

Newsletter of the Australian Society for History of Engineering and Technology

Making cars in Australia

By Ian Arthur

By the end of October 2017 Australia will no longer be a mass producer of cars, with the closure of the manufacturing plants of Toyota in Melbourne and General Motors Holden in Adelaide. All new cars mass produced for the Australian market will be fully imported.

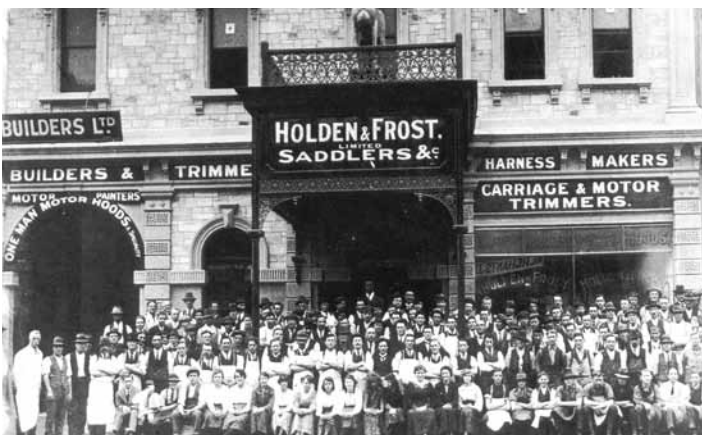
This article briefly traces the history of car making in Australia, from the early years of the twentieth century when cars began to be assembled in Australia from locally made and imported parts, through the years of increasing Australian content and diversity up to the present day.

An enduring name

The Holden name has been associated with Australian business since 1856, and specifically with the car business since early in the twentieth century, when the Holden company commenced making car body parts and assembling complete cars. 2017 marks the end of Holden car manufacturing in Australia but the brand name will live on attached to cars imported by General Motors for sale in Australia.

In 1852, James Holden, aged 17, with the encouragement of his family in England, emigrated to Australia and settled in Adelaide. His father, who ran a leather business in Walsall, had died the previous year, and left to each of his 11 children an inheritance of \$130, available when they turned 21.

In 1856 James established a business, J. A., Holden & Co., specialising in saddlery, and purchased a property in the heart of Adelaide. In 1860 his eldest son Henry joined the business, which became J. A. Holden and Son. In 1884 he introduced as a partner Henry Adolf Frost, who had migrated from Germany with his parents and who had worked in the business since 1879. In 1885 James sold his share of the business, which was renamed Holden and Frost, to his son Henry and retired.



Holden and Frost, saddlers, at Gawler Place, Adelaide

Henry's son Edward studied science and engineering at Adelaide University and on graduation in 1905 joined the business. Edward encouraged his father to become involved in the car industry, which was gaining importance. In 1909 Frost died and Henry bought his share of the business, which now expanded into making car body parts, upholstery and motor cycle side cars. In 1914, the company received an order to build a custom body for a Lancia chassis. This led to further orders for building custom bodies for a range of chassis.

In 1917 the Commonwealth government placed a limitation on the import of completed car bodies to boost local manufacturing and provide more space on ships for wartime supplies. Holden and Frost seized the opportunity to increase its production capabilities by buying another Adelaide body-builder, F. T. Flack. In 1918 Holden Motor Body Builders (HMBB) was set up as a division of Holden and Frost. It produced 587 bodies in its first year and 1,600 in the following year.

HMBB invested heavily in modern production equipment and in 1924 opened a new factory in Woodville, South Australia. It also opened assembly plants in Victoria, NSW and Queensland. It did a deal with General Motors (GM) to be the exclusive builder in Australia for cars built on GM chassis, and also to exclusively receive details of upcoming models to allow it to have bodies immediately available for fitting to new model chassis as they arrived in Australia.

By 1925 Holden's body building operation was the largest in the world outside Europe and North America, employing 2,600 people and producing over 34,000 car bodies in the year.

The depression had a disastrous effect on car sales, and in 1931 HMBB produced only 1,611 bodies, with its Woodville plant closed for much of the year. GM moved to protect its interests in Australia by purchasing HMBB and merging it with General Motors Australia to form General Motors Holden Limited (GMH), appointing Sir Edward Holden as its President, and assigning Laurence Hartnett, a Director of GM's British company Vauxhall to 'fix GMH or shut it down'.

