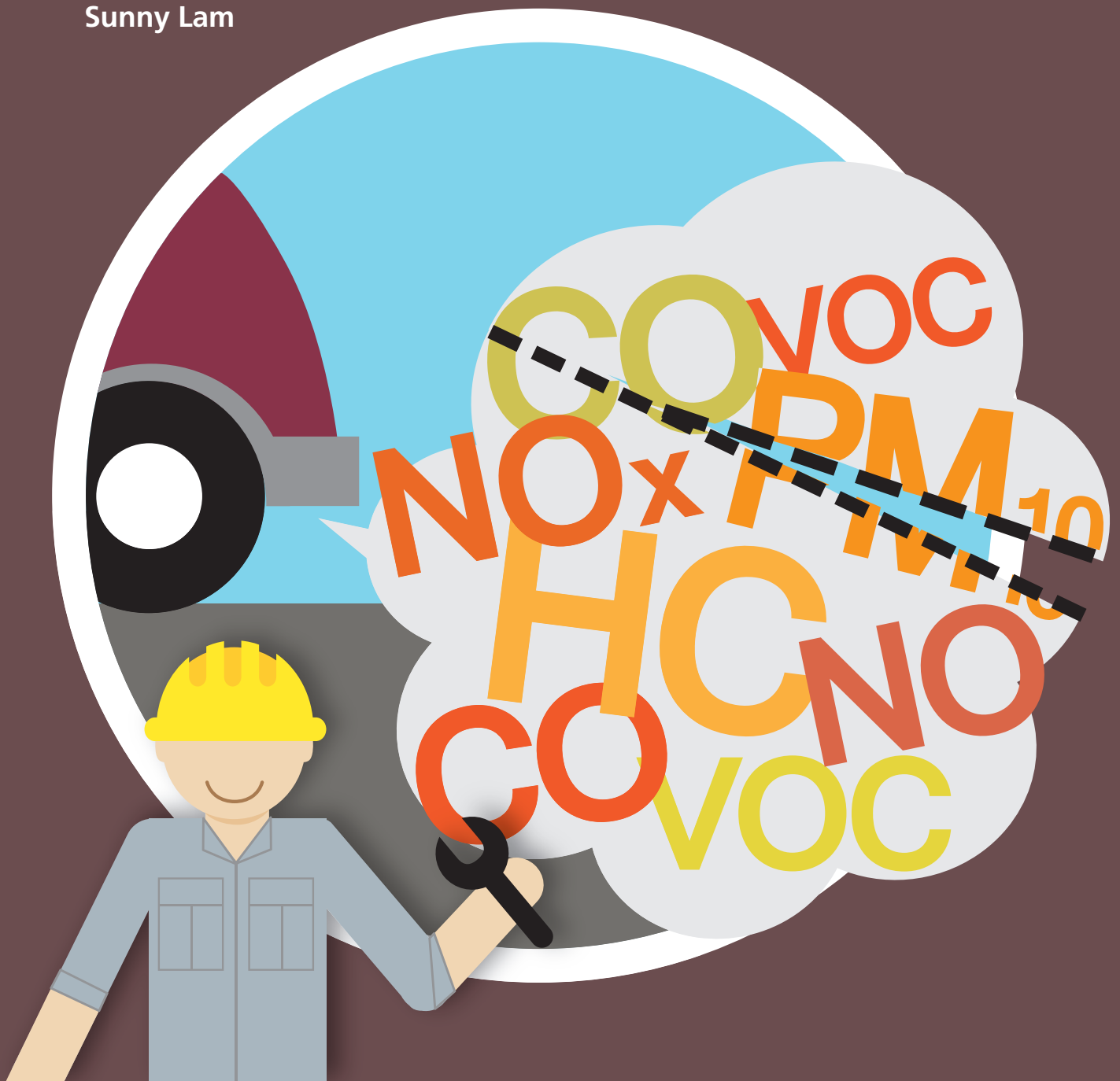


# Training and Development of Inspection and Maintenance Personnel in Hong Kong for Road Vehicles

January 2016

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## About Civic Exchange

Civic Exchange is an independent Hong Kong-based public policy think tank established in 2000 with a mission to advance civic education and engage society to shape public policy.

Civic Exchange undertakes evidence-based research in areas such as air quality, energy, urban planning, climate change, nature conservation and water resources management, helping the Government and stakeholders gain a better perspective on these issues, thereby making better policy decisions. For more information about Civic Exchange, visit <http://www.civic-exchange.org>.

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## Preface & Acknowledgements

Civic Exchange has a longstanding interest in improving Hong Kong's air quality. In the past few years, in particular, Civic Exchange has invested resources in examining the inspection and maintenance programme for on-road vehicles in Hong Kong, as we believe that a comprehensive vehicular pollution control strategy should also include a well-designed programme to inspect and maintain on-road vehicles.

In 2013 and 2014, Civic Exchange published a total of three research reports on this topic, informing and engaging stakeholders in relevant policy discussions. This report represents our efforts in the past year to specifically look at the issue that has been raised in two of our previous reports – the number and competency of vehicle repair mechanics in Hong Kong. There is a growing concern that the capability of the repair trade as a whole will need to be urgently enhanced as the share of advanced vehicles increases in Hong Kong in the coming years, which poses challenges not only to current practising mechanics, but to those who are about to enter the trade and the institutions that are providing training to the mechanics (would-be mechanics included). We hope that this report will help focus the discussion on this important component of the inspection and maintenance programme for vehicles.

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# Acronyms and abbreviations

AEDBC	Automotive Engineering DataBase Centre
AESG	Automotive Engineering Special Group of the Hong Kong Institution of Engineers
ApL	Applied Learning of Hong Kong Diploma of Secondary Education
AQGs	Air Quality Guidelines
ATB	Automobile Training Board of the Vocational Training Council
AUTC	Automobile Industry Training Centre
BCC	Basic Craft Certificate
BIBB	Federal Institute for Vocational Education and Training in Germany
BMBF	Federal Ministry of Education and Research in Germany
CityU	City University of Hong Kong
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
CP6	Competent Person (Class 6) for Liquefied Petroleum Gas Vehicle Servicing Programme
CPD	Continuing Professional Development
CUHK	The Chinese University of Hong Kong
DFS	Diploma of Foundation Studies
Dual VET System	Dual Vocational Educational and Training System in Germany
DVE (AT)	Diploma of Vocational Education (Automotive Technology)
EMSD	Electrical and Mechanical Services Department of the HKSAR Government
EPD	Environmental Protection Department of the HKSAR Government
ERB	Employees Retraining Board
ETC	Emissions Test Cell
ETWB	Environment, Transport and Works Bureau of the HKSAR Government
EU	European Union
F&HE	Further and Higher Education
FSP / PM <sub>2.5</sub>	Fine Suspended Particulates
HD	Higher Diploma
HKAIC	Hong Kong Automobile Information Centre
HKDSE	Hong Kong Diploma of Secondary Education

HKIE	Hong Kong Institution of Engineers
HKJCCT	Hong Kong Jockey Club Charities Trust
HKSAR Government	The Government of the Hong Kong Special Administrative Region of the People's Republic of China
HKU	The University of Hong Kong
HKUST	The Hong Kong University of Science and Technology
I/C	Internal Combustion
I/M	Inspection and Maintenance
ITAC	Industry Training Advisory Committee
ITBs	Industry Training Boards of the Vocational Training Council
ITD	Industry Training Division
IVE	Hong Kong Institute of Vocational Education
JCHVETRC	Jockey Club Heavy Vehicle Emissions Testing and Research Centre
KMB	The Kowloon Motor Bus Company
KMK	Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany
L&T	Learning and Teaching
LegCo	Legislative Council of the Hong Kong Special Administrative Region
LPG	Liquefied Petroleum Gas
MITO	Motor Industry Training Organisation in New Zealand
NO <sub>x</sub>	Nitrogen Oxides
NZQA	New Zealand Qualifications Authority
NZQF	New Zealand Qualifications Framework
OLE	Other Learning Experiences of Hong Kong Diploma of Secondary Education
PAAU	Pro-Act Training and Development Centre (Automobile)
PolyU	The Hong Kong Polytechnic University
PSG	Project Steering Group
PTDR	Part-Time Day-Release
QF	Qualifications Framework
R&D	Research and Development
RSP / PM <sub>10</sub>	Respirable Suspended Particulates

SAE	Society of Automotive Engineers
SCS	Specification of Competency Standards
SUS Plus	Skills Upgrading Scheme Plus
TED	Technical Education Division
TFC	Technician Foundation Certificate
The Department of AE	Department of Automotive Engineering of the Vocational Training Council
TD	Transport Department of the HKSAR Government
TRoQ	Targeted Reviews of Qualifications
TVET	Technical Vocational Education and Training
UK	The United Kingdom
UoCs	Units of Competency
US	The United States of America
VET	Vocational Education and Training
VMRU	Vehicle Maintenance Registration Unit of the Electrical and Mechanical Services Department
VMTAC	Vehicle Maintenance Technical Advisory Committee
VOCs	Volatile Organic Compounds
VPET	Vocational and Professional Education and Training
VRS	Voluntary Registration Scheme
VTC	Vocational Training Council
WHO	World Health Organization

# Executive summary

Road transport connects people and brings mobility to every city in the world. The rising trend in vehicle ownership, however, has intensified roadside pollution. Policies in response have been strategically formulated and rolled out in the past five decades; the determination of the Government of the Hong Kong Special Administrative Region (HKSAR Government) to improve air quality is obvious.

