplier, which gave us new opportunities to tune in a different way. And we have specifically tuned the vehicle to be best suited to the European market.

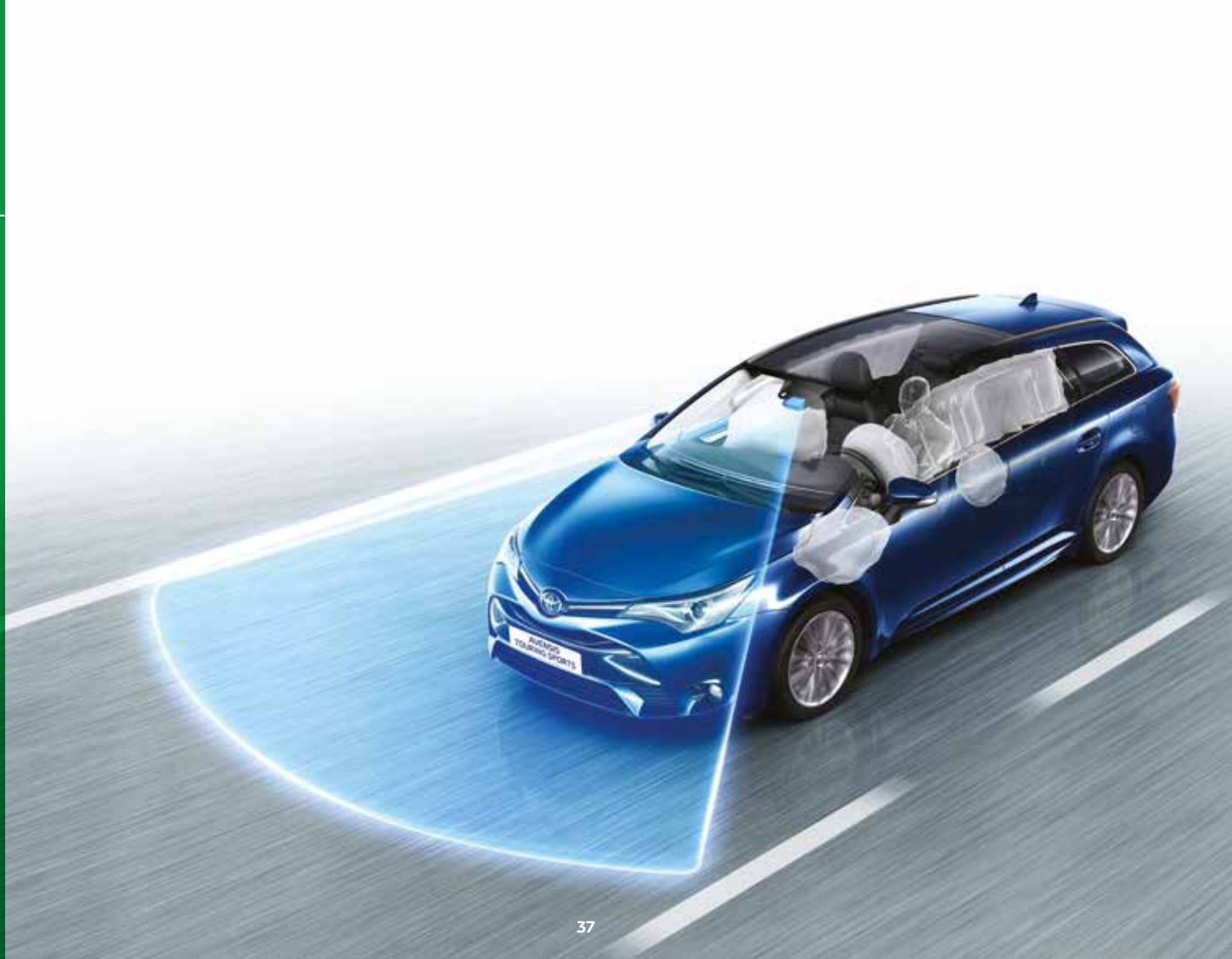
For instance, the rear end of a Toyota is traditionally tuned to be quite stable, because, to a Japanese customer, that feeling of stability is extremely important. But in Europe, customers are more concerned with the agility and sharpened steering feel they want from the car. So we have been able to shift the balance of the vehicle more towards the European dynamic style, at the same time stiffening up the bodyshell to compliment that.

