

**[1]** The Japanese auto giant Toyota first began making cars in Australia in 1963 and at the height of production around 3000 workers were employed in the production facilities in Victoria, with many thousands of others involved in component supply and support for the local manufacture of the range of Toyota vehicles. In 1994, all vehicle manufacturing operations were moved from Port Melbourne to Altona in Western Melbourne. In 2010, and after the securing of a \$35 million production subsidy from the Australian Government, Toyota started to build the engines for their new Hybrid Camry – a model also produced at the Toyota Motor plant in Thailand.

**[2]** At Altona there are seven separate plants involved in the car manufacturing process – press, unit, weld, paint, resin, powertrain and assembly. In the factory the efficient movement from manufacture and assembly of parts to produce fully completed vehicles is underpinned by a strong company-wide safety ethic. The health and safety of the company employees is as much a consideration as the safety of the cars produced. The interests of the customers who will be driving the car, their passengers and the impact of the cars on the wider social and physical environment is at the heart of all design and production decisions in the plant.

**[3]** In all the production processes at the plant, ensuring a safe reliable and skilled work environment is the starting goal. Six types of accidents which are likely to cause death and disability have been identified. These have been designated as “STOP6-type accidents” – the target is to ensure there is a working environment that produces “Zero Accidents” factory wide.

**[4]** The company has acknowledged that creating a comfortable working environment can reduce employee fatigue and the discomfort caused by over-exertion and constant repetition of tricky working procedures. Sickness and physical injury can also be caused by exposure to harmful substances and electrical and mechanical hazards. With the aim of allowing everyone to work smoothly and comfortably, Toyota introduced its own workload evaluation method. The ongoing creation of smarter and safer processing techniques is encouraged through ergonomic thinking and the introduction of new technology where possible. At Altona the increasing use of robotics (in areas such as welding processes) and computer-assisted working environment monitoring and control has been a feature of this ongoing assessment procedure.

**[5]** The factory is set up for flexible continuous manufacturing of a range of Toyota models, with the seven separate plants operate separately but in a carefully managed, integrated way.

**[6]** The first plant is PRESS. Here four massive stamping machines produce the 100 or so different parts required to make up the car body. Ear protection for workers is essential and because of the amount of heavy lifting involved the movement of machinery is a constant hazard.

**[7]** The smaller UNIT plant sits at the rear of the factory. Here about 40 robots with assistance from a ‘small army of welders’ make a range of assembly parts including struts and the rear and front suspension members. (2)

**[8]** RESIN is another small but vital part of the factory. It’s here that the front and rear bumper bars are made from melted granulated resin. Computer controlled industrial robots are used to speed up the painting process taking under a minute for the application of successive coats of primer, base and clear glaze. After drying a final inspection takes place to ensure that no defects have occurred.

**[9]** The WELD plant is sometimes referred to as ‘robot central’. In here there are almost 300 differently sized robots doing the material handling and helping to put the metal body, engine compartment, doors and luggage shelf together. These robots are programmed to safely weld the bulky metal parts with millimetre precision. They are a cost effective production tool, able to produce consistent high quality work. Sparks from the welding process can cause defects such as burrs and scratches on the metal, so not only is this a safety hazard, but it means that close inspection of each body is critical before it leaves this part of the factory to go to the paint shop.

**[10]** In the PAINTSHOP plant the next stage for these ‘bodies in white’, as they are known, is to get rid of the inevitable covering of oil and welding grime from the prior welding. A 200 metre pathway through a series of cleaning and pre-treatment tanks has to be followed by each car body. A phosphate treatment provides a receptive surface for the paint to bond onto. The paint bath coats all parts of the body but the joints have to be sealed for waterproofing. This sealing is carried out using an innovation suggested by one of the workers as part of the cycle of promotion of continuous improvement. Not only is the body now waterproof, the underbody is also protected from stone chips as well.

**[11]** The steel has been stamped, welded, cleaned, primed and the body sealed. Now it is ready for adding some colour. This part of the Paint shop has to be entered through an air lock to prevent contamination of the

atmosphere inside. Protective clothing has to be worn - to limit transfer of factory dust and human skin particles, but also to protect the workers from the harmful effects of the paint transfer. The car bodies are given four coats – the paint being applied by electro- deposition, with a final ‘clear’ application. The process is highly automated with standard paint cartridges being filled according to the individual car’s colour specifications and loaded into robotic sprayers. At each stage there is a close inspection of the surface to check for blemishes.