An often overlooked element in addressing roadside air quality is the training and development of inspection and maintenance (I/M) personnel. Availability, quality and capability of I/M personnel has a pivotal impact on the effectiveness of an I/M programme: a stable supply of qualified I/M personnel, at different working levels, can ensure service accessibility so that demand from the market can be satisfied; while the knowledge, techniques, tools and working experience of I/M personnel, determine the quality of I/M work performed.

University education is now the preferred option compared to technical vocational education and training (TVET). Manpower surveys reveal that I/M manpower over the past 30 years could not catch up with the rapidly growing vehicle population. A noteworthy decline in the voluntary registration scheme for vehicle mechanics (VRS for vehicle mechanics) in the last three years illustrates that the I/M trade in Hong Kong is experiencing a stagnant period. In addition, ambiguous prospects have failed to attract high-calibre entrants to the trade. Furthermore, the indefinite career ladder faced by apprentices or trainees makes I/M jobs even more unappealing.

Due to the fundamental changes in the education system and job expectations, the local I/M trade has been facing substantial difficulties in employing and nurturing the next generation of mechanics and technicians. Professional training in automotive engineering has a history of over 30 years in Hong Kong; it once prospered when blue-collar work prevailed in the economy. Economic restructuring to a commercial-based society entirely altered the definition of a typical job; people preferred to work in offices instead of workshops. Adverse perceptions of a mechanics' prospects and working environment disincentivised young people from entering vehicle I/M trade.

Connections with the industry, for both teaching staff and apprentices, are often weak or non-existent. On the one hand, teaching staff have difficulties in joining the official training offered by manufacturers, given the commercial confidentiality of new products and techniques; while on the other hand, industry practitioners are not directly approached for teaching but only as consulting representatives because they are too costly with no guarantee of proficiency as trainers. Comprehensive but less in-depth curriculum, reduced TVET programme duration and a significant number of generic courses, appear to be the main causes of the lack of time for apprentices to thoroughly learn the present-day technologies and day-to-day operations within an industry setting.



Maintenance information and tools are crucial to servicing and repairing the new generation of vehicles with computer-controlled onboard diagnostic systems. The information and related product training are usually offered exclusively to official agents or main dealers, so that vehicle maintenance can only be carried out in their own authorised workshops. The rest of the trade can only access vehicle data and information by paying a substantial price or after a few years when it is released to the market. This situation curtails the operational capability of many non-official workshops and hinders the development of the trade.

I/M personnel in Hong Kong run into intense competition locally and across the border. Faced with increasingly more sophisticated vehicle systems, regular tightening of emission regulations and enhanced servicing capability on the Mainland, continuing professional development (CPD) and life-long learning are one of the vital means for local I/M personnel to improve and compete with others in this day and age. Mechanics in small-scale workshops, with no internal training at all, express their difficulties in regularly participating in external CPD: either the training venues are too distant from the workplace or their heavy workload discourages them from attending courses after work.

Both the apprenticeship training scheme in New Zealand, and the Dual Vocational Educational and Training System (Dual VET System) in Germany, are useful references to shed light on the crux of the problems associated with the I/M training system in Hong Kong. These two systems, by coincidence, maintain a good balance between on-the-job and off-the-job training, nurture batches of certified mechanics and technicians who generally meet industry's expectations and needs, and contribute to the flourishing automobile I/M trade in the respective countries.

With regard to manifold challenges faced by trainers and personnel in the I/M trade, it is recommended in this report that some measures should be carried out jointly by the industry and the HKSAR Government, to provide better TVET and programmes for I/M personnel in Hong Kong:

#### **Reviewing and strengthening the Inspection and Maintenance curriculum**

Fundamental changes in the education system need to take place, with the support of the Qualifications Framework (QF), to make TVET qualifications equally attractive as other undergraduate and higher diploma (HD) courses. Employers will need to support such changes by offering attractive pay levels, a clear career path and well-equipped working environments. The HKSAR Government could provide more subsidies and funding to the I/M sector as social investment to promote I/M TVET, especially to its youth.

Rigorous and sustained liaison with industry can help teaching staff keep abreast of the services demanded and the latest vehicle technologies in real-world I/M operations. TVET providers, as the present major channel of supplying I/M personnel to the trade, should continually enhance trainers' teaching expertise and quality. Teaching teams and industry should meet regularly to continually adjust the curriculum and associated learning and teaching methodologies in response to the learners and industry needs.

#### **Strengthening current initiatives to enhance professional standards and recognition**

Mandatory registration of vehicle mechanics in Hong Kong is a requisite for successfully building up the QF along the chain for the I/M profession. This can help connect the starting point of the existing career pathway and improve the trade's image accordingly. The HKSAR Government needs to consult trade immediately to agree on the time frame of obligating all in-service mechanics to be fully qualified.

#### **Reviewing the Continuing Professional Development system**

The concept of CPD has to be fully implanted in the mentality of I/M personnel at all levels, including workshop owners and mechanics. Considering CPD as a mutually beneficial development related to workplace productivity and customers' satisfaction, owners should devote more resources to internal and external CPD, such as paying their employees for CPD hours additionally, thus mechanics will be incentivised to participate outside working hours. Furthermore, in order to make CPD system work effectively, the current requirements over different qualifications should be raised to an extent that enables continuous in-depth learning.

CPD providers need to keep an eye on the market trend, such as the latest emission standards and changes in vehicle regulations and incorporate them in courses at regular review points. A wide range of in-depth CPD activities should be offered at different times and at various locations by professional bodies, so as to increase the convenience to participants.

#### **Making maintenance data available**

The HKSAR Government should consider legislating the mandatory disclosure of technical data and information, urging vehicle manufacturers to share their maintenance data with the rest of the I/M trade or creditable third parties during the license approval process of newly launched vehicles, this can better enhance the effectiveness of the whole trade and avoid the present market bias in favour of large-scale authorised workshops.

The relaunch of the Automotive Engineering Database Centre (AEDBC) in the form of the Hong Kong Automobile Information Centre (HKAIC), which offers technical data, CPD and advice to its members, can perhaps serve a similar function once its copyright issue is resolved. By making manufacturers' data, software and maintenance information available, it would also be able to enhance the overall competitiveness of all I/M providers.

#### **Setting up a communication platform among key stakeholders**

Public participation of key stakeholders can be effective at driving the industry forward. To further enhance performance and professional standards among the trade, the HKSAR Government should take the lead by initiating a communication platform and convening regular meetings among training institutions, industry players, professional groups, relevant advisory committees and government departments' representatives, to constantly review the challenges and brainstorm ways to move forward. This would enable all parties to share insights and plan strategies for both the automotive industry and the related TVET for I/M personnel.

This platform should work at full stretch to forge a consensus on the importance of I/M work carried out by I/M personnel, which could attract social benefits in the form of more effective vehicle emission control, better roadside air quality and reduced health risks to society.

# Introduction

## 1.1 Overview

Road transport is a major contributor to air pollution in Hong Kong, according to the 2013 Hong Kong Emission Inventory Report

Road transport contributes a large part of the air pollution in Hong Kong. As revealed by the *2013 Hong Kong Emission Inventory Report* released by the Environmental Protection Department (EPD), about 59 per cent of carbon monoxide (CO), 23 per cent of volatile organic compounds (VOCs), 23 per cent of nitrogen oxides (NO<sub>x</sub>), 21 per cent of fine suspended particulates (FSP or PM<sub>2.5</sub>) and 18 per cent of respirable suspended particulates (RSP / PM<sub>10</sub>) emitted in Hong Kong are generated from vehicular mobile sources.<sup>1</sup> Vehicles propelled by internal combustion (I/C) engines also emit carbon dioxide (CO<sub>2</sub>) and raw heat, which are significant drivers of climate change.