As ever, though, there's a difference between the requirements of private and fleet customers. The fleet customer spends much more time on the road, so he likes a more dynamic style of driving along with long-haul comfort. For the private buyer, the emphasis on handling is not so high; having a good looking car and value for money is more important to him than the last word in driving dynamics.

That being said, it's not efficient to focus on just one area of vehicle development. For Europe, the overall balance of the Avensis is far more important than any one aspect. If the customer climbs aboard, he shouldn't be distracted by either one very good thing or one very bad thing; he will spend a lot of time in the car, and simply wants to feel completely at ease.

- Comprehensive active safety and driver assistance package, fitted as standard across the entire model range
- Includes Pre-Collision System, Lane Departure Alert, Road Sign Assist and Automatic High Beam

TOYOTA SAFETY SENSE



In anticipation of a 5-star rating from the Euro NCAP crash test programme, the new Avensis takes active safety and driver assistance to new levels with the Toyota Safety Sense system, fitted as standard across the entire model range.

Toyota Safety Sense features a Pre-Collision System[1] (PCS) and Lane Departure Alert (LDA). To further enhance safety as well as driver convenience, it also incorporates Automatic High Beam (AHB) and Road Sign Assist (RSA) systems.

Between speeds of approximately 10 km/h to 80 km/h, **Pre-Collision System** detects vehicles in front and reduces the risk of hitting them from the back. When there is a possibility of a collision it prompts the driver to brake with an audible and visual alert.

PCS also primes the brake system to deliver extra stopping force when the driver presses the brake pedal. If the driver fails to react in time, the system automatically applies the brakes, reducing speed by approximately 30 km/h[2] or even bringing the car to a complete stop, in order to prevent the collision or mitigate the force of impact.

The **Lane Departure Alert** system monitors lane markings and helps prevent accidents and head-on collisions caused by leaving lanes. If the vehicle starts to deviate from the lane without the indicators having been engaged, LDA warns the driver with an audible and visual alert.

Automatic High Beam helps ensure excellent forward visibility during night-time driving. It detects both the headlights of oncoming vehicles and the tail lights of preceding vehicles, automatically switching between high and low beams to avoid dazzling other drivers. By using high beams more frequently the system enables earlier detection of pedestrians and obstacles.

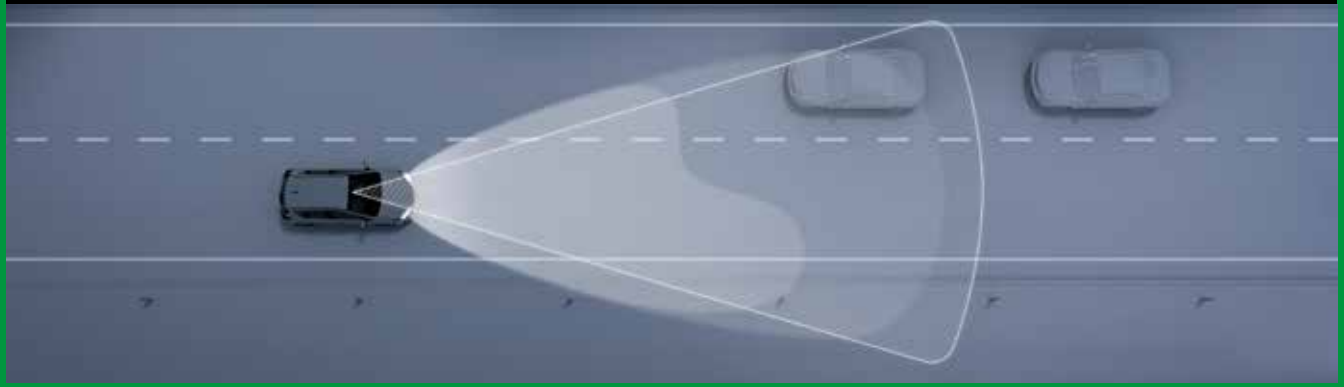
Road Sign Assist supports drivers by ensuring they always have the best possible information, even if they have, perhaps, overlooked a road sign. It identifies traffic signage such as speed limit and no overtaking signs. System status and alert information is displayed to the driver on the instrument colour TFT multi-information screen. In case of speed limits, the system gives a visual and audible alert should the driver exceed the posted limit.