**[12]** POWERTRAIN is where the engines for the Camry and Hybrid Camrys are built. The plant is dominated by two huge aluminium casting units. In the first, aluminium ingots are melted and transferred to the second larger furnace which holds the 10 tonnes of molten metal at a constant 700 degrees Celcius to maintain the quality of the metal. 600kg batches of the molten metal are poured out every 30 minutes into the moulds to form the cylinder blocks and cylinder heads for the engines for the new AR Hybrid Camry engines. When completed, the newly built engines move to a ‘Hot test’ area where they are put through their paces. Before any of the engines leave Powertrain they have to pass an 84 point inspection.

**[13]** ASSEMBLY is the final plant in the Toyota factory and the biggest. Car bodies come through from Paint shop and are put on a table lifter and dropped onto the production line. The first stage of assembly is the removal of the doors to give easier access to the interior – and to prevent unnecessary damage. The process involves seven separate assembly lines where close to 13 000 separate parts have to be fitted in 237 key processes to bring the whole car together. To aid quality control critical processes are tagged for computer control to check that pre-set specifications have been met.

**[14]** At each stage of the process the need for a quality job is reinforced with workers taking pride and care in their work. Eight quality gates have to be passed through during the process. No quality defect is accepted and every last nut and bolt has to be right.

**[15]** Cars are continually moving along the seven assembly lines each with its own teams of workers. Unlike previous parts of the production process, assembly has only one lone robot - in the windscreen fitting area. Every task is sequenced to take less than 120 seconds and every problem has to be fixed quickly. If there is a problem the operator can pull on the andon chord and a light flashes on a ceiling-mounted control board showing where the problem is in the assembly line. Support can be given while the vehicle is moving through the assembly process - if it can’t be fixed by the time it reaches the end position stop, only then will the line be stopped.

**[16]** At the end of the process the doors are then re-attached with the computer- controlled material transfer systems ensuring that it is the exact same doors removed at the start of the assembly process. The cars then move to the quality control area where each completed car is subjected to a meticulous series of tests to make absolutely sure it is fitted to its exact specifications before it can be driven out the door. Inspectors have just 120 seconds per car to check off close to 100 items. Then a check of the wheel alignment is the first in a series of all important dynamic and diagnostic tests. Every electric and driving function is closely scrutinised including the functioning of the on-board computers, with a TVEC system plugged in to carry out an 81 additional checks. When the all clear is given, a final shower of recycled water is jet-blasted onto the car to test the 2.5kg of sealant put on in the paint shop.

**[17]** Driver safety has always been an important customer consideration in the purchase of a new car, and continuous improvements in both passive and active safety measures have been a feature of ongoing innovation in the industry. Integrated collision avoidance systems (such as ABS braking) are becoming standard and more sophisticated systems like infrared night vision are being explored. This all increases the complexity of the manufacturing process and reinforces the need for skilled work and scrupulous product control procedures.

**[18]** The environmental impact of the car has also become increasingly important to potential customers and this was the focus of many of the design innovations in the new Hybrid Camry and the incorporation of the dedicated engine production facility at the Melbourne plant.

**[19]** Powertrain was officially opened In December 2012 making Toyota the first Australian car manufacturer to produce both petrol and hybrid engines for its locally built cars. The new 2.5 litre engine was designed to meet customer expectations by providing significant improvements in fuel efficiency and greater power than the previous 2.4 litre engine. The building of a new engine plant in Australia was seen by Toyota as being at the heart of its global manufacturing strategy and a necessary next step to ensure that local car manufacturing could maintain its presence in the always highly competitive marketplace.

**[20]** However, despite this massive recent financial investment, the impact of domestic factors such as high wages, low import tariffs and a strong currency together with the close proximity of other better positioned Asia-Pacific competitors has limited the ability of Australian manufacturers to profitably export cars . In February 2014 Toyota announced its decision to stop building cars in Australia and revert to sales and distribution only.