Research illustrates the potential health risk caused by roadside emission

Toxic gases emitted from road vehicles are carcinogenic and harmful to human health, according to the cancer research arm of the World Health Organization (WHO).<sup>2</sup> A recent study from the University of Hong Kong (HKU) suggests that elderly residents face special health risks from PM<sub>2.5</sub>, which can deeply penetrate into people's lungs.<sup>3</sup> In two of the major traffic nodes in Hong Kong – Central and Causeway Bay, the PM<sub>2.5</sub> daily average concentrations were found to exceed the WHO's Air Quality Guidelines (AQGs) on almost 280 days within a one-year period from March 2014 to February 2015.<sup>4</sup>

Government is tackling local air pollution based on *A Clean Air Plan for Hong Kong*

To reduce air pollution and its associated health risks to people, *A Clean Air Plan for Hong Kong* was strategically launched with cross-bureau efforts in 2013.<sup>5</sup> The Government of the Hong Kong Special Administrative Region (HKSAR Government) has rolled out a series of policies to tackle different types of air pollution, including programmes to cope with roadside emission, such as the Scheme to Phase Out Pre-Euro IV Diesel Commercial Vehicles by the end of 2019 with the provision of ex-gratia payments. Another initiative is the Strengthened Emission Control for Petrol and Liquefied Petroleum Gas (LPG) Vehicles: the EPD identifies vehicles emitting excessive emissions by mobile remote sensing equipment and requires owners to conduct further maintenance and an emission tests.<sup>6</sup>

Two previous Civic Exchange reports reviewed the existing I/M programme in Hong Kong and the emission inspection technologies for diesel commercial vehicles respectively

In 2013 and 2014 respectively, Civic Exchange published two reports reviewing vehicle inspection and maintenance (I/M) programmes in Hong Kong. The first report – *A Review of the Hong Kong Inspection and Maintenance Programme for On-road Vehicles*,<sup>7</sup> was a comprehensive overview of the I/M programme in Hong Kong with reference to international best practices, and the second report – *Improving Hong Kong's Emission Inspection Programme for On-road Diesel Commercial Vehicles*,<sup>8</sup> focused on the latest developments in emission inspection programmes for diesel commercial vehicles around the world and their relevance to Hong Kong.

Training and development of I/M personnel is often an overlooked element in I/M programme

After publishing these reports and conducting the related stakeholder engagement, an important but frequently overlooked issue has been identified in the current I/M programme – the training and development for I/M personnel in Hong Kong. Compared to other advanced countries with thriving automotive industries, the public tends to underestimate the

value and contribution of the local I/M trade. Qualifications of mechanics, technicians and other practitioners receive insufficient recognition and value in general, resulting in a diminishing trend in new entrants to the trade. It should be emphasised that without sufficient well-trained and dedicated I/M personnel, initiatives to reduce vehicle related air pollution would not be successful.

**I/M personnel have to catch up with new vehicle technologies developed by manufacturers**

Evolution of vehicle technology is another challenge: The latest vehicles embody the most sophisticated technologies, which enhance safety and fuel efficiency and minimise exhaust emissions. Furthermore, the more proactive manufacturers such as Toyota, Tesla and Hyundai are producing hybrid, battery-electric and hydrogen fuel cell vehicles. On-the-job training and Continuing Professional Development (CPD) presently provided in Hong Kong is insufficient to equip mechanics with the in-depth knowledge and full range of technical skills for their day-to-day work.

**The changing technologies also bring in challenges to students who want to enter the trade**

Vehicle technology has become more and more intellectually challenging to the learner; good quality secondary school graduates able to understand, quickly learn and keep abreast of rapidly changing technologies (especially sophisticated electronics) have become a must for the motor industry. As a matter of fact, there has been a steady decline in student passing rates, starting in the mid-1990s, especially with regard to vehicle technology topics. It is logical to foresee a shortage of mechanics in terms of both supply and capability in the near future.

**Maintenance tools and data may not be accessible to workshops and mechanics, which hinder their daily operation**

From the perspective of workshops, access to manufacturer's specifications, software, diagnostic codes, wiring diagrams and special tools, for the precise model of vehicle under repair, are critically important in present-day vehicle maintenance. Most garages are facing difficulties in accessing the aforementioned information and specialist tools. Local I/M workshops also have to compete with Mainland workshops in providing technically demanding maintenance services at the lowest cost.

**Stable supply of qualified mechanics is crucial to an effective I/M programme**

All the above issues are closely related to the vehicle I/M trade. Mechanics and workshops clearly have critical roles in carrying out regular checks and maintenance work on vehicles; they are affecting the quality of maintenance done directly and the effectiveness of emission control programmes indirectly. To ensure the effectiveness of vehicular I/M programmes in the city, a stable supply of qualified and capable mechanics has to be seen as the first priority for the industry.

To build on what the previously published reports have achieved in this field, this report in particular recounts both the development history and the current situation regarding the training offered to I/M personnel in Hong Kong. In section 2, an overview of the training and development of I/M personnel in Hong Kong is briefly provided to set the scene. In sections 3 and 4, the major challenges faced by training institutions and I/M personnel respectively are identified and elaborated upon. Section 5 consolidates the experiences of vocational training in New Zealand and Germany as best practices to learn from, while section 6 examines the possible improvements and recommends the most feasible solutions that best-fit I/M trade in Hong Kong.

# The training and development of Inspection and Maintenance personnel in Hong Kong

## 2.1 Vocational training

VTC is the largest vocational education and training provider in Hong Kong

### 2.1.1 Institutional setup of the Vocational Training Council

The Vocational Training Council (VTC) has been the largest institution in providing technical vocational education and training (TVET) in Hong Kong since 1982.<sup>9</sup> In the early 1980s, the VTC oversaw nine technical institutes, schools for the disabled, a management development centre and 16 training centres. It provided a wide range of TVET services but has expanded over the years and now also offers undergraduate courses; there were about 46,500 students receiving pre-employment vocational training from the VTC in the 2013/14 academic year, which constituted ten per cent of the full-time student population in Hong Kong's upper secondary and tertiary education.<sup>10</sup>

### 2.1.2 Development of Inspection and Maintenance Technical Vocational Education and Training over time

The VTC, as a public organisation in Hong Kong, has carried out its mission to offer diversified TVET all the while with the use of its resources. VTC has trained up thousands of vocationally capable I/M personnel to enter the labour market over these years.

The Department of Motor Vehicle Engineering was set up in 1983/84 to provide specialised training on vehicle knowledge

In the 1983/84 academic year, the VTC opened a new academic department which specialised in heavy vehicle engineering, namely the Department of Motor Vehicle Engineering. This was located at the Lee Wai Lee Technical Institute in Kowloon Tong. Light vehicle I/M courses were provided by the VTC's Morrison Hill and Kwun Tong Technical Institutes.

AUTC was opened in 1986 to offer training to secondary school graduates

In 1985, a number of VTC training centre complexes were opened. The Kwai Chung Training Centre Complex included an Automobile Industry Training Centre (AUTC) which opened that year. The AUTC offered off-the-job craft level full-time training courses for the light vehicle I/M sector, aimed at post-form 3 school leavers. It should be noted that the size of vehicles, used for training purposes, was limited by a vehicle lift. This meant that large vehicle related hands on training could not be fully accommodated by the AUTC. Furthermore, the introduction of VTC training centres created a certain degree of competition with existing technical institute departments.

ATB was set up to advise VTC on the latest development of the automotive industry

In the same year, Industry Training Boards (ITBs) were established to provide advice to VTC on the latest industry situation,<sup>11</sup> and one of which, the Automobile Training Board (ATB), was set up specifically for automobile industry.<sup>12</sup> The ITBs in Hong Kong are similar to those already operating in the United Kingdom (UK). In the UK, an amendment to the Education and Training Bill had been passed in 1969 which led to the setting up of a range of training boards, some of which are still operating but privatised today. Unlike Hong Kong, the cost of operation of UK's ITBs was originally covered by a levy on industry.

