

Archaeology of the Automobile industry in Victoria 1896-2016

This paper presents some preliminary thoughts on the evolution of automotive factory design in Victoria, based on a typological analysis of some surviving and documented buildings. It stems from heritage assessments undertaken for the Fishermans Bend Urban Renewal Area, and earlier studies of Dandenong and Broadmeadows.¹ This is the first time that a thorough list of automotive factories has been compiled or that an analysis of building types employed for motor manufacture has been presented. The design of automotive factories reflected changes in the nature of the industry, from essentially a backyard workshop pursuit, through large traditional manufacturing, and then purpose- designed buildings serving specialist functions and accommodating the new manufacturing technologies of moving assembly lines.

Introduction - Origins

Automobile manufacture in Victoria is around 120 years old. It arose as an extension of the existing transport industry, primarily the carriage builders producing horse-drawn road vehicles but with pollination from bicycle-makers, steam-engineering and electric traction. The first car factories were therefore the blacksmith shops, farriers, coach builders and engineering works.

Expansion was achieved by adding more sheds to existing workshops until substantial capitalisation became necessary to avoid bottlenecks in production and led in turn, to purpose-built factories. These first took on the form of the standard masonry commercial buildings, brick and stone facades with timber frames. The south-facing saw-tooth roof was borrowed from textile mills to light the workspaces, and as space became a premium, multi-story factories were built in inner urban areas. This building form evolved into the specialised 'Daylight factory', which in turn was superseded by the sprawling single level production-line factory of the present day. Refinements of this last form have been in creating larger roof spans to cover uninterrupted floor areas.

The car factories are themselves, both an enduring product of this industry, even after manufacture of cars ceases, and also a source document to help understand the history and evolution of the industry.

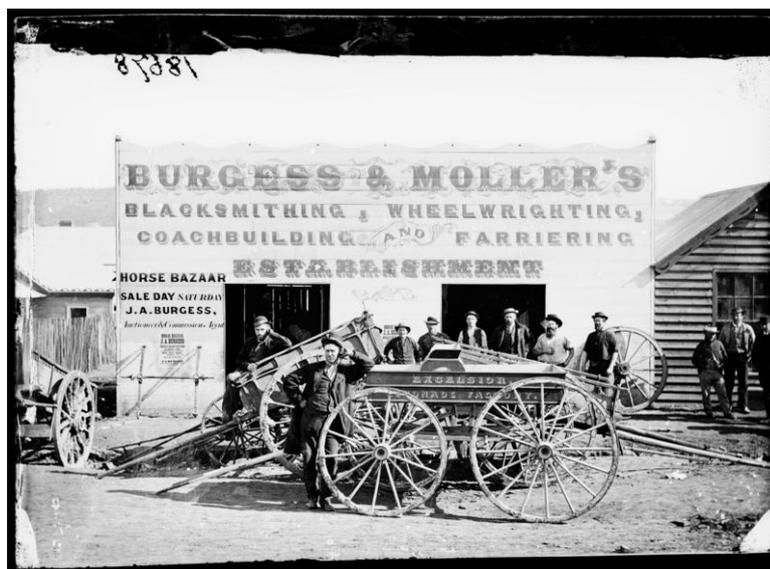


Figure 1. Burgess & Moller's blacksmithing, wheelwrighting, coachbuilding and farriering establishment, Hill End, New South Wales 1917 (State Library of New South Wales PIC/12254/692 LOC Album 1136 http://acms.sl.nsw.gov.au/_DAMI/image/21/160/a2822566r.jpg)

Development of manufacturing from the early engineering workshops

The design or architectural character of these first works was the 'shed vernacular'; timber-framed and corrugated iron-clad, gable-ended structures, similar to most commercial and farm buildings of the period. In more densely developed urban contexts they earned a second story, although this was usually only suitable for the offices, storage and smaller manufacturing tasks. A large carriage entrance led either onto the main road (announcing the building function) or to a lane behind.

Herbert Thomson and Edward Holmes' steam car was built in their workshop in High Street Armadale in 1896.ⁱⁱ Like many small engineering works, this was a simple single story structure with a large entry to the street. Thompson's workshop was unusual in the elaborate facade, perhaps in keeping with the more salubrious neighbourhood, rather than the simpler tin sheds found in more industrial areas.

