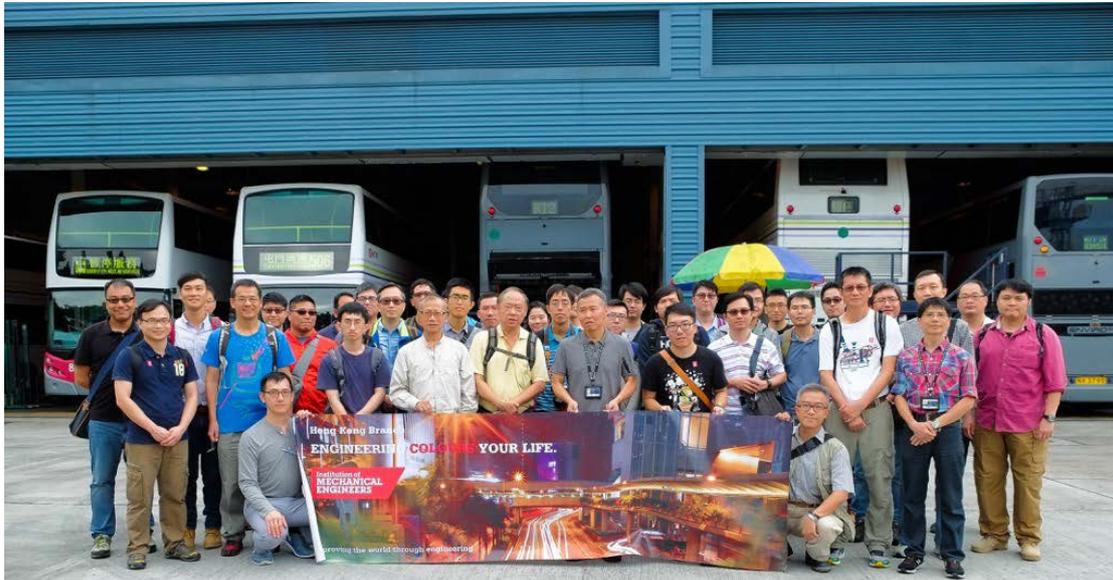


INSTITUTION OF MECHANICAL ENGINEERS HONG KONG BRANCH
TECHNICAL VISIT TO MTRC TAI PO BUS MAINTENANCE CENTRE ON
19/11/2016



MTRC in Hong Kong not only operates both above-ground train and under-ground metro services, it operates a fleet of single and double deck buses to provide feeder bus services to and from many MTR stations in the New Territories. The maintenance and reparation of the 155 passenger-carry vehicles are shouldered by the MTRC bus depot in Tuen Mun and Tai Po Bus Maintenance Centre (TPBMC). Institution of Mechanical Engineers Hong Kong Branch (IMechE-HKB) was privileged to visit TPBMC on 19/11/2016 to appreciate how the MTR buses were maintained to serve the general public in their territory of operations.

Overview

MTRC has three (3) sites for its bus operations. One is the bus depot cum warehouse in Tuen Mun which is responsible for the maintenance and parking of about 30 buses. Another one is Hung Shui Kiu Bus Depot in Yuen Long serving as stable and parking for around 80 buses, plus minor reparation. TPBMC is the result of relocation of the MTRC bus depot previously in Fo Tan of Sha Tin in New Territories. The land of the Fo Tan depot was leased from the government and, in subsequent of the government decided to turn the Fo Tan plot into property development, in 2015 the facility moved to the current site at the outskirts of Tai Po Industrial Estate, on short-term lease from the government with an annual consideration of HK\$120 million.

Taking-Over dated 30/7/2015, TPBMC sizes gross area 4,200 m² and 1,200 m² of which is covered. Staffed by maximum 30 men, it features eight (8) service pits and one (1) dual service and tester pit, an advanced automatic bus wash plant, a wastewater treatment plant (WWT Plant), and a single building housing a workshop for pneumatic device reparation and parts stock, staff amenity and auxiliaries. TPBMC resides on a disused bus terminus and taxi stand, which irregular geometry had posted challenges to site planning. The original vegetation is all retained and the building is orientated towards south, utilising natural ventilation. Although, together with the bus

depot in Tuen Mun, TPBMC is not designated project such that no Environmental Impact Assessment was required for the site selection, contrary to bus depot, the lease term of “Maintenance Centre” prohibits parking of any vehicle. All vehicles inside TPBMC shall only be subject to either maintenance or statutory vehicle test. TPBMC is a Vehicle Examination Centre designated by Transport Department of the government (TD), and so is Tuen Mun Bus Depot, while both test facilities serve the MTR bus fleet exclusively.

Operations and Engineering



TPBMC provides Preventive Maintenance (PM) and Corrective Maintenance (CM) to MTR buses, overhaul to components and equipment and the said statutory Annual Vehicle Examination, Certificate of Roadworthiness (COR) to the MTR bus fleet. While COR is an annual undertaking for certifying the fitness of the vehicle, every bus is subject to overall visual check in Monthly Inspection and more in-depth component condition inspection, such as brake soundness, in Minor Dock between CORs.