**The rebranding exercise of the Department of AE and PAAU showed the changes and progressions in automotive training in VTC**

In the mid-1990s, the Department of Motor Vehicle Engineering was renamed the Department of Automotive Engineering (the Department of AE), after all automotive engineering courses and resources based at the Morrison Hill and Kwun Tong institutes were transferred to it. Automotive engineering courses was not offered at any of the universities at that time. The new name of the Department of AE was based on the US Society of Automotive Engineers (SAE)<sup>13</sup> which embraces all aspects of automotive engineering. Similarly, the name of the AUTC was changed to the Pro-Act Training and Development Centre (Automobile) (PAAU) during a rebranding exercise in 2007, apparently to widen its remit and enhance its appeal.<sup>14</sup>

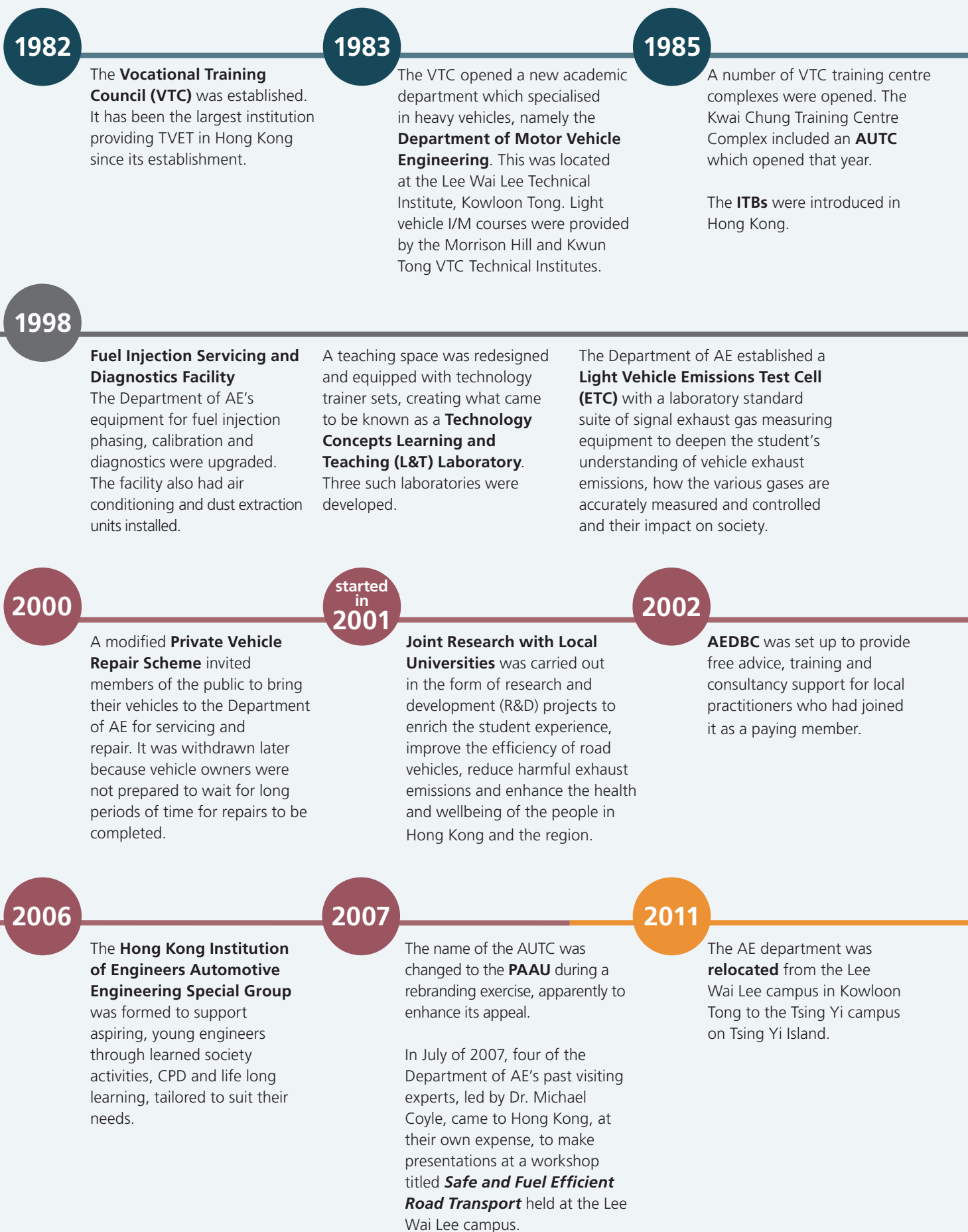
**The Department of AE was recognised as Centre of Excellence for its contributions to the industry and the society**

By 2004, the Department of AE had become a VTC Centre of Excellence due to its state of the art facilities, the unique role it played and the proactive stance it had adopted for the benefit of students, industry, local universities and society. In regard to vehicle emission control, for example, the Department of AE submitted a paper containing a list of measures aimed at alleviating air pollution caused by road vehicles in 2006. The paper, *Vehicle Related Air Pollution: In Support of the HKSAR Government Chief Executive's Action Blue Sky Initiative* (see Appendix I), was also published on the websites of the Automotive Engineering Database Centre (AEDBC) and Clear the Air.

**VTC has put a lot of efforts in developing its facilities and teaching content over the past 30 years**

In addition to producing graduates who would become automotive mechanics or technicians, the Department of AE also saw the need to provide the start of a pathway to professional automotive engineer status. The Department of AE was faced with the urgent need to develop and modernise its teaching and learning resources, in order to accommodate its expanding portfolio. Developments undertaken in the provision of training facilities, teaching approaches and related research over years are listed in Appendix II. An extracted development timeline of automotive I/M training in the VTC is shown in Figure 1.

**FIGURE 1: Development timeline of automotive maintenance training in VTC<sup>15</sup>**





## 1989 continues annually

Providing realism to students and keeping academics up-to-date with industry continue to be major challenges faced by off-the-job training providers. Both students and staff were therefore sent on attachments to industry under the **Student / Staff Industry Attachment Scheme**.

## 1993

The VTC set up two **Technical Colleges (Tsing Yi and Chai Wan)** to take over the Higher Diploma and Higher Certificate courses previously offered by the Hong Kong Polytechnic and City Polytechnic. Vocational education offered by the VTC was extended to post-secondary level.

## mid 1990s

The Department of Motor Vehicle Engineering was renamed the **Department of AE**, after all automotive engineering courses and resources based at the Morrison Hill and Kwun Tong institutes were transferred to it.

## 1998 continues annually

### Expert Visits Initiative

This involved bringing one well-established international, automotive engineering expert to Hong Kong each year. Experts met and worked closely with students, staff and local practitioners to improve networking for the Department of AE and accrue additional benefits for all concerned.

## 1999

A **Light Vehicle Transient Chassis Dynamometer** was consigned to the Department of AE to enable more sophisticated student projects to proceed and to carry out research and development (R&D) work for the EPD.

All technical institutes and technical colleges were merged together to establish the **Hong Kong Institute of Vocational Education (IVE)**.

## 2003

### Vehicle Electrical and Electronics Laboratory

was developed to track the evolution of hybrid or EV technologies and driverless vehicles, and to keep students up-to-date with the latest electrical and electronics technologies.

## 2004

The Department of AE became a VTC **Centre of Excellence** due to its state of the art facilities, the unique role it played and the proactive stance it had adopted for the benefit of students, industry, local universities and society.

## 2006

The Hong Kong Jockey Club Charities Trust (HKJCCT) donated HK\$16.61 million for the building and equipping of **the Jockey Club Large Vehicle Testing (R&D) and Emissions Centre**. This was intended to enable the hands-on study of all large vehicle systems.

## 2013

The Tsing Yi Campus of the IVE established **the Jockey Club Heavy Vehicle Emissions Testing and Research Centre (JCHVETRC)**. The Centre undertook testing and research on the exhaust emissions of vehicles to promote environmentally friendly logistics and transport. The Centre was the first ever vehicle testing centre in Hong Kong certified to the latest Euro V standards.

The PAAU launched a restricted form of the AEDBC, namely the **Hong Kong Automobile Information Centre (HKAIC)**, and due to copyright concerns the new HKAIC is now only used for internal purposes.

## Review annually

### Stock Vehicles for Hands-on Practical Projects

The Department of AE will consider purchasing vehicles each year to keep training vehicles up to date, and write older vehicles off once they are no longer fit for purpose.

### 2.1.3 Courses and curriculum

The VTC offers diversified courses and programmes to meet with the needs of different targeted students.