By 1932 the worst of the depression was over, and with increasing car sales GMH made a modest profit. It purchased 50 acres of land at Fisherman's Bend in Melbourne for a head office, warehouse and production line and with provision for an engine plant and foundry. Hartnett set his sights on an all Australian car, and was moving towards this when World War II intervened. GMH diverted its resources to the war effort and became the first company in Australia to mass produce internal combustion engines for aircraft and boats as well as road vehicles.



GMH works at Fishermans Bend, 1936

The early history of Ford in Australia

The Ford Motor Company began to produce cars in a converted factory in Detroit in 1903. Two Ford cars reached Sydney in 2004. Imports of Ford cars grew slowly until Ford introduced the mass-produced Model T in 1908. It was attractively priced and proved extremely popular. By 1914 it was Australia's best selling car, with new registrations of 1,142 in that year. There were Ford agents in most towns. From 1917 Ford cars were imported to Australia in completely knocked down form (CKD) and assembled by dealers. In 1923 Ford sent two representatives to Australia

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Next ASHET events

Monday 23 October 2017

Talk by John F. Brock

Hadrian's Wall: Boundary Monument for the Northern

Over hundreds of years much has been written to attribute purposes to the wall across northern Britain at the behest of the formidable Roman emperor whose name has been given to this intriguing edifice.

Was it built for defence, border control, a demonstration of power or some combination of military reasons? Many postulates have been advanced by engineers, stone masons, clerks of works, military experts, academics, archaeologists, historians and paleontologists.

In this analysis he will be putting forward his offering to the discussion table about the main reasons for the erection of such a notable memorial to the time in the renowned civilization during the second century. After he elaborates further on the wall's design with specific attention drawn to certain features not before grouped together along with a focus on the desires and intentions of Emperor Hadrian himself there may be some agreement that this iconic line across the topography is a true boundary monument in the ancient Roman traditions as a demarcation line of the northern limit of the Empire's frontier at its north western territory second century extremity.

John Brock has been a private land surveyor since 1973, Bachelor of Surveying (UNSW 1978), MA (Egyptology) from Macquarie University (2000), and is now Director of Brock Surveys at Parramatta (near Sydney).

He has presented papers worldwide on the history of surveying, mapping and archaeology, including in June 2014 – The Great Wall of China: The World's Greatest Boundary Monument" and in April 2017 "Hadrian's Wall: Boundary Monument for the Northern Frontier of Roman Britannia."

Venue: History House, 133 Macquarie Street, Sydney

Time: 5.30 for 6 pm

Cost; Includes light refreshments on arrival; RAHS and ASHET members \$10, others \$12
Bookings: phone RAHS on (02) 9247 8001 or email history@rahs.org.au



Hadrian's Wall at Greenock

Thursday 23 November 2017

Talk by Judith Dunn OAM

Corrugated Iron - Australia's Iconic Building Material

This very visual presentation supported by many photographs from Sydney to the outback, shows the extensive use of corrugated iron in Australia. It explores the many reasons why it became such a popular material, embraced by the working class and at first spurned by major builders - until Prince Albert ordered a corrugated iron room at Balmoral Castle. Australians generally proved to be innovative metal workers and used the material in a great variety of ways from housing to the decorative arts. The talk will explore how and why corrugated iron was invented and its rapid spread around the world, but particularly within Australia.

Judith Dunn is a Councillor of the Royal Australian Historical Society and one of two NSW representatives to the Federation of Australian Historical Societies. She is a Councillor for Parramatta and District Historical Society, Convenor of the Historic Graves Committee, President of Friends of Mays Hill Cemetery, President of Friends of St Johns Cemetery, Vice President of Friends of the Female Factory and Vice President of Friends of Bella Vista Farm. Judith is also a sought after public speaker on a variety of subjects. In 2011 she was awarded an OAM for services to History and Heritage.