As his engineering skills and business were in component parts, the larger spaces needed for vehicle assembly, whether horse drawn carriage or motorcar, were not necessary but a public facade to draw in custom was important.

James Alexander Holden in Adelaide was just one of many carriage builders that made the transition to motor vehicle manufacture in an organic way, initially repairing and maintaining imported motorcars and then building sidecars for motor cycles under the partnership of Holden and Frost. In 1917, James' sons, Henry and Edward Holden, formed Holden's Motor Body Builders to build car bodies in a shed at the rear of the firm's premises in Grenfell Street Adelaide. In 1919 they established a new workshop at 400 King William Street.ⁱⁱⁱ

Many other carriage works simply transferred their skills to the new mode of transport by constructing bodywork to wrap around the mostly-imported chassis and mechanical components. Another avenue into motorcar manufacture was through the bicycle.

Kellow Falkiner Pty.Ltd is the oldest surviving motor vehicle builders and agents in Melbourne. It was one of a number of businesses that commenced as a bicycle manufacturer and repairer, (in their case in 1889) and went on to manufacture, maintain or sell motorcars.^{iv}

Urban sites on busy roads also allowed a degree of advertising, both painted on the walls, and in the form of the building itself. The renaissance revival of Holden's Adelaide works combined the urban commercial style with the utilitarian spaces behind.

Sometimes evidence of their past uses are only evident from small details, such as this over-scaled chimney on the side of Frank Northcott's coach and body building works in Elizabeth Street. This once served a blacksmith or foundry within the works.

Melbourne's early carriage builders were concentrated around the north end of the city. A logical place, since the horse and hay markets were located near the junction of Royal Parade and Flemington Road, on the main routes to the goldfields, the Western District squatters and New South Wales.

The finishing line for the 1913 overland motor reliability test, from Sydney to Melbourne was at the Haymarket. It was also the venue for earlier bicycle races, when that sport became the fashionable form of transport in the 1890s. Motor industry related showrooms and suppliers continue to occupy this part of Melbourne.^v

Elizabeth Street became the motoring retail centre, with the surviving motorcycle traders continuing a tradition that goes back to the gold rushes.

First dedicated assembly factories

As motoring grew in popularity, so did the factories. Coach builders could not keep up, and so the specialist automobile manufacture came to be. The production line had been devised, patented and implemented by Ransom E. Olds in 1901, increasing five-fold, the production capacity of the curved dash Oldsmobile. Henry Ford was quick to pick up the idea, and then set to create the production line factory to house this process.

In Australia, mass production took longer to implement. Economies of scale were hard to achieve when the total market was so small. Efficiencies in manufacture did not return much greater profit, so the old manufacturing methods and the buildings housing them continued in use.

Import restrictions played an important role in developing the auto industry. Following Federation in 1901 and the elimination of customs duties between states, a prohibitive import duty was placed in car bodies in 1902.^{vi} In 1917, the Hughes Federal Government, under the provisions of the War Precautions Act, prohibited importation of complete motorcars. However mechanical components and knock-down chassis were exempt from import duty, which gave the impetus to local manufacture of custom-built car bodies.^{vii}

Also around this time, all-steel bodies began to replace timber-framed sheet-metal clad

construction, further contributing to the transition from craftsman-built individual cars to mass production techniques. The import ban was soon lifted, but high tariffs on complete cars remained as a basis of protecting local motor body builders.

The first of the Melbourne automobile makers to have anything approaching a real factory was Colonel Harry Tarrant, who in 1897 made Australia's first petrol automobile. Although purely experimental, Tarrant was able to put what he learnt into manufacturing cars on a commercial basis in 1901, with the assistance of Melbourne bicycle maker, Howard Lewis. The firm occupied a number of buildings in Melbourne with separate departments for machining, bodybuilding, assembly, painting, repairs and other functions.^{viii}

