Background

It may not be easily noticed that, Hong Kong builds its own single-deck buses and coaches to carry school children, employees, residents, tourists and public service personnel every day. These coach bodies built on coach chassis supplied from various countries were indigenously designed, built, tested and licensed. Coach body building is one of the very few remaining manufacturing industries in the territory, and out of the active three (3) coach body builders, for the first time ever, IMechE Hong Kong Branch (IMechE-HKB) was fortunate enough to visit Asia Auto Body Works (AABW) on 20 July, 2013. Locates in Yuen Long, New Territories, it assembles bus and coach bodies for many large and small bus fleets and government departments, carrying thousands of passengers per day.

Company background and outline
AAWB started bus and coach body building in 1988, whereas its root could be traced back to the 1960s, when the founders produced metal craft-works. Annual production is about 80 units. In addition to large and small bus fleets, AAWB also takes orders from non-profit making and voluntary organisations, which vehicles are often tailor-made to suit their unique operating conditions. An example is for a particular bespoke design, in spite of the vehicle is able to accommodate 29 seats, the seating capacity is limited to 28 in order to fulfil the owner’s organisational funding conditions.

In all cases, the vehicles are designed and built to comply with the statutory requirements of the Hong Kong governments, in terms of dimensions, axle weights and any applicable parameters. For instance, the total length of a bus is governed to be 12 metres or less.

**Chassis extension**

Buses arrive at AAWB in chassis, on which steel structures are built according to the guidelines given by the chassis original equipment manufacturer. The document of Body Guideline contains the information a bus body builder needs to take into account in body design and construction, such as heat exhaust size and welding point.

The European-brand chassis comes in the form front and rear modules, bolted together. The front module contains the front axle with suspension and steering, while the rear one carries the power-train and the rear axle with suspension. Upon body construction, a steel frame is installed between and welded onto the two modules, forming the resulted final length of the bus. As observed during the visit, the Mercedes-made chassis modules were bolt-fastened, enabling quick release for chassis extension. Moreover, their cables had been wired to be 13.5 metres long (the allowable total length of a two axle bus in Europe is 13.5 metres), saving the effort of re-wiring during body construction. Chassis extension not only saves the cost of chassis shipment, whereas also gives flexibility to the bus wheel-base. AAWB pioneered chassis extension in Hong Kong by performing the first case on a Mercedes-made chassis in 1996. 30 Volvo B7R chassis underwent the same process in 1998, and more models and chassis followed since.
The Japanese chassis to date, however, comes in a single piece, in the form of a pair of parallel C-channel on which the axles, steering, suspension and power-train are attached, and so is the resulted body is expected to construct. The wheel-base is fixed by the chassis, lacking the flexibility of variation. Following many successful extensions on the European-brand chassis, in 2004 Isuzu consented AAWB to modify its chassis by cutting behind and before the front and rear cross members on the chassis. The middle C-channels are disposed of after cutting, while the remaining front and rear sections are welded to the extended section, or “cage”, which is usually used as luggage compartment. AABW’s “cage” is designed to be compatible with all made of chassis.

**Body construction**

The extended chassis is formed by welding. The “cage” is welded onto the front and rear chassis modules. The workmanship of welding on such key structural components would affect the performance of the resulted vehicle throughout its life-time. Upon the construction of each first model, the chassis’ original equipment manufacturer, or OEM, sends its specialists to examine the extension works. The
welds on the extended chassis are checked, whereas no specific non-destructive examination is performed. Above all, OEMs have given high safety factor for the chassis connection and incorporated amber margin to tolerate imperfect welds. In addition, examinations on the early models have revealed that corrosion on the chassis welds is well within acceptable range. As a result, welding on chassis is a proven and acceptable process for bus body construction.