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Corrugated iron building at Rutherglen,

Powerhouse Museum; more delays to government decision on its future

The NSW government is continuing to work with the Museum of Applied Arts and Sciences (MAAS), on the 'extended business case' for moving the Powerhouse Museum to Parramatta. The business case has been expanded to include an arts and cultural space in Ultimo that considers keeping some MAAS presence at the current Powerhouse Museum site. No date has been announced for the completion of the business case and its presentation to the NSW Cabinet, but it has been expected by the end of 2017.

Meanwhile an Upper house committee has been considering the future of museums and galleries in NSW, with a particular emphasis on the future of the Powerhouse Museum. It held its eighth meeting on 29 August, at which the committee interviewed the Minister, Don Chadwick, who provided little that was new. The committee announced that it planned a ninth meeting on 11 September to which it would call Premier Gladys Berejiklian, former premier Mike Baird and the former Arts minister Troy Grant as witnesses. The meeting was postponed to a date yet to be announced. The committee's reporting date has been again moved, this time to 1 March 2018.

Ian Arthur



First Ford car imported to Australia, Model A, 1904

to investigate complaints about Ford dealers and quickly concluded that Ford should set up its own operations in Australia. Ford purchased 100 acres of land for a factory at Geelong in Victoria and formed two companies, the Ford Manufacturing Company of Australia and the Ford Motor Company of Australia Pty Ltd. Ford rented a factory in Geelong to assemble Model Ts at the rate of 17 per day in 1925 while its own steel body factory and assembly line were under construction. In 1925 Ford had 14.7 per cent of the Australian new car market and General Motors held 16.9 per cent.

In 1927 Ford released its Model A in Australia and in 1932 the Model B with a V8 engine. In 1934 Ford introduced the 'ute' or Coupe Utility, designed in Geelong and similar to a model produced in America since 1928. By this time Ford and GMH had established themselves as the leading suppliers of new cars to Australian market.



Sir Lawrence Hartnett, National Portrait Gallery

Australia's own car

In 1943, with the war coming to an end, Laurence Hartnett revived his plans for an all-Australian car, and requested his engineers to produce a prototype. While this work was in progress, the Commonwealth government invited submissions from 80 companies that might be interested in producing an Australian car. GMH responded promptly, offering to undertake the work without a subsidy, and to use Australian funds for the

project. The government accepted the GMH proposal in February 1945, before it had received a formal response to its request from any other company.

GMH sent engineers to GM headquarters to work with the Americans on the design of the car and produce three hand-made prototypes for testing in Australia. At the same time it prepared its manufacturing plant for production of the car and trained the staff. The three prototypes were tested in America and shipped to Australia late in 1946 for testing and modification to overcome deficiencies and incorporate improvements. Series production commenced in 1948 and in November that year the car, to be named the Holden, was revealed to 1000 invited guests and launched by Prime Minister Chifley. At this time GMH was holding 18,000 advance dealer orders. The Holden plant was designed to produce 20,000 cars per year. By 1951 GMH was planning on expansion.



'Australia's own car', the first Holden model, 1946

Ford also made a submission to the government offering production of an Australian car, but the government found it was financially less attractive than the offer from GMH, and no agreement resulted.

The Holden was initially produced in one body style and trim level with a choice of four paint colours. The body and chassis were welded together into one unit, with a separate bolted on framework to carry the front suspension and the engine. Outer body panels were bolted on. The engine, made in Australia, was a 2.2 litre 6 cylinder American design. Weight of the car was 2,010kg. Transmission was 3 speed manual with a column mounted gear shift. Seating capacity was 5-6 with a bench type front seat. Imported parts made up around 10 per cent of the total cost.

In 1950 a utility was released, based on the sedan. In 1953 a Business Sedan designed for fleets and taxis was added. Late in 1953 a face-lift including a new grille and various other changes to the trim, and a panel van and a luxury version named the Holden Special were introduced. Work was under way on an expansion of the plant to a capacity of 40,000 vehicles per annum, but it was soon realised that this would be insufficient to meet demand. In 1954 an expansion to 72,000 along with moving assembly to a new site at Dandenong was announced. Exports to New Zealand began in 1954, and by 1960 exports to 45 countries had reached 10,000 per year.

In 1956 GMH released the first major upgrade to the Holden, the FE model. The body was an all new design, bigger and slightly heavier than the previous one. Changes to the engine design resulted in an increase of 10 bhp to 70 bhp. A station wagon was added to the range.