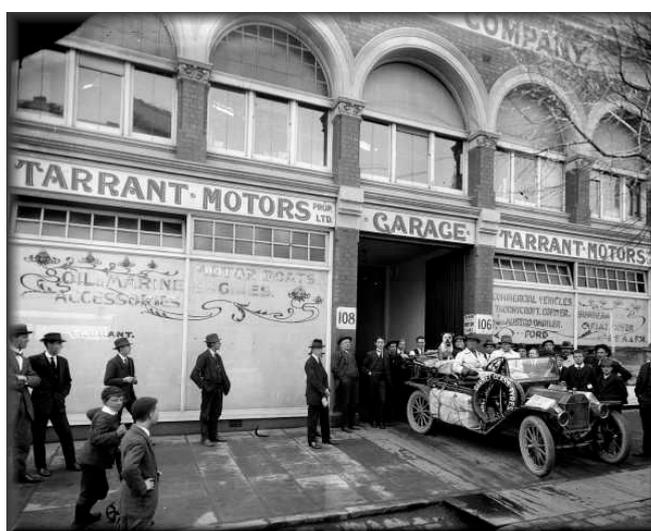


Figure 2. Tarrant works Russell and Collins Street Model 'T' (Ford Club of Victoria <http://www.mtfca.com/discus/messages/80257/108690.html?1261576254>)

Tarrant Motors spawned several operating subsidiaries including Smith's coach building business in Queensbridge Street, South Melbourne in 1903, and in 1907 the motor body department took over larger premises in Exhibition Street, with the title the "Melbourne Motor Body Works" In 1909 larger premises in Lygon Street were acquired to accommodate assembly of Fords and a new factory opened in Lonsdale Street during the First World War. In 1925 Ford built their own plant at Geelong and cancelled the contract with Tarrant, The Melbourne Motor Body Works then concentrated on fitting bodies to a range of British and American chassis although the Depression hit hard and the workforce fell from 400 to just 40.^{ix}

The quintessential mass producer in Australia was probably H V McKay,^x who at his Sunshine Harvester Works, created a vast factory of timber-framed, corrugated-iron clad, saw-tooth roofed factory buildings.^{xi} Among them was the Scott Motor Works, initially

created around 1910 by James L. Scott to manufacture small, petrol-driven motors for farm machinery. McKay gained a controlling interest and turned part of the works to bodying imported chassis, and possibly the trial construction of whole cars. It is believed this included the Sunshine Motor Car, but no examples are known.



Figure 3. Scott Motor Works Sunshine, Royal Show (Museum Victoria Collections <http://collections.museumvictoria.com.au/content/media/4/10754-small.jpg>)

In 1925, the Melbourne Motor Body and Assembling Co., which had its origins in Tarrant Motors, built a new plant which occupied the entire block between Batman Street and Dudley Street West Melbourne. This was also known as Autocar Industries Proprietary Limited Assembling and Motor Body Works. Perhaps in recognition of the competition from Ford's Geelong Plant the building employed a number of the most modern manufacturing methods.

An interesting and unusual feature in the lay-out of the factory is the absence of lifts, though the building is one of three stories. The necessity for lifts is avoided by the use of well-planned ramps, which make it possible to move a car under its own power, if desired from the bottom floor to the top. On the chassis conveyor the assembling is done stage by stage, as the chassis are carried slowly forward on rollers. The heavier parts of the equipment are delivered by travelling trollies suspended from overhead gear. All hand tools such as drills, spanners, riveters, and screw drivers are driven by compressed air.^{xii}

In 1930 the works was recapitalised and renamed by the managing director, Mr. Percy L. Strong, as Ruskin Motor Bodies Pty. Ltd.

Car bodies were made on numerous makes of chassis. A contract was made with Morris Motors Ltd. and another with Hudson for their Terraplane chassis as well as long standing contracts with Austin for the A30 and A50 models. These two makes accounted for much of the firm's workload up to the outbreak of the war when, in common with most of the Australian motor industry, the company became involved in defence requirements, increasing its workforce to 600 in the process.^{xiii}



Figure 4. Ruskin Motor Body Works later Austin Motor Company Australia, Dudley St West Melbourne Fowler, Lyle & Commercial Photographic Co. (Harold Paynting Collection, State Library of Victoria H92.20/3536 <http://handle.slv.vic.gov.au/10381/158895>)

The Austin Motor Company later took over Ruskin, changing its name to Austin Motor Co. (Australia) Ltd in 1948 and after the merger of Austin & Morris to form the British Motor Corporation plant and equipment were transferred to the B.M.C. plant at Victoria Park racecourse in Sydney and later production moved to Sydney.^{xiv}

Like all large car manufacturers, both Tarrant and Ruskin had to deal with the need to bring numerous complex manufacturing operations closely together to ensure a smooth and uninterrupted production flow. In addition, very large and heavy machinery was required for stamping out parts, including whole panels, as automation replaced the handcraft skills of the carpenter and metalworker. The buildings also needed strong floors and high roofs to accommodate these.