Thanks to the Toyota Safety Sense system reducing the risk of being involved in traffic accidents, drivers of the new Avensis may benefit from lower insurance costs[3] or a more advantageous insurance reclassification[3].

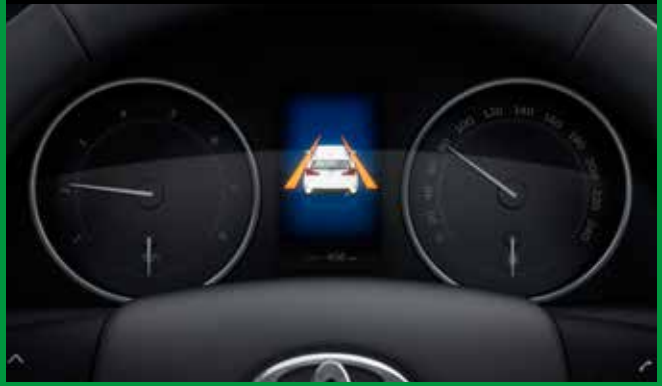
[1] Technical name: Pre-Crash System
[2] Results achieved during testing using a vehicle travelling at 30 km/h and a stationary vehicle; system operation depends on driving environment (incl. road and weather) and vehicle circumstances.
[3] Market dependant

TOYOTA SAFETY SENSE FITTED AS STANDARD ACROSS THE ENTIRE MODEL RANGE

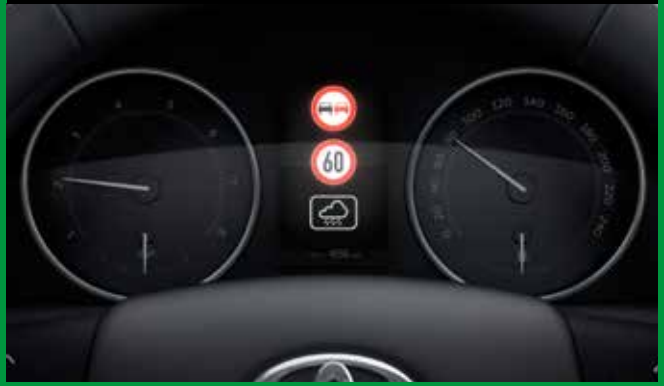
AUTOMATIC HIGH BEAM



LANE DEPARTURE ALERT



ROAD SIGN ASSIST



SPECIFICATIONS

ENGINE	1.6 Valvematic	1.8 Valvematic	1.8 Valvematic CVT	2.0 Valvematic	1.6D-4D	2.0D-4D
Engine code	1ZR-FAE	2ZR-FAE	2ZR-FAE	3ZR-FAE	1WW	2WW
Type	4 in-line cylinders	4 in-line cylinders	4 in-line cylinders	4 in-line cylinders	4 in-line cylinders	4 in-line cylinders
Fuel type	95 unleaded petrol or higher	95 unleaded petrol or higher	95 unleaded petrol or higher	95 unleaded petrol or higher	48 Cetane diesel or higher	48 Cetane diesel or higher
Valve mechanism	DOHC 16-valve Valvematic	DOHC 16-valve Valvematic	DOHC 16-valve Valvematic	DOHC 16-valve Valvematic	DOHC 16-valve	DOHC 16-valve
Fuel system	EFI	EFI	EFI	EFI	common rail + piezo injection	common rail + piezo injection
Supercharging	-	-	-	-	variable tubo charger	variable tubo charger
Displacement (cm^3)	1,598	1,798	1,798	1,986	1,598	1,995
Bore x stroke (mm)	80.5 x 78.5	80.5 x 88.3	80.5 x 88.3	80.5 x 97.6	78.0 x 83.6	84.0 x 90.0
Compression ratio	10.7 : 1	10.7 : 1	10.7 : 1	10.5 : 1	16.5 : 1	16.5 : 1
Max. power (DIN hp/ kW @ rpm)	132/97 @6,400	147/108 @ 6,400	147/108 @ 6,400	152/112 @ 6,20000	112/82 @ 4000	143/105 @ 4,000
Max. torque (Nm @ rpm)	160 @ 4,400	180 @ 4,000	180 @ 4,000	189 @4400	270 @ 1,750 - 2,250	320 @ 1,750 - 2,250
Emissions level	Euro 6	Euro 6	Euro 6	Euro 6	Euro 6	Euro 6
Stop&Start System	no	no	no	no	yes	yes