Over the following years new models were introduced at irregular intervals of one to three years.

The late 1950s were a good period for GMH, with sales and profits growing each year. In 1958 it held 53 per cent of the mar-

ket. In 1960 GMH became a private company, following a buy back of shares. Its future looked bright. Holden sales reached a peak of 142,000 units in 1964, but its market share had fallen to 43 per cent. Recent entries Toyota and Nissan had only a small share at this time but were growing rapidly.



Australian Ford Falcon XK, 1960

Ford had introduced the Falcon in 1960 and held 15 per cent of the market in 1964 and Chrysler with the Valiant held 13 per cent.

The Australian 1960 XK Ford Falcon was close to being a right hand drive version of its American parent. A feature was its three speed Fordomatic transmission as an option. It was well received and demand soon exceeded supply in the Australian market. To catch up GMH introduced its Hydromatic transmission as an option on its 1961 EK series Holden. Holden's 1965 HD with an all new longer and roomier body was described as its first genuine six-seater. It was followed in 1965 by the HR, essentially a face lift of the HD, and GMH's most popular car of the nineteen sixties. The HK series, released in 1968, included a wider range of options, including imported V8 engines, than any other car available in Australia. Models available included the Kingswood, replacing the Special, a range of coupés derived from the Kingswood and named Monaro, and the Brougham replacing the Premier. The Holden HT and HG series released in 1969 and 1970 were essentially face-lifts of the HK. But by 1970 GMH's market share had fallen to 34 per cent.

During the 1960s Ford introduced a series of models with styling changes and engine options, culminating in the XY Falcon released in 1970. It proved very popular with both the public and fleet owners.

The XA Falcon released in 1972 was Ford's first car to be completely designed and built in Australia. It offered a wide choice of options, including a station wagon that had a longer wheelbase than the sedan. Ford and GMH saw themselves as the two major competitors in the Australian market. But other car makers were vying for a significant share of the market.

Competition in the market for Australian made cars

British Motors and Leyland

In 1945 Lord Nuffield, Chief of the British Nuffield Corporation, maker of Morris cars, visited Australia and bought the site of the Victoria Park racecourse in Sydney, announcing his intention to manufacture cars in Australia. In 1951 the Austin and Nuffield organisations merged as the British Motor Corporation (BMC) with factories in Melbourne and Sydney making parts and assembling cars. The Sydney factory at Victoria Park manufactured engines, chassis and bodies as well as assembling cars. The facilities were of modern design and highly automated.



Press shop at BMC works, Victoria Park, Sydney

However by 1960 BMC's Australian market share was declining, and this was made worse by a recession and credit squeeze in 1961. Drastic changes were made including retrenchment of 1,000 employees. 1962 to 1965 were years of optimism, with production rising to capacity on two shifts and the Australian operations becoming profitable for the first time. Production of cars and station wagons rose from 24,000 in 1960 to 42,000 in 1964. But BMC had no model that competed directly with the family cars produced by Ford and GMH. A small Australian team was formed in 1968 to develop two cars for local production: a small model (Model A) and a family model (Model B) with maximum commonality. Lead time to production was estimated at five years.

BMC's British parent company was in serious financial difficulty in 1968 and was taken over by Leyland. Major changes followed including a decision in Britain to fast track a new four cylinder model named Marina based on existing components and to adapt it for manufacture in Australia with an Australian engine. Work on the Australian Model A was put on hold, while work proceeded on Model B, named the P76. The P76 was released in 1973 with optional Australian six and eight cylinder engines. Time for rectifying faults prior to the cars going into production was skimped and the P76 quickly gained a bad reputation among dealers and purchasers. In 1974 Leyland, desperate for cash, decided to close its overseas plants. The Victoria Park plant was closed, 6,800 employees were retrenched and manufacture of the P76 was discontinued.