#### (i) Diploma of Vocational Education (Automotive Technology)

DVE (AT) is the automotive training course provided to secondary school graduates up to QF level 3

The PAAU and Youth College (Kwai Chung and Tuen Mun), the member institutions of the VTC, jointly offer both light and heavy vehicle modules in the form of Diploma of Vocational Education (Automotive Technology) (DVE (AT)) Programme and practical training up to level 3 of the Qualifications Framework (QF) to secondary schools graduates:

#### Box 1

##### Courses offered by PAAU and Youth College (Kwai Chung and Tuen Mun)<sup>16</sup>

A full-time, 3-year DVE (AT) offered to Secondary 3 students

A full-time, 1-year DVE (AT) offered to Secondary 6 students

A part-time-day, 3-year Craft Certificate in Automotive Technology offered for Apprentices

A part-time-day, 3-year Craft Certificate in Vehicle Body Repair offered for Apprentices

“Multi-entry-multi-exit” of DVE (AT) provides more flexible options to suit different students’ needs

Every year, the PAAU and Youth College undertakes the training of 600 part-time students with its resources and facilities. Other than that, over 100 Secondary 3 graduates and 40 Secondary 6 graduates are being admitted annually by the DVE (AT) programme respectively.<sup>17</sup> The programme adopts competency-based training and a “multi-entry-multi-exit” system, giving student options to alter their progression path according to their interests, capabilities and career orientations.<sup>18</sup> A general trend for pathway selection can be seen: the longer the training period for the students, the more the further studies is preferred (see Table 1). Students who decide to enter the labour market after graduation will receive more training on practical techniques; students who select the pathway of further studies, will be given more generic courses accordingly. The following table clearly illustrates that the 3-level qualifications available in the DVE (AT) programme provides their students great flexibility in choosing either to work or study further:

**TABLE 1: Qualifications offered by PAAU and Graduates' Pathway<sup>19</sup>**

Qualification awarded	Training Period	Graduates' Pathway Selection	
		Employment	Further Studies
Basic Craft Certificate (BCC)	1 year	Roughly the same	Roughly the same
Technician Foundation Certificate (TFC)	2 years	Small proportion	Large proportion
Diploma of Vocational Education (DVE)	3 years	Small minority	Significant majority

**(ii) Higher Diploma in Automotive Engineering**

HD in Automotive Engineering is a specialised vocational course with the recognition of QF level 4

The Department of AE at the Hong Kong Institute of Vocational Education (IVE) (Tsing Yi), another institute under VTC, offers the Higher Diploma (HD) in Automotive Engineering as an extension to the DVE under level 4 of the QF in Hong Kong.<sup>20</sup> The detailed course list for the HD in AE can be found in Appendix III.

**Box 2**

**Courses offered by the Department of AE, IVE<sup>21</sup>**

A full-time, 2-year HD in Automotive Engineering offered to holders of the Hong Kong Diploma of Secondary Education (HKDSE), Diploma of Foundation Studies (DFS), Diploma of Vocational Education (DVE), and Yi Jin Diploma, or equivalent.

Graduates can choose to work in the industry or pursue higher academic education at local universities

Students of this programme can transfer to a Bachelor's degree in engineering at five local universities, namely HKU, The Hong Kong University of Science and Technology (HKUST), The Chinese University of Hong Kong (CUHK), The Hong Kong Polytechnic University (PolyU), and City University of Hong Kong (CityU).

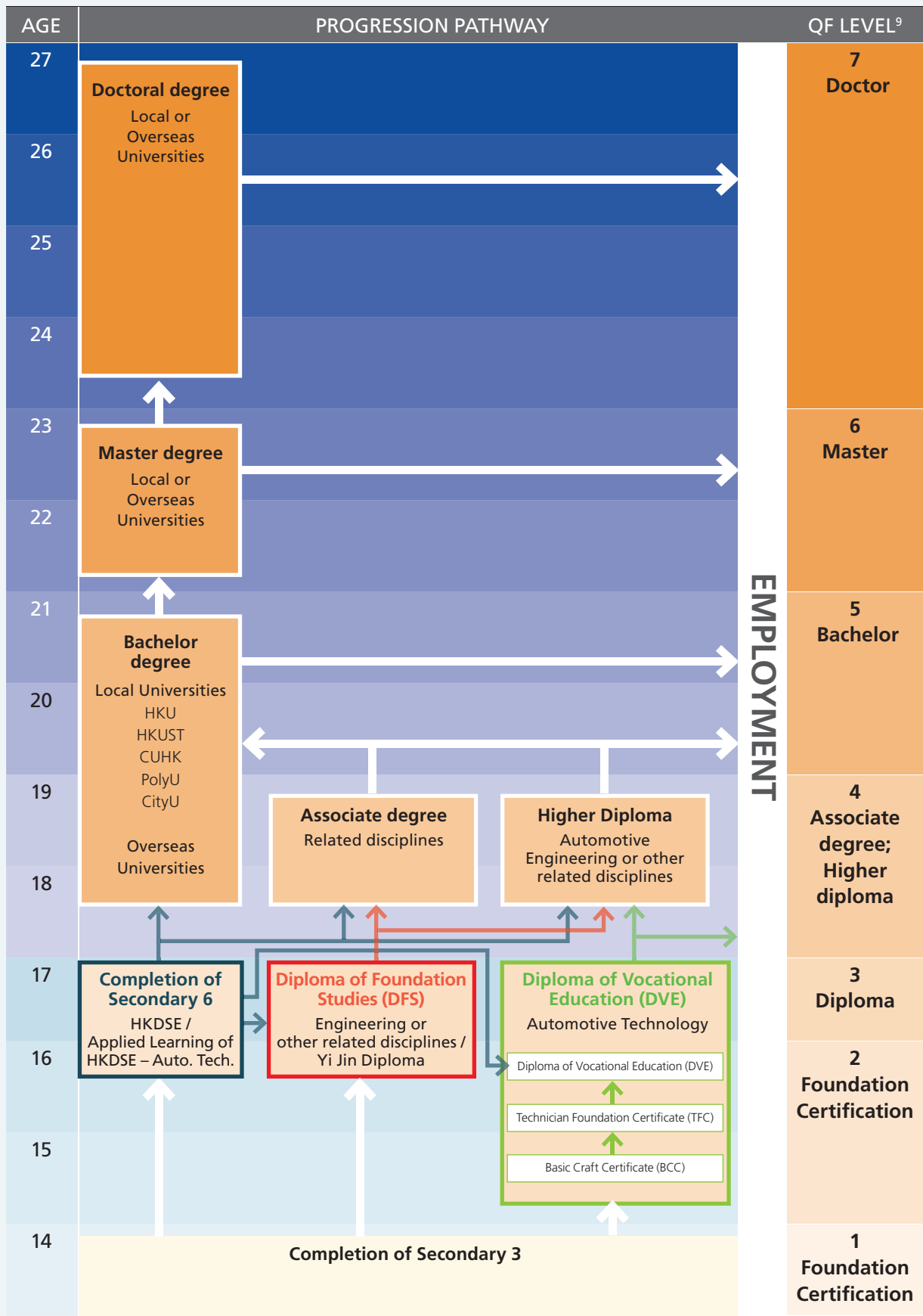
The HD courses are well-recognised by local and overseas professional groups

The HD programmes offered by the Department of AE over the years are accredited by the Institute of the Motor Industry Hong Kong and the Hong Kong Institution of Engineers (HKIE), and recognised by other professional bodies around the world, such as Society of Operations Engineers, Institute of Transport Engineers and Institute of the Motor Industry in UK, the SAE in US and others.<sup>22</sup>

**Table 2: HKIE Accredited Programmes (HD in AE)<sup>23</sup>**

HKIE Accredited Programmes	Year of Accreditation
HD in Automotive Engineering (3-year full-time)	2011
HD in Automotive Engineering (4-level part-time evening)	2013
HD in Automotive Engineering (2-year 5-semester full-time) (under interim recognition status for intake years 2012-2014)	2019