TRANSMISSION	1.6 Valvematic	1.8 Valvematic	1.8 Valvematic CVT	2.0 Valvematic	1.6D-4D	2.0D-4D
Type	Manual	Manual	CVT	CVT	Manual	Manual
Gear ratios (:1)						
1st	3.538	3.538	Forward	Forward	3.818	3.818
2nd	1.913	1.913	2.480	2.517	1.913	1.913
3rd	1.310	1.310	to	to	1.218	1.218
4th	0.971	0.971	0.396	0.390	0.860	0.860
5th	0.818	0.818	Reverse	Reverse	0.790	0.790
6th	0.700	0.700	2.604	2.517	0.673	0.673
Reverse	3.333	3.333	to 1.680	to 0.696	4.139	4.139
Differential gear ratio (:1)	4.538	4.214	5.698	5.182	3.526*; 3.045**	3.777*; 3.238**
*1st to 4th gear;**5th, 6th, Reverse						

SPECIFICATIONS

CHASSIS	1.6 Valvematic	1.8 Valvematic	1.8 Valvematic CVT	2.0 Valvematic	1.6D-4D	2.0D-4D
Front suspension	MacPherson Strut	MacPherson Strut	MacPherson Strut	MacPherson Strut	MacPherson Strut	MacPherson Strut
Stabiliser bar diameter (mm)	24.2	24.2	24.2	24.2	24.2	24.2
Rear suspension	Double wishbone	Double wishbone	Double wishbone	Double wishbone	Double wishbone	Double wishbone
Stabiliser bar diameter (mm)	23	23	23	23	23	23
Steering	Rack & Pignon, Electric Power Steering	Rack & Pignon, Electric Power Steering	Rack & Pignon, Electric Power Steering	Rack & Pignon, Electric Power Steering	Rack & Pignon, Electric Power Steering	Rack & Pignon, Electric Power Steering
Overall ratio (16"/17"/18")	13.3:1 /13.3:1/13.4:1	13.3:1 /13.3:1/13.4:1	13.3:1 /13.3:1/13.4:1	13.3:1 /13.3:1/13.4:1	13.3:1 /13.3:1/13.4:1	13.3:1 /13.3:1/13.4:1
Lock to lock (with 17" wheels)	2.67	2.67	2.67	2.67	2.67	2.67
Min. turning circle	10.8	10.8	10.8	10.8	10.8	10.8
Brakes						
Front	Ventilated disc	Ventilated disc	Ventilated disc	Ventilated disc	Ventilated disc	Ventilated disc
Rear	Solid disc	Solid disc	Solid disc	Solid disc	Solid disc	Solid disc
Tyres	205/60R16, 215/55R17	205/60R16, 215/55R17, 225/45R18	205/60R16, 215/55R17, 225/45R18	205/60R16, 215/55R17, 225/45R18	205/60R16, 215/55R17, 225/45R18	215/55R17, 225/45R18