Leyland P76, designed and manufactured in Australia, 1973

Chrysler and Mitsubishi

Chrysler Australia Limited was formed in 1951 and initially assembled imported cars and trucks produced by the American Chrysler Corporation, rebadged under various Chrysler brand names. Beginning in 1962 it assembled Plymouth Valiants and developed a local variant marketed as the Chrysler Valiant, adapting it for largely Australian manufacture in several models. It opened a new assembly plant in South Australia in 1964 and an engine plant in 1968. In the same year, when Chrysler USA acquired the British Rootes Group, Chrysler Australia took over its Port Melbourne factory. In 1971 Chrysler Australia's parent company acquired an interest in the Japanese Mitsubishi Motors Corporation. This led to the manufacture and marketing of Mitsubishi designed cars including the Chrysler Valiant Galant and in 1977 the Chrysler Sigma. Mitsubishi purchased equity in Chrysler Australia and in 1980 purchased the remaining share held by Chrysler and renamed the company Mitsubishi Motors Australia Limited. It built Valiant models marketed under Chrysler badging until 1981 and Sigma models under the Mitsubishi name until 1987. It continued to produce Mitsubishi models until it ceased production of cars in 2008.

Australian Motor Industries

Australian Motor Industries was founded in 1926 by the Crosby family as an agency and assembler of imported vehicles. It developed formal arrangements with overseas manufacturers including the British Standard Motor Company, with brand names of Standard, Vanguard and Triumph; Daimler Benz, with the Mercedes brand name; and American Motors with the Rambler brand. In 1963 it secured the Australian franchise for Toyota. In 1967 it was assembling 32 different Toyota models for the Australian market at its Port Melbourne plant as well as importing fully assembled Toyota Corollas.

Toyota acquired a controlling interest in AMI in 1968. It bought out British Leyland's interest in AMI in 1972 and announced plans to spend \$27 million on an engine and gear box plant. Toyota acquired the remaining share of AMI in 1989 and amalgamated it with its other Australian interests.

Nissan, Renault, Rootes and Volkswagen

These four companies, along with the ones mentioned above, were the major participants in the manufacture of cars in Australia. They were encouraged to undertake local assembly of cars and manufacturing by the Government's policy of import licensing during the years immediately after World War II, designed to protect the Australian currency. Import restrictions were lifted in 1960 leading to increased competition from imports. Local manufacturing continued to receive the protection offered by a tariff of 35 per cent on imported cars and parts.

Nissan began local assembly of Datsun models in 1966 at the Clayton, Victoria works of a newly formed company Motor Producers Ltd. It progressively increased the local content using Australian made components. By 1971 the cars had 60 per cent Australian parts. The 1973 oil crisis generated an increased demand for small four cylinder cars and Nissan produced models in Australia including the Pulsar, Pintara and Skyline to meet it. In the 1980s Nissan was experiencing financial difficulties and closed its Australian factories in 1992.

Renault (Australia) Pty. Ltd. was established in Australia late in the 1950s to organise import and assembly of vehicles in Australia. In 1966 it purchased assembly facilities at Heidelberg in Victoria to Assemble Renault vehicles and also to assemble cars for Peugeot. The plant was closed in 1981 after which Renault cars were fully imported into Australia.

Rootes Australia was established in 1946. It was the first British owned company to establish a production line in Australia and produced a range of models for its British parent, including Hillman, Humber and Singer. In 1965 Rootes Australia was merged with Chrysler Australia, which continued to assemble Hillman cars until 1972.

Volkswagen cars were assembled in Australia by Martin and King at Clayton in Victoria from 1954. Volkswagen Australia Ltd. acquired the

company in 1957 and expanded it to produce body panels, engines and other components until 1968, when it reverted to assembly only, assembling Datsun and Volvo models along with Volkswagens. The factory was sold to Nissan in 1976 and Australian assembly of Volkswagens ended shortly afterwards.

The turbulent 1970s

In 1970 production of cars in Australia reached an all time peak of 475,000, after which it steadily declined. In 1971 Holden released its HK model which over the next three years became the largest selling Holden ever. Ford's XY model, released in 1970 was also a great success, with better performance than its competitors. In 1972 the XA Falcon was the first to be completely designed and built in Australia.

Then the oil crisis of 1973 upset everything. The price of petrol increased dramatically and large cars became suddenly unpopular. Toyota with its range of smaller vehicles seemed like a winner but some of its cars come under criticism for their handling qualities and this affected sales.