**FIGURE 2: I/M Personnel Progression Pathways and Corresponding Qualifications Framework Level<sup>24</sup>**



## 2.1.4 Latest developments in Inspection and Maintenance Technical Vocational Education and Training in Hong Kong

### (i) Implementation of Qualifications Framework in the automotive industry

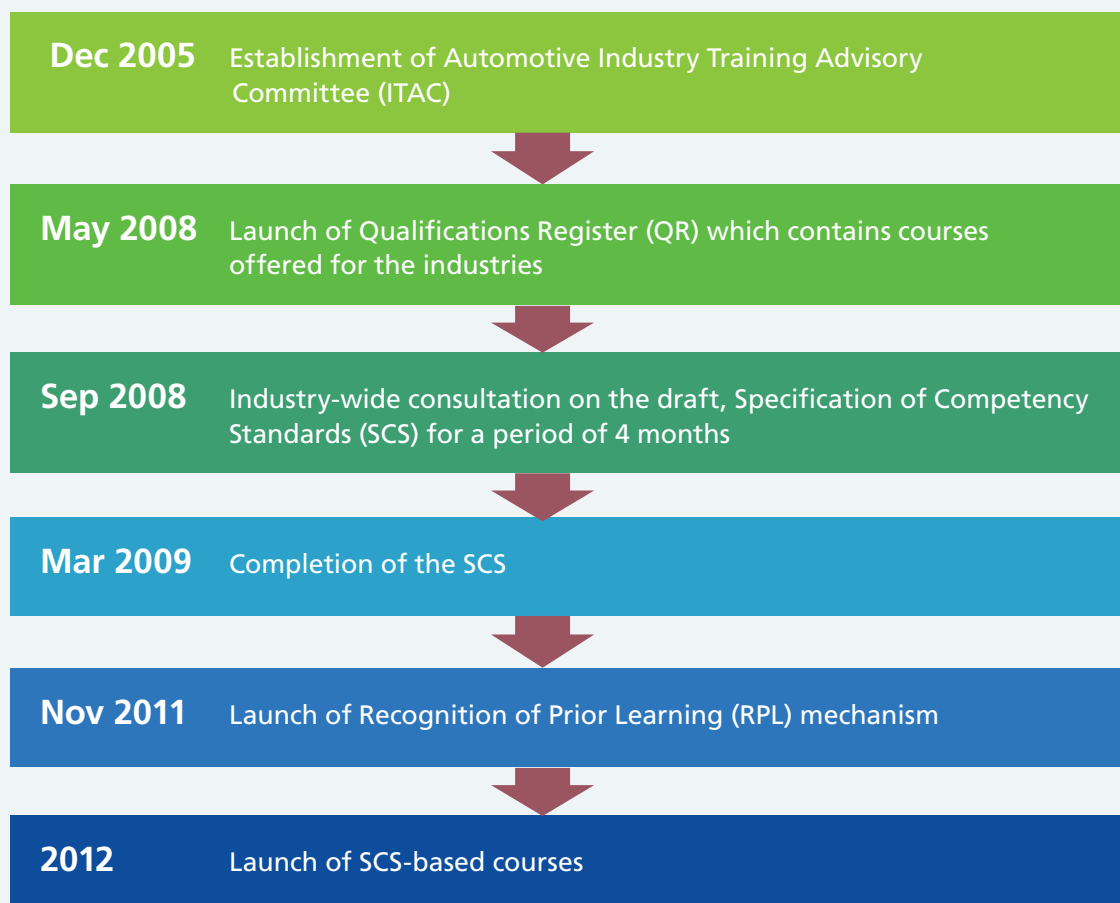
QF is an important tool for both employees and employers to better comprehend one's qualifications of work and education

The QF was first launched in 2008 to promote life long learning and facilitate progression up the qualifications ladder. The automotive industry was one of the earliest industries to set up its own Industry Training Advisory Committee (ITAC), which steers the work of Specification of Competency Standards (SCS) and promotes the QF to the industry. In 2011, the QF adopted the Recognition of Prior Learning (RPL) to those existing practitioners to obtain qualifications up to QF level 4 based on their relevant working experience or their assessment results.<sup>25</sup>

Detailed specifications make QF more comprehensive

So far, there are 16 major functional areas and each consists of various Units of Competency (UoCs) at different QF levels;<sup>26</sup> Vehicle Servicing and Testing is one of the functional areas, covering 84 UoCs from QF level 1 to level 6 on vehicle structure, system, spare parts, inspection, maintenance, vehicle testing, and more.<sup>27</sup>

**FIGURE 3: Automotive Industry – QF Implementation<sup>28</sup>**



**(ii) Pilot Training and Support Scheme / Earn and Learn Pilot Scheme**

**A Pilot Training and Support Scheme was launched in 2014 to encourage apprenticeship among the youth**

In his 2014 Policy Address, the Chief Executive recognised the need to promote vocational training and re-establish its position within the existing education system.<sup>29</sup> A Pilot Training and Support Scheme (also named the Earn and Learn Pilot Scheme) was launched to integrate apprenticeship training with more competitive income and clearer progression pathways. The proposed Scheme aims at attracting and retaining quality manpower to the industries that face labour shortages or ageing problems.

**The Scheme covers several industries suffered from labour shortage**

The VTC cooperates with related associations and federations to offer training and stable income to youth in the industries of electrical and mechanical services, printing, retail, watch and clock, automobile, testing and certification, and probably more in the foreseeable future.<sup>30</sup> The Scheme involves HK\$144 million of public expenditure; it is expected that 2,000 vocationally trained students can benefit from the Scheme.

**Students showed their interests in the Scheme and their response was overwhelming**

The automotive industry is one of the targeted industries under the Scheme;<sup>31</sup> 62 DVE (AT) students joined the Scheme and around 40 of them are still in it as at November 2015.<sup>32</sup> Scheme participants can work as apprentices in some large-scale companies and operators, such as Zung Fu, BMW, Crown, Electrical and Mechanical Services Department (EMSD), New World First Bus, Citybus and more.<sup>33</sup> The completion of the Scheme is equivalent to the qualification of DVE, which is on level 3 of the QF. Students may pursue higher level qualifications like a HD at QF level 4 or Bachelor's degree at QF level 5 according to their interest.

**The Scheme guarantees each participant a monthly salary during the part-time study period and a monthly subsidy throughout the entire 4-year**

Given that a monthly subsidy from the employers can be received by the students in the first year of the Scheme (full-time study), there is a cost implication (i.e. HK\$2,800 x 11 months = HK\$30,800) to the employers before they receive any labour services in return, thus a higher expectation on the apprentices' academic result and course attendance is often seen as a guarantee of participants' qualities. The HKSAR Government supplies the monthly subsidy for the following three years on top of the monthly salary to ensure a guaranteed monthly income to encourage students to stay in the industry.<sup>34</sup> More importantly, the VTC plays a coordinating role in supporting both the students and employers in the job-matching process after the completion of the 4-year Scheme.

**Table 3: Mode of training and income to be received by a student under the Pilot Scheme<sup>35</sup>**

Year	Mode of Study	Minimum Monthly Salary (HK\$)	Incentive Allowance		Total Monthly Income (HK\$)
			Monthly Subsidy	Funding Source	
1st	Full-time	--	2,800 (for 11 months)	Industry / employer	2,800
2nd	Part-time study alongside on-the-job training	8,000	1,500	HKSAR Government	9,500
3rd		8,000	2,000	HKSAR Government	10,000
4th		8,000	2,500	HKSAR Government	10,500
Completion		10,500	--	--	10,500

HD students can gain more working experiences under industrial attachment with the support from the HKSAR Government

**(iii) Industrial attachment**

To provide better pre-employment working experience for TVET students, the HKSAR Government has set aside a recurrent budget of HK\$18 million for the provision of industrial attachment since 2014/15 academic year.<sup>36</sup> Opportunities will be given to VTC's full-time HD students. The students from automotive engineering and automotive technology can take part in the attachment programme to gain day-to-day working experience in automotive business and management, automotive engineering and automotive technology under the Engineering branch of the student industrial attachment programme.<sup>37</sup>

The Partnership Programme is mutually beneficial to the business and the student

**(iv) Business-School Partnership Programme**

Another initiative, the Business-School Partnership Programme, has been helping students understand daily operations and expectations of businesses since 2005.<sup>38</sup> It is a win-win situation that helps enterprises to promote their corporate image, and assists students plan their careers. Visits to the Kowloon Motor Bus (KMB) and Dah Chong Hong provided students an initial understanding of vehicle maintenance and servicing at their young age.<sup>39</sup>

Constructive recommendations have been made by the Task Force to further promote vocational education in the society

**(v) Report of the Task Force on Promotion of Vocational Education**

The Task Force on Promotion of Vocational Education was formed in mid-2014 to outline the strategies on vocational education in Hong Kong. It studied the current landscape of vocational education comprehensively with the aim to rebrand and promote it among the public. After a year of meetings and continuous public engagement, the Task Force published a report with detailed recommendations for HKSAR Government's considerations in July 2015. The three major strategies proposed in the report are stated in Table 4 as follows:

**Table 4: Strategies proposed by the Task Force on Promotion of Vocational Education<sup>40</sup>**

<b>Strategy 1:</b>	<b>Rebranding Vocational Education and Training (VET):</b>
	Rebranding VET as vocational and professional education and training (VPET); and Covering programmes up to degree level (QF level 5).
<b>Strategy 2:</b>	<b>Strengthening Promotion:</b>
	Promotion of professional image of VPET (publicity, facilities, teaching and research quality);
	Provision of more information about VPET and related career through VPET portal and forum;
	Promotion of VPET through whole school approach career and life planning education;
	Closer collaboration between related chambers of commerce and VPET providers;
	Devise comprehensive human resource strategy;
	Promotion of applied learning through accreditation, admission bonus and subsidies from the HKSAR Government; and Provision of financial support by the HKSAR Government in Pilot Training and Support Scheme, industrial attachment and study subsidy scheme for designated professions or sectors.
<b>Strategy 3:</b>	<b>Sustaining Efforts:</b>
	Promotion of VPET by the HKSAR Government officials;
	Promotion of QF; and Conduct tracking surveys on attitude change.