MTR bus maintenance regime has observed (i) Hong Kong Ordinance Chapter 374A – Road Traffic (Construction and Maintenance of Vehicles), (ii) operation and maintenance recommendations and service bulletins issued by the bus manufacturer, (iii) TD maintenance guideline, (iv) industrial practice and (v) equipment failure mode and history. Gearboxes and engines are subject to maintenance and reparation every 50,000 hours and 300,000 hours of service respectively. Generally, the time-based maintenance regime in place for MTR buses (versus mileage based maintenance for rolling stocks) is above statutory requirements, ensuring the top integrity of the buses to serve the public. Nevertheless, the ever greater demand on the bus availability has shortened maintenance intervals and has posted challenges to TPBMC to upkeep maintenance within ever shrinking envelop.

By law, the asset life of the MTR buses is limited to 17 years [contrary to the metro rolling stock (M-stock) of 50 years]. As a result, 40 Dennis/TransBus International-made Trident vehicles designated with “7 series” fleet number had been withdrawn in

2016, while 22 “6 series” units will be phased out by 2017. In the MTR bus fleet, the double-deck three (3) axle Alexander Dennis (ADL) Enviro 500 MMC is commended for its high reliability attributable to its mature design and incremental yet prudent improvement from preceding model, while the single-deck ADL Enviro E200 has observed its super-low floor has left insufficient ground clearance causing the front over-hang underside often scratches the road surface. Besides, it is worth nothing that there are nine (9) double-deck two (2) axle ADL Enviro 400 vehicles (E400) in the MTR bus fleet which principally serve the north-west end corner of New Territories, Lau Fau Shan. The terminus in Lau Fau Shan locates at a narrow roundabout which turning radius is too small to be only suitable for short wheel-base double-deck units such as E400. In parallel, Lau Fau Shan is a popular place of eating seafood and seafood is replenished by trucks frequently, leading the roads to Lau Fau Shan to be extra salty. The daily high intensity travel of the E400 units to and from Lau Fau Shan results their chassis corroded more severely than usual and hence their maintenance additionally heavy.



The workshop repairs bus components and parts and test them for readiness of return to service. Many systems on a bus, including braking, operate pneumatically and, while an on-board compressor compresses air from atmospheric to 10 bar, the distribution of the compressed air to the consumers such as brakes and pneumatic gates falls on the three way valve. A three way valve is designed to function such that, in case of any one consumer malfunctions and leaks continuously, it is able to isolate the leaked consumer in order to protect the other two consumers from insufficient compressed air supply and hence supply pressure drop. A testing rig is in place to thoroughly test this safety-critical component to ensure the released units are sound and reliable for use.

Environmental Conscious



TPBMC equips with an advanced automatic bus wash plant supplied by Jardine Engineering Corporations. A bus travels in the plant at constant speed of 5 km/h, whereby the body is sprayed with detergent and then the sides, front, rear and roof-top passes through the spinning wheel brushes and spray of fresh water, having dirt removed from the body surface. After then, reverse osmosis (R.O.) water, recovered from the washing process and treated clean by the R.O. facility affiliated to the plant, is sprayed on the washed body for the removal of water marks. Water is reused to the maximum extent and the consumption of fresh water and hence the water foot-print is therefore minimised.

The terms of land lease include the adoption of on-site waste water treatment facility (WWT) to process effluent generated by the activities inside TPBMC, principally from vehicle works and sewage. Waste-water is discharged into Waste-Water Pump Pit whereby the effluent is transferred to WWT for treatment. The first stage treatment is pH adjustment, pre-filtration and sedimentation. pH control is attained by the dosage of appropriate amount of base or acid with sodium hydroxide and hydrochloric acid respectively in order to facilitate the necessary pH condition for biodegradation. Pre-filtration, or equalisation, which equipment of worth over HK\$100,000 is defined Confined Space, separates solid particles over 6.5 mm in diameter from the downstream process.

After equalisation, the second stage treatment is Membrane Biological Reactor (MBR), also a Confined Space, which uses bacteria to digest the substances in the effluent and sever water from particles, or sludge. The third stage after MBR is disposal. The severed water is exposed to ultra-violet light for disinfection before discharge to the designated point. Conversely, the sludge is collected and transferred to sludge holding tank where it is de-watered for proper disposal.

Remarks

MTRC operates feeder bus services to extend the coverage of service network to the wider communities in Hong Kong, while TPBMC has contributed to the readiness of the vehicles with modern and environmentally friendly facilities. TPBMC and its operations are yet another example of mechanical engineering improves people's lives with safe and reliable means of road transport rendered by the MTRC buses.

IMechE-HKB thanks Mr. Yat-Man Ching, Bus Engineer of MTR Corporation Limited and his colleagues for their hospitality.

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