WEIGHT (KG)	1.6 Valvematic	1.8 Valvematic	1.8 Valvematic CVT	2.0 Valvematic	1.6D-4D	2.0D-4D
Curb weight min/max (Sedan)	1,365/1,435	1,370/1,455	1,405/1,475	1,435/1,505	1,455/1,545	1,470/1,550
Gross weight (Sedan)	1,970	2,000	2,020	2,050	2,040	2,100
Curb weight min/max (Wagon)	1,400/1,480	1,405/1,510	1,430/1,530	1,465/1,560	1,490/1,610	1,490/1,610
Gross weight (Wagon)	1,970	2,000	2,020	2,050	2,040	2,100
Towing capacity braked/unbraked	1400/500	1500/500	1600/500	1800/500	1600/500	1800/500

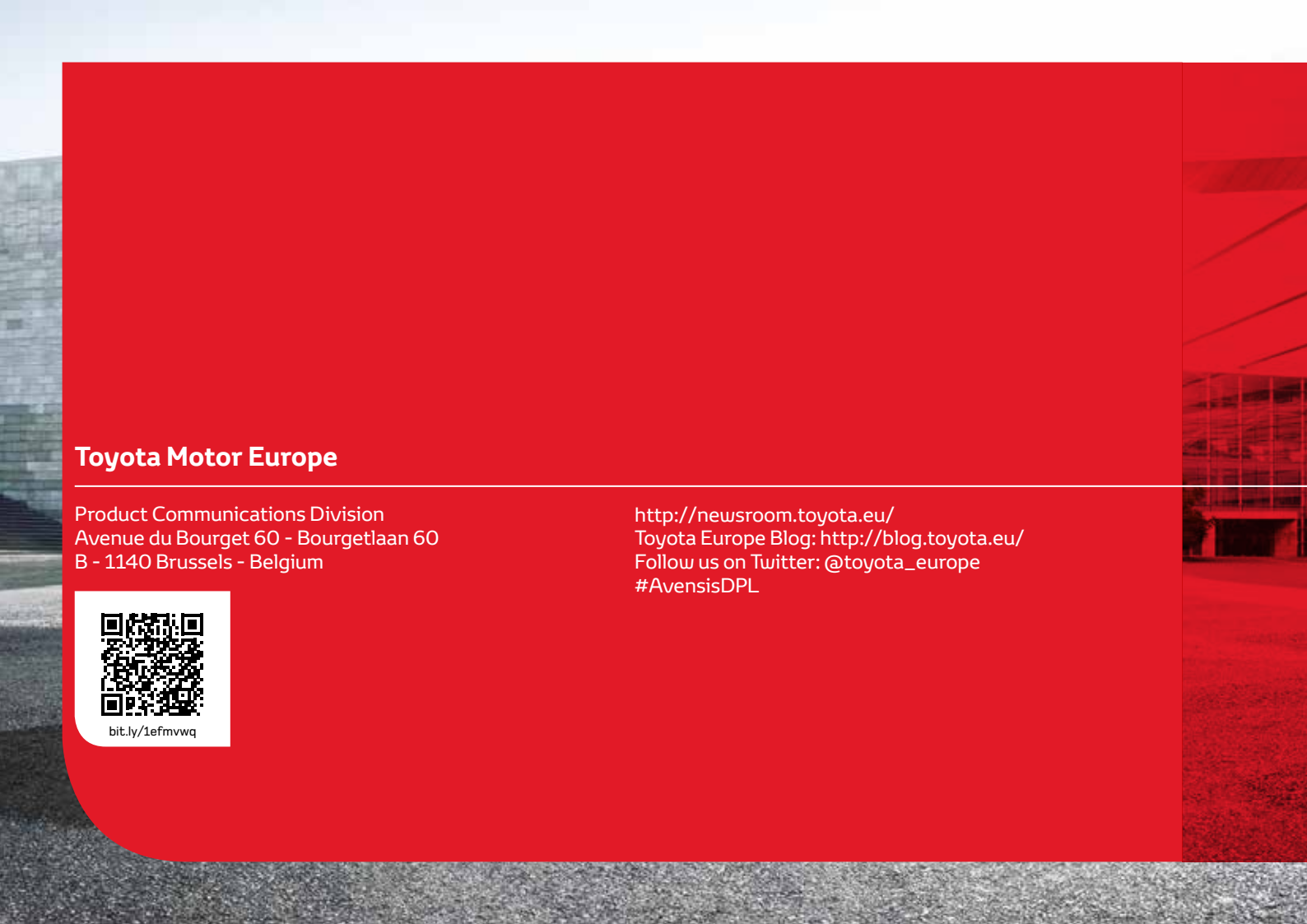
EXTERIOR DIMENSIONS (MM)	Sedan	Wagon
Overall length	4,750	4,820
Overall width	1,810	1,810
Overall height	1,480	1,480
Wheelbase	2,700	2,700
Tread front (16"/17"/18")	1,560/1,550/1,550	1,560/1,550/1,550
Tread rear (16"/17"/18")	1,550/1,540/1,540	1,550/1,540/1,540
Front overhang	1,015	1,015
Rear overhang	1,034	1,105
Ground clearance	140	140