Two systems were required – sequential production (a precursor to the modern production line) and a building large enough to contain the operations. One solution was the multi-story factory with weight-bearing masonry walls and heavy supporting floors, good natural light to all parts, and connections between the parts.

The Dudley Street Works along and Holden's Adelaide motor body plants represented a form of multi-story factory that had developed in Europe among the urban textile mills from the late eighteenth century through the industrial revolution. It was refined at the beginning of the twentieth century, primarily in America, to serve a range of mass production uses, but proved ideally suited to the motor industry.

The Daylight Factory

Brother's Albert and Julius Kahn played a significant role in expanding the application of reinforced concrete building around 1903 when the Kahn System of 'steel-trussed concrete' was developed, and the firm Trussed Concrete Steel Company (Truscon) established to implement it. While some consider Kahn more an engineer than an architect, it was his marriage of these disciplines that produced the reinforced concrete frame allowing wide, clear spaces for the uninterrupted operation of production lines and improved ventilation and lighting in American automobile factories.

This form reached a high point in Kahn's Building #10 for the Packard Motor Car Company on East Grand Boulevard in Detroit. There the reinforced concrete frame held the loads so that the perimeter walls of the factory could be filled with glass to allow natural light to penetrate into the interior workspaces. The type was known as the "Daylight Factory."^{xv}

Henry Ford then took up on the idea and commissioned Kahn to design his new Highland Park Factory in Detroit in 1909. But the innovation was short lived because when Ford pioneered the moving production line in 1913 - making a car in one hour 33 minutes instead of 12 hours 38 minutes - the vertical building became obsolete. Instead, long low sheds were needed, extendable in every direction.

The development of the "multi-story American industrial buildings with exposed concrete frames, filled in only by transparent glazing" went on to influence architecture worldwide. In 1913, Walter Gropius (of the Bauhaus) included a photograph of Highland Park in an influential essay on industrial buildings.^{xvi} The craze for 'Americanism' - understood as comprising efficiency, rationalism and technological advance - would transform advanced European architecture.^{xvii}



Figure 5. Kahn's Building 10 for Packard (Wikipedia - https://upload.wikimedia.org/wikipedia/commons/9/90/Packard_plant_no_10_construction.jpg)

International Modern (production line sheds)

Kahn's influence can also be found in the development of the single level production line factory. He designed many of the buildings at Ford's River Rouge plant, with its butterfly roof-lights, and a range of distinctive building forms for the glass works and engine plant. However, it was the light-weight, steel-truss, sawtooth-roof form that became ubiquitous as the international style of car factory. This provided even indirect light over the whole plant by aligning the roof-lights to the north (in the northern hemisphere and south in the Southern) to avoid the contrasts of direct sun and shadow.

The first of the Australian single level production line car factories was the Ford Motor Company Works at Norlane Geelong in 1925. Kahn's signature design elements are evident in the large glazed areas and roof forms, as well as the deep wide gutters around the buildings, intended to drain away the snow melt. These elements were introduced with the rest of the off-the-shelf factory design that came out of Michigan or Canada and exported around the world.

The Geelong Ford factory was modelled on the company's 1923 assembly plant at Toronto, Canada, designed by Kahn. The original Geelong buildings from 1925 are the work of Melbourne engineers Fyvie and Stewart, in partnership with William Grassick, also an engineer. Presumably they adapted Kahn's plans, but given the anomalies of the snow gutters and the misalignment of the roof-lights, they may have not made many changes to suit local conditions.^{xviii}

Here we see the influence of automotive factory design on the modernist architectural aesthetic, with direct reference to the Bauhaus. The butterfly roof form demonstrates the

source of the Geelong plant design.^{xix}



Figure 6. Aerial View of Ford Norlane Assembly Plant (State Library Victoria H2007.25/22
<http://handle.slv.vic.gov.au/10381/288742>)

The next major car factory in Australia was Holden's Fishermans Bend Plant, created as a consequence of the Australian merger between Holden's Motor Body Builders and General Motors in 1931 to become General Motors-Holden's Limited (GM-H). The new plant was commenced in 1936, under managing director Laurence Hartnett, but the intervention of wartime production saw it used for military production, with car manufacture not commencing until after the war.