The alignment of the front and rear chassis modules is paramount. Summarising all OEM practices, AABW checks parallel of the resulted chassis by measuring the axial separation before and after the extension. As long as the difference in the relative measurements lies within five (5) and three (3) millimetres linearly and diagonally respectively, the resulted chassis is considered aligned and acceptable. For reinforcement, the chassis welds are strengthened by reinforcing pads, or “fish plates”.

The “cage” forms an integral part of the resulted bus chassis, which carries the loads and distributes the loads to the entire body structure. Pneumatic pipes and cables are hidden beneath the walkway level of the “cage” to connect the front and rear chassis sections together for power and pneumatic supply. In terms of material, the “cage”, together with the skeletons for the floor, sides and roof, are made of British Standard Grade 43 series (equivalent to BS EN S275 series) box sections principally imported from the mainland China.
Once the body skeletons are erected in place, they are applied with anti-rust paint before skin-covering. Upon skin-covering, flattened galvanised steel plate is attached to the skeleton to form the surface of the bus. Notwithstanding higher in weight than aluminium or aluminium alloy, galvanised steel sheet is used for the skin panel above the cabin floor level. During summer when the air-conditioning is on to keep the cabin cool, the temperature differential between inside the cabin and outside is high, initiating thermal expansion. The galvanised steel sheet shares the same coefficient of expansion with which of the carbon steel-made skeleton. The expansion is therefore uniform, warranting the skin flatness. If, however, the skin panel is made of dissimilar material such as aluminium, the skin panel will expand higher than the skeleton and wrinkle, comprising the surface smoothness of the bus body. A special feature of skin-covering is, the skin plate is under tension upon installation to maintain consistent and long-term flatness. One end of the plate is spot-welded onto the skeleton to provide fixture, while another end is then stretched by four (4) to five (5) millimetres, and spot-welded onto the skeleton.

Below the cabin floor level is the luggage compartment which is not air-conditioned. The temperature differential to which the compartment is subject is
less than the cabin; thus the concern of dissimilar thermal expansion of the compartment door frame and skin panel is less. Stainless steel and aluminium sheet are used to form the former and the latter components respectively.

Next is the installation of the air-conditioning unit, exterior front and rear panels, glasses and doors. AABW produces in-house glass reinforced plastic panels modules for exterior and interior panels and accessories. Then the bus is painted and installed with interior fittings such as control panels and dash boards, lighting, seats, handrails and guards. The resulted bus is tested and finally delivered.

The bus body industry and final remark

AABW launched the current model eight (8) years ago and the model will continue being built in the foreseeable future. Upon the model redesign, however, the skeleton profile and configuration, together with the shape of the front and rear panels and windows, will be revamped. On the other hand, Hong Kong has no indigenous bus body designer because the industry is so small to support an individual dedicated for bus body design.

Hong Kong builds its own buses and coaches to transport thousands of residents, employees, school children and tourists to and from work, school, and tourist attractions every day. The bus body industry contributes, albeit quietly, to the movement of people and goods, whereas its contribution is often omitted by the residents of Hong Kong. IMechE-HKB was, therefore, privileged to be able to visit the cradle of buses, AABW, where the buses were given live. IMechE-HKB extends its gratitude to Mr. Vincent Lau of Asia Auto Body Works and the colleagues of Scania Hong Kong who facilitated this remarkable and rewarding event.
IMechE-HKB delegation visited to Asia Auto Body Works

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Activity Sub-Committee
Local Technical Visit Group

TECHNICAL VISIT TO ASIA AUTO BODY WORKS

Have you seen a coach was originally like the picture shown above? You may be surprised that the coach featured, which may carry you to school, work or cross the border, was made in Hong Kong!

IMechE Hong Kong Branch is fortunate to visit one of the three coach body builders in Hong Kong, Asia Auto Body Works. Members who are interested in local manufacturing, vehicle engineering or buses and transportation should not miss this opportunity to learn first-hand what “Made In Hong Kong” means in the bus and coach context.

Date: 20 July, 2013
Time: 1000 hours to 1200 hours
Free of charge for IMechE members only
Number of participants limited to 10

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