The Government is studying the feasibility of the recommendations suggested by the Task Force

The Education Bureau of the HKSAR Government in general welcomed the publication of this report and all its recommendations. The authority is now examining the feasibility of the proposed strategies. It is expected that the implementation of these strategies can provide more flexibility and confidence to young people in their life planning, especially along a vocational education pathway.

ApL offers more opportunities to students to gain wider exposure and experience in addition to learning from textbooks

**(vi) Applied Learning of the Hong Kong Diploma of Secondary Education**

Under the current Hong Kong Diploma of Secondary Education (HKDSE) curriculum, candidates may gain career-related knowledge and experience of different vocations through elective Applied Learning (ApL) courses and Other Learning Experiences (OLE) activities. An ApL course specialising in automotive technology has been offered under the category of “Civil, Electrical and Mechanical Engineering – Engineering and Production” to HKDSE candidates since the 2010/12 cohort.<sup>41</sup> In 2014, there were 41 candidates from 28 participating schools taking this automotive technology course.<sup>42</sup> One of the advantages of taking ApL is that, it can add to the candidate’s attractiveness to tertiary institutions.<sup>43</sup>



## 2.2 Continuous training

CPD helps practitioners maintain or even enhance their competencies

As vehicle technologies advance rapidly, qualified mechanics should keep themselves updated with state of the art vehicle maintenance techniques. CPD, an important component in TVET, is one of the “means by which people can maintain their knowledge and skills related to their professional life”.<sup>44</sup> It has been regarded as a way to continuously advance skills and competencies of I/M personnel in the trade.

Mechanics have to attend 20 hours of CPD training in every three years to renew their registration

### 2.2.1 Continuing Professional Development requirements of Voluntary Registration Scheme for vehicle mechanics

In the Voluntary Registration Scheme for vehicle mechanics (VRS for vehicle mechanics) (see section 2.3.3), CPD is especially critical for mechanics’ empowerment and renewal of registration under the scheme; the merits of CPD will be seen in the long-term.<sup>45</sup> To renew the registration for further three years, mechanics are required to attend at least 20 hours of CPD training in the previous three years, in order to acquire sufficient knowledge of the latest technologies.

**Table 5: Options of CPD in VRS for vehicle mechanics<sup>46</sup>**

A range of training, courses or activities that help mechanics developing their competence, skills and knowledge will be counted as CPD hours. Options of CPD in VRS for vehicle mechanics are listed in the below:

(i)	Training / courses organised by the Department of AE of the IVE or other relevant educational institutes;
(ii)	Training / courses organised by PAAU of VTC;
(iii)	Training / courses provided under the “Skills Upgrading Scheme Plus” (SUS Plus) of the Employees Retraining Board for the Transportation and Support Services Industry;
(iv)	Technical training / courses provided by vehicle suppliers for the automobile industry or in-house staff;
(v)	Relevant training / courses / seminars organised by professional institutions or trade associations / unions of the automobile industry;
(vi)	Technical talks / seminars for the automobile industry;
(vii)	Training / courses / seminars for enhancing personal knowledge in areas such as legislation, language, customer service, supervisory skills, occupational safety and health, etc.;
(viii)	Technical visits relevant to the automobile industry; and
(ix)	Through RVM Newsletter.

## 2.2.2 Continuing Professional Development providers (vehicle maintenance) in Hong Kong

### (i) Pro-Act Training and Development Centre (Automobile)

Diversified courses have been offered by PAAU

In Hong Kong, the PAAU of VTC offers a wide range of CPD courses to the trade in the form of in-service short courses. Course content varies from vehicle electronics to mechanical servicing, equipping the trade with knowledge and skills in servicing different vehicles that can be found on-road, including diesel, LPG, petrol, hybrid and electric vehicles. (See Appendix IV for a complete list of PAAU courses)

PAAU closely cooperates with the industry and organises CPD activities for mechanics and technicians

The CPD courses at PAAU are popular among mechanics and technicians; in the 2014/15 academic year, there were more than 500 enrollments for the PAAU in-service training held in the evening off-work hours.<sup>47</sup> Most of these courses are under the “industry-first” principle, which lets applicants with recommendations from employers be admitted first.

Highly responsive to market demand makes PAAU’s training popular among mechanics

PAAU is actively responding to the needs of industry practitioners. On average, there are new courses organised every year to fill up the latest gaps and challenges faced by practitioners in daily operations.<sup>48</sup> In April 2015, there was an explosion in an LPG taxi maintenance workshop in Wong Tai Sin; the community became concerned about the safety of LPG vehicle maintenance workshops. To respond to this concern for supplementing knowledge and safety awareness in the servicing of LPG vehicles, PAAU organised two specific courses to recapitulate and enhance the training for LPG vehicle mechanics (Competent Person (Class 6)) (CP6), both these courses were well-attended and welcomed by the trade.

PAAU also provides training to the HKSAR Government departments to equip the related knowledge to the officials

Apart from offering the courses for the trade, PAAU also runs specialist training courses for HKSAR Government departments to help them perform their duties. For instance, the Hong Kong Police Force receives training from the PAAU in road traffic accident reconstruction and vehicle construction and maintenance regulations specifically, which were originally developed and taught by the Department of AE. The Hong Kong Customs and Excise Department and Transport Department (TD) are some of the other HKSAR Government departments that have received systematic training, originally from the Department of AE and now from PAAU to further strengthen their working competencies.

In addition, PAAU closely works with HKSAR Government departments in disseminating information on policies. For example, the EPD cooperated with PAAU in giving a technical seminar on Euro VI emission reduction technologies and maintenance for diesel commercial vehicles in November 2015, soon after the proposed adoption of Euro VI in 2016-2018. A valuable exchange on concerns and challenges between 300 practitioners took place; PAAU is acting as the bridge between the industry and the HKSAR Government.

**HKAIC supported the trade a lot in technical aspect in the past**

Formerly known as AEDBC, the Hong Kong Automobile Information Centre (HKAIC) is a sub-centre of PAAU which shares vehicle maintenance information and data with the trade from time to time. AEDBC was a useful provider of CPD activities for member-practitioners in the past. Once the paying member-practitioner received the sought-after technical information, they could contact the AEDBC and request guidance on how to correctly apply the information to the vehicle under repair. Free verbal guidance was provided or, if this was not enough, the member-practitioner could come to the Department of AE's workshops and be shown how to properly complete the repair. The AEDBC was once serving over 80 local member-practitioners in 2007 and contributing significantly to consumer protection and the provision of CPD.

**HKAIC is becoming more active in CPD provision with the aid of social media platform**

In recent years, due to copyright and budget constraints, HKAIC provides only limited training and support. Starting from October 2015, industry practitioners can enroll as members of HKAIC to keep posted about seminars or activities held by HKAIC and PAAU.<sup>49</sup> A social media platform was set up in September 2015 to share up-to-date vehicle information and promote CPD activities as well.<sup>50</sup> It is expected that HKAIC will take up a more active role in organising CPD in the future if the operation is economically feasible.<sup>51</sup> It certainly helps the trade to keep in touch with the latest developments in vehicle technologies.