In planning the GMH plant, personnel made overseas visits to study the latest assembly plant practices and factory layouts. During World War Two the factory produced more than 30,000 vehicle bodies for the Australian and United States forces and manufactured a wide range of equipment, including field guns, aircraft, aero and marine engines. After the war, and partly in response to continuing and increasing import tariffs, Holden commenced manufacture of a fully-Australian product, the 48-215, later FJ.^{xx}

GMH was the first of a number of automotive works in the Fishermans Bend area, attracted to the availability of large manufacturing sites close to rail and sea transport close to the centre of commerce and with a nearby workforce.

Taking their inspiration and often actual designs from North American practice, Australian car makers enthusiastically adopted the open sawtooth roof sheds, which despite their origins in the early nineteenth century cotton weaving sheds, proved admirably adaptable to automobile production lines.^{xxi} The building form provided large roof areas with natural light.

The use of riveted and later welded steel trusses allowed larger spans, and therefore wider spaced columns. As it was essentially modular, factories could be expanded as required by extending in any direction.



Figure 7. GMH looking over the empty expanse of Fishermans Bend c 1940. (State Library Victoria H91.160/259 <http://handle.slv.vic.gov.au/10381/20924>)

Post War production expansion

Ford's Norlane and GMH's Fisherman's Bend can be seen as the precursors of nearly all subsequent car assembly factories in Victoria. The same form of lightweight steel framed sawtooth roof factory was then applied to subsequent works as the Australian motor industry expanded and diversified under continuing tariff protection.

Australian Motor Industries has its genesis in the firm of Eclipse Motors, which secured the Victorian agency for Standard Motor Company's cars in 1929. In 1952 one of its main investors, the Crosby family, in conjunction with Standard Motors in England financed a new plant in Port Melbourne to assemble Standard Motor Cars. It took over the former Felton Grimwade building in Ingles Street Port Melbourne in 1954, changed its name to Australian Motor Industries (AMI), and assembled Fiat, Triumph, AMC and Mercedes Benz cars. In 1963 it secured the Australian franchise for Toyota cars and started assembling the Tiara Model. This was the first Toyota car built outside Japan. Toyota acquired a controlling stake in AMI in the 1960's. Port Melbourne production was eventually shifted to Altona in Victoria in 1994.^{xxii}

In 1937, the State government and American motor manufacturers were negotiating the establishment of a major automobile factory. Three of the four US majors, including both

Ford and Chrysler, were considering this option.^{xxiii} The intervention of the war delayed any action, but in the mean time the Australian government developed a program to establish an armoured division and provide locally made tanks, with an experimental tank depot constructed at Fishermans Bend around July 1941.^{xxiv} In that year the Australian Prime Minister Robert Menzies, travelled to Britain to consider collaborative wartime vehicle production, meeting Billy Roote, head of the Rootes Manufacturing Group. In January 1946, the Minister for Post War Reconstruction Mr. John Dedman (who succeeded Ben Chifley) announced the manufacture of cars by Rootes Ltd at the Fisherman's Bend tank factory, initially assembling the Hillman Minx. This was the first instance of a British motor manufacturer establishing a production line in Australia.

From December 1965, Rootes Australia Ltd. merged with Chrysler Australia and assembly was gradually relocated to Chrysler's Tonsley Park factory in South Australia, which was built in 1955 and eventually covered 170 acres.



Figure 8. Rootes Factory looking west, Williamstown Road on the left (credited to Darryl Jenetsky Sunbeam Car Club, <http://www.sunbeam.org.au/wp-content/uploads/fishbnd2.jpg>)

GMH expanded production in the 1950s as the FJ and subsequent models became large sellers. The Fisherman's Bend Plant was constrained, however, and so a new works in Dandenong was built in 1956 at a cost of £9 million. As well as making Holdens, the factory also assembled Bedford trucks, which came to Australia in CKD form (Completely Knocked Down)

The designing architects were Stephenson and Turner, who were noted for their industrial and hospital work in Australia and were strongly influenced by 'International Style

Modernism', using reinforced concrete, aluminium curtain walls and ceramic glass.