The recession that followed the oil crisis affected all the manufacturers. In addition the legislation to limit vehicle emissions resulted in engines becoming less economical and less powerful, as well as imposing costs on manufacturers as they adapted to the new requirements. By the early 1970s GMH was losing money. In 1975 General Motors appointed Charles Chapman, chief Engineer of its German subsidiary, Opel, and its Chief body Engineer, Joe Whitesell, both Americans, to GMH to turn it around.

By the end of 1975, GMH plans for a new line of Holden models, termed the W line, were scrapped and all GMHs engineering activity was directed towards the V-car, based on an Opel, and seen by GM head office as a world car. The V-car was initially designed as a 4 cylinder car, but was adapted to accommodate a 6 cylinder engine as an option for the Australian market. It was released in Australia in 1978 as the Commodore.

In 1975 GMH had introduced the compact Gemini, an Australian version of the Opel Kadett, jointly developed with GMs Japanese affiliate Isuzu. It was well received in the market-place and lived on with minor changes until 1987.

GMH closed its Pagewood NSW plant in 1980, with the company still losing money. There was a small profit of \$61 million in 1981, followed by a loss of \$126 million in 1982, and a forecast loss of \$4,300 million in 1983. But by this time GMH had drastically reduced its workforce and rationalised its activities.

The Button Plan

In the early days of the Whitlam Labor government, tariffs were reduced from 35 to 25 per cent. Toyota, Mazda and Nissan immediately began importing cheap, well-equipped cars from Japan. The government quickly introduced import quotas and sales tax reductions to provide some assistance to Australian car makers. In 1975 the government increased tariffs to 45 per cent and restricted imports to 20 per cent. The following Fraser coalition government raised tariffs in 1983 to a flexible 57.5 per cent with an import tariff quota under the Lynch Plan.

Soon after this the Fraser government was replaced by the Hawke Labor government. The new minister John Button appointed a tripartite committee, the Car Industry Council, to report on the long term future of the industry and make recommendations. The outcome was the Button Plan, announced in 1984, which included a vision, to be fully implemented by 1992, of an industry with three producers and six or less models being produced, with tariffs to be progressively reduced. (In 1983 there were five manufacturers and fifteen models in production.) At the mid-term review in 1988 the reductions in protection were accelerated by immediately abolishing tariff quotas, reducing the general tariff to 45 per cent and aiming at 35 per cent in 1992. The substantial depreciation of the A\$ in the mid-1980s helped to offset the impact of the tariff reductions on the car industry by increasing the A\$ cost of imports.

The Button Plan reduction in the number of manufacturers and models was to be achieved by badge engineering, where the same basic vehicle was sold by several companies under different names. The arrangements

made to achieve this proved unpopular and were gradually unwound, with Holden, Ford and Toyota, rather than sharing locally assembled models with other manufacturers, importing fully built up models to make up their range of offerings. Nissan ended local manufacturing in 1992, and Mitsubishi, which did not share models with other manufacturers, ending local manufacturing in 2008. This left three companies, GMH, Ford and Toyota, manufacturing cars in Australia for the mass market.

Toyota in Australia

From 1963 Toyota cars were assembled in Australia by AMI at Port Melbourne, Victoria. The first Toyota car to be assembled there was the Toyota Tiara. It was the first Toyota car ever built outside Japan. The range of Australian assembled Toyotas gradually increased. In 1978 Toyota established its own plant at Altona, Victoria and commenced production of engines there. In 1994 all Toyota car assembly was moved to Altona. The Port Melbourne plant was closed in 2006 when all Toyota manufacturing moved to Altona. The one-millionth Australian built Toyota was produced in 1992, and the two-millionth in 2004.

By this time Toyota had a substantial export market for Australian cars and components with completely knocked down (CKD) kits being shipped to assembly plants in Thailand, Malaysia, Indonesia, Vietnam and the Philippines. Toyota was by now the largest supplier of cars to Australia, with volumes of around 200,000 cars per year. This was a large figure by Australian standards, but an uneconomically small one by world standards. Toyota in Australia still required protection if it was to survive.