CARGO	Sedan	Wagon
Capacity (dm^3)		
Rear seats up	509	543
Rear seats down	-	1609

INTERIOR DIMENSIONS (MM)	Sedan	Wagon
Lenght	1,959	1,959
Width	1,508	1,508
Height	1,180	1,180

SEDAN	1.6 Valvematic	1.8 Valvematic	1.8 Valvematic CVT	2.0 Valvematic	1.6D-4D	2.0D-4D
PERFORMANCE						
Max. speed (km/h)	200	200	200	205	180	200
Acc. 0 - 100 km/h (seconds)	10.4	9.4	10.4	10	11.4	9.5
Acc. 0 - 400 m (seconds)	-	16.8	18	17.3	17.8	16.8
FUEL CONSUMPTION (l/100)						
Urban (16"/17"/18")	8.0/8.3/-	8.1/8.1/8.4	8.0/8.1/8.4	8.3/8.4/8.9	5.1/5.1/5.3	-/5.7/5.9
Extra-urban (16"/17"/18")	5.1/5.0/-	4.9/4.9/5.2	4.8/4.9/5.2	4.9/5.0/5.5	3.6/3.7/4.0	-/3.8/4.1
Combined (16"/17"/18")	6.1/6.1/-	6.0/6.0/6.4	5.9/6.1/6.4	6.1/6.2/6.7	4.2/4.2/4.5	-/4.5/4.8
Fuel tank capacity (l)	60	60	60	60	60	60
CO_2 EMISSIONS (g/km)						
Combined (16"/17"/18")	142/144/-	139/140/148	138/140/148	142/144/155	108/109/116	-/119/124

WAGON	1.6 Valvematic	1.8 Valvematic	1.8 Valvematic CVT	2.0 Valvematic	1.6D-4D	2.0D-4D
PERFORMANCE						
Max. speed (km/h)	195	200	200	200	180	200
Acc. 0 - 100 km/h (seconds)	10.6	9.7	10.7	10.3	11.7	9.8
Acc. 0 - 400 m (seconds)	17.4	17.1	18.3	17.6	-	-
FUEL CONSUMPTION (l/100)						
Urban (16"/17"/18")	8.0/8.3/-	8.1/8.3/8.4	8.0/8.3/8.4	8.5/8.7/8.9	5.1/5.1/5.3	-/5.7/5.9
Extra-urban (16"/17"/18")	5.1/5.1/-	4.9/5.1/5.2	4.8/4.8/5.2	5.0/5.1/5.5	3.7/3.8/4.0	-/4.0/4.1
Combined (16"/17"/18")	6.2/6.1/-	6.1/6.2/6.4	6.0/6.06.4	6.3/6.4/6.7	4.2/4.2/4.5	-/4.6/4.8
Fuel tank capacity (l)	60	60	60	60	60	60
CO_2 EMISSIONS (g/km)						
Combined (16"/17"/18")	143/145/-	140/143/148	139/142/148	145/148/155	109/110/116	-/120/124



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