Ford too needed additional manufacturing capacity and so obtained a site on the Hume Highway in Campbellfield, in 1956. This was connected with the Geelong Plant by dedicated rail sidings at each end using specially designed rail wagons carrying components between the factories. In 1959, assembly operations were moved to Campbellfield, and the Australian headquarters was shifted there in 1961 to a purpose built modernist glass curtain wall building designed by Buchan Laird & Buchan in 1964 (with a dedicated computer centre) and a Plastics Plant added 1972.^{xxv}

Volkswagens were first assembled from CKD packs in Australia in June 1954 at the railway carriage manufacturer and car body works of Martin and King Pty Ltd in High Street Clayton, under contract to Regent Motors. Martin & King were a subsidiary of Clyde Industries and had previously assembled cars using Riley and Wolseley components.

Continental and General Distributors in Heidelberg began assembling Renault and later Peugeot and Citroen cars in 1966 having previously assembled cars such as the Simca Aronde, NSU Prinz, and Studebaker Lark. Renault took a controlling interest but ceased manufacture in 1981 following low sales and political fallout from the French pacific nuclear tests.

Motor Producers Ltd. in Clayton took over the Martin & King factory, and appear to have been involved in assembly of a number of brands, including Nissan, (who shifted assembly from their plant at Pressed Metal Corporation in Enfield Sydney in 1972). They subsequently erected an engine manufacturing plant at Clayton, but ended local manufacture in the 1990s. The factory also assembled Volkswagens between 1971 and 1976 and Volvo up to 1988.^{xxvi}

Clearspan Factories and new production systems

The ultimate form of factory architecture is a continuous roofed area over the entire production line. Various forms of long-span, clear-span and light weight truss roofing forms are used now, in some cases eliminating intermediate supports. The main benefit of these larger open structures is its flexibility to accommodate any configuration of plant. Column centres in earlier structures determined the position of production lines and machinery, but with their elimination designers were freed to use optimal layouts for machinery and work stations. The developments in the design of automotive manufacturing buildings were, to a great extent, driven by parallel developments in manufacturing systems, and in particular

“lean production” concepts which focussed on reducing waste in material, energy and worker inputs.^{xxvii} The capacity to optimise the manufacturing process without constraints imposed by the buildings was critical.

Australia's car factories were mostly completed by the 1970s, with the exception of Toyota's Altona plant, and so this latest evolution in factory design is poorly represented in the typology of automotive manufacturing building forms. Toyota Altona is only 20 years old and adopted the Japanese parent's 'lean production' methods, with state of the art architecture and robotic production systems.^{xxviii}

Conclusion

The loss of Australian auto manufacturing might be blamed on a number of factors, such as international trade treaties and local economic and political responses to globalisation such as the shift from a protectionist to free trade policies. But another factor may also have been at play in the way the industry fell behind in the technology of manufacture, as represented in changes to the design, scale and form of the factories themselves. The average age of Australian automotive factory buildings is over 50 years, with the median located in a period when short runs and static manufacturing techniques were the norm. In many cases modernisation of production lines resulted in excess space, as more cars could be built in less room.

Automotive manufacture in Australia has developed from backyard workshops to vast dedicated, purpose designed, automated assembly-line factories over a period of 100 years. At each stage, specific design solutions have been found to accommodate the changes in manufacturing technology, car design and assembly procedures.

The physical evidence of the Australian motor industry, in the form of surviving Australian designed and/or built cars, is readily recognised and preserved by enthusiasts. However, the physical evidence of the places where they were designed and built, while still standing in many cases, is now under threat as the industry goes through a period of dramatic change. Whether the built heritage of the automobile industry survives in the future will depend on finding future uses for its buildings, and raising public awareness of its value to Australia's history.



Figure 9. Nissan car factory in Melbourne (National Archives of Australia Image no. : A6180, 16/4/80/3

<http://recordsearch.naa.gov.au/scripts/PhotoSearchItemDetail.asp?M=0&B=11793458&SE=1>)

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