Government car industry policy after the Button Plan

In December 1990 the Australian Government's Industry Commission (IC), which replaced the Industries Assistance Commission (IAC), was able to report that 'for the first time in at least twenty years there have been ongoing reductions in assistance to the industry'. In 1991 it spelt out the arrangements to further reduce protection in the years to 2000, with the general tariff rates to be reduced from 35 per cent to 15 per cent, and a further review before 2000 to inform decisions beyond that year.

Following a change in government at the 1996 election, the Treasurer in the newly elected Howard coalition government, Peter Costello, announced that he review was to be undertaken immediately by the IC, to assist the new government in formulating policy. The IC presented its draft report before the end of the year, recommended the tariff continue to be phased down from the 15 per cent planned for 2000 report and suggested a reduction of 2.5 per cent per annum until it reached 5 per cent.

The Hawke/Keating governments had made a commitment under Asia-Pacific Economic Cooperation (APEC) to implement free trade by 2010. The Howard government now made a commitment to freeze tariffs on cars for five years from 2000, effectively moving the bulk of the action to achieve free trade to the years 2005-2010. It also announced its Automotive Investment and Competitiveness Scheme as a transitional scheme assist the automotive industry in the years 2000 to 2005, limiting the total benefits to \$2,000 million. It was followed by similar government schemes to provide assistance to car manufacturers with capital investments and research and development. The Australian car makers were losing money.

The end of car manufacturing in Australia

In May 2013 Ford announced it would cease Australian manufacture of cars by October 2016. The two other Australian manufacturers, GMH and Toyota, soon followed with announcements that they would cease manufacturing in October 2017. These companies produce vehicles in two states, Victoria and South Australia, supported by around 160 businesses around the country providing engineering and manufacturing services. In 2013 it was estimated that there were around 44,000 people in Australia

engaged in automotive manufacture, around four per cent of the total Australian manufacturing workforce.

There were also around 230,000 people employed in repair, maintenance and retailing of motor vehicles and parts. This number is not significantly affected by the extent of car manufacturing in Australia.

Employment in the automotive manufacturing industry had already declined by 45 per cent between 2006 and 2013. Ford, Holden and Toyota estimate that the manufacturing plant closures will directly affect about 6,600 of their employees. The Productivity Commission's 1914 report on Australia's automotive manufacturing industry estimates that up to 40,000 people may lose their jobs as a result of the closure of the motor vehicle manufacturing plants and the rationalisation of firms in the supply chain. (To put this number in perspective, the Commission estimated that in the year to February 1913, not an exceptional year, about 355,000 people were involuntarily retrenched throughout Australia).

General Motors has announced that it plans to retain its global design studio and its proving ground at Lang Lang Victoria, after manufacturing ceases. Toyota has closed its Toyota Technical Centre in Melbourne. Ford will retain its former headquarters and manufacturing facility at Broadmeadows, Victoria which it plans to become its Asia-Pacific Product development Centre.

Sources and further reading

A wide range of sources contributed to this article. It included books, government reports, research papers and information published by industry participants, most of which is readily available on the web. The principal sources are mentioned below.

There are no books or papers that provide on their own a comprehensive history of the car making industry in Australia, but there are several books that provide detailed histories of individual companies, including:

Darwin, Norm; *100 years of GM in Australia*, H&nd Publishing, Ballarat, Vic, 2002;

Toby Hagon and Will Hagon; *Holden: our car*, Pan Macmillan Australia, Sydney, 2016;

Bedwell, Steve; *Holden vs Ford: the car, the culture, the competition*, Rockpool Publishing, Dulwich Hill, NSW, 2009;

Ford Australia: *The cars and the people who built them*, New Holland Publishers, 2016;

BMC-Leyland Australia heritage group. *Building cars in Australia: Morris, Austin, BMC and Leyland, 1950-1975*; Halstead Press, Sydney, 2012.

There are a number of important government reports and papers on Australian industry in general, and the automotive industry in particular, including:

Michel Emmerly, Parliamentary Library Research Paper 3 1999-2000, Industry Policy in Australia, Parliament of Australia, 1999;

Productivity Commission Inquiry Report, Australia's Automotive Manufacturing Industry, 2014;

David Richardson, Parliamentary Library Current Issues Brief 22 1996-7, Protection in the Motor Vehicle Industry.

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