**SUS Plus of ERB is an CPD alternative under VRS for vehicle mechanics**

## **(ii) Employees Retraining Board**

Employees Retraining Board (ERB) is a statutory body that coordinates and offers "market-driven and employment-oriented" training courses for employees in the labour market.<sup>52</sup> Specifically, under the VRS for vehicle mechanics, registered mechanics can attend ERB's Skills Upgrading Scheme Plus (SUS Plus) courses to earn CPD hours to renew their registration (see Table 5 in section 2.2.1). However, only very few of the SUS Plus courses being offered in 2015/16 are directly related to vehicle maintenance. For instance, the customer service course on occupational safety and health can fulfill the CPD requirement of the VRS for vehicle mechanics; others include driving safety and one-test-two-certificates courses which do not help mechanics to develop their knowledge and skills at work.<sup>53</sup>

HKIE also poses a CPD requirement on its members to keep and enhance their competencies and professionalism

**(iii) Hong Kong Institution of Engineers**

The HKIE,<sup>54</sup> as the premier engineering professional body in Hong Kong, also deems CPD necessary for engineers to maintain their working capabilities in a changing world (see Appendix V). Courses shown on the HKIE website are mostly run by external parties; there are 33 course providers collaborating with HKIE in providing CPD for members as at July 2015.<sup>55</sup> HKIE considers itself a coordinator and facilitator of CPD activities for its members, in order to help them achieve the minimum CPD requirement for engineers in the pre-Corporate Member stage.<sup>56</sup>

**Box 3**

**CPD Requirement of HKIE<sup>57</sup>**

HKIE has also laid-down CPD requirements for its members, as follows:  
“For training, candidates are required to acquire knowledge, skills and attitudes of a practical nature which can be learned in an industrial or commercial environment. For CPD, the general experience and mature routes require a minimum average of 45 hours per year for six and three years immediately prior to their applications for Professional Assessment.”

Some approved groups can provide CPD training to their members under the VRS for vehicle mechanics

**(iv) Other trade associations and unions**

Associations and unions from the maintenance trade are able to provide CPD to their members. These organisations usually have close connections with the mechanics and technicians in the sector, representing their rights and providing benefits to existing practitioners. Some well-recognised CPD providers include the Traffic Services Employees Association, the Institute of the Motor Industry Hong Kong, the Hong Kong Vehicle Repair Merchants Association Limited, the Hong Kong Vehicle Repairing Industry Employee General Union, etc.<sup>58</sup> There are usually two forms of CPD provided: first is the joint workshops or seminars held together with HKSAR Government departments and vocational training institutes; second is the training provided by the in-house expertise or activities to their own members exclusively.

## 2.3 Professional recognition: Voluntary Registration Schemes

In order to enhance the standard of the local vehicle maintenance trade, a discussion on mechanic registration was held in January 2004 by the Panel on Transport of Legislative Council (LegCo). At that time, the Environment, Transport and Works Bureau (ETWB) proposed implementing a VRS for vehicle mechanics.

**VRS for vehicle mechanics can help promote a positive image on vehicle maintenance in the society**

The VRS for vehicle mechanics was seen to be beneficial to both the industry and society in several aspects: first, it improves the image of the trade and attracts better quality labour into the trade, mechanics are delighted as they are given a registration card and stamp as recognition;<sup>59</sup> second, it guarantees the maintenance work and gradually eliminates those mechanics with unqualified skills. Quality is further assured as the registration scheme becomes a means of preventing mechanics from any misbehaviour that violates their code of practice, while punitive measures including suspension and revocation of licenses can be deployed in the existing performance monitoring points system;<sup>60</sup> third, the qualified maintenance ensures roadworthiness in reducing accidents and enhancing road safety; fourth, proper maintenance carried out by well-trained mechanics can help to protect the health of the public by minimising vehicles' negative impact on air quality.

**Survey results highly supported the implementation of VRS for vehicle mechanics**

A survey was conducted among workshop operators and mechanics by the ETWB in late 2004 to evaluate responses from the trade.<sup>61</sup> The majority of responses received (i.e. over 90 per cent of respondents) was in favour of the registration scheme for vehicle mechanics. With such general acknowledgement from the trade, the ETWB then embarked on the introduction of the registration scheme.

### 2.3.1 Vehicle Maintenance Technical Advisory Committee

The Vehicle Maintenance Technical Advisory Committee (VMTAC) was later set up in May 2006 with the inclusion of industry representatives, professionals and HKSAR Government officials (see Table 6 for the detailed composition). Members are all appointed with a 2-year term of office by the Secretary for Transport and Housing; this particular group is responsible for steering and supervising the registration scheme.

**Table 6: Composition of the 5th VMTAC (May 2015 to 30 April 2016)<sup>62</sup>**

Sectors represented	No. of representative(s)
Chairperson	1
• Director of Electrical and Mechanical Services	
Trade Associations	5
Workers Unions	4
Training Institutes	3
Transport Operators	2
Professional Institution	2
HKSAR Government Departments	
• EPD	2
• TD	
Vehicle Owners' Association	1
Independent Person	1
• Nominated by the Home Affairs Bureau	
<b>TOTAL</b>	<b>21</b>

**VMRU was set up to support and manage the registration schemes**

### 2.3.2 Vehicle Maintenance Registration Unit

Administrative support and daily management of the registration scheme is performed by the Vehicle Maintenance Registration Unit (VMRU) under the EMSD. There is an independent appeal mechanism in the VMRU to review its own decisions upon applicants' request. If the applicants are not satisfied with these review results, they can further appeal to the Appeal Panel made up of VMTAC members and HKSAR Government officers.

**VRS for vehicle mechanics provides solid recognition to the existing personnel in the trade**

### 2.3.3 Implementation of Voluntary Registration Scheme for vehicle mechanics

The VRS for vehicle mechanics was finally established in January 2007 with the continuous effort of the VMTAC and the VMRU.<sup>63</sup> Feedback was positive while the trade actively engaged in the registration. As at 30 June 2015, about 70 per cent of vehicle mechanics in the trade registered in the scheme (see Table 7).

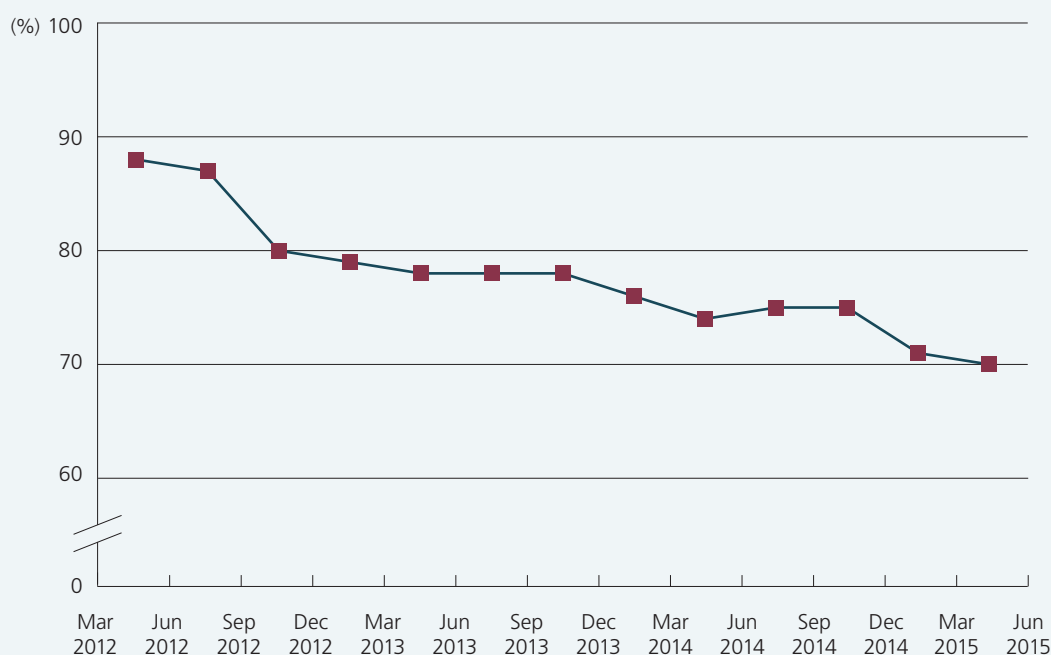
**Table 7: Latest information on the number of registered vehicle mechanics<sup>64</sup>**

Number of vehicle mechanics in the vehicle servicing sector in 2014 (2014 Manpower Survey Report by Automobile Training Board)	9,072
Number of registered vehicle mechanics (as at 30 June 2015)	6,314
Participation rate (Percentage has been rounded up to 1 decimal place.)	69.6%

Participation rate of VRS for vehicle mechanics remains high despite a decline recorded in the recent three years

Every registration and renewal will be valid for three years. From a temporal perspective, however, the participation rate of VRS for vehicle mechanics has persistently dropped, from 88 per cent in March 2012 to less than 70 per cent in June 2015 (see Figure 4), as revealed in the RVM newsletters.

**FIGURE 4: Participation rate of VRS for vehicle mechanics<sup>65</sup>**  
31 March 2012 - 30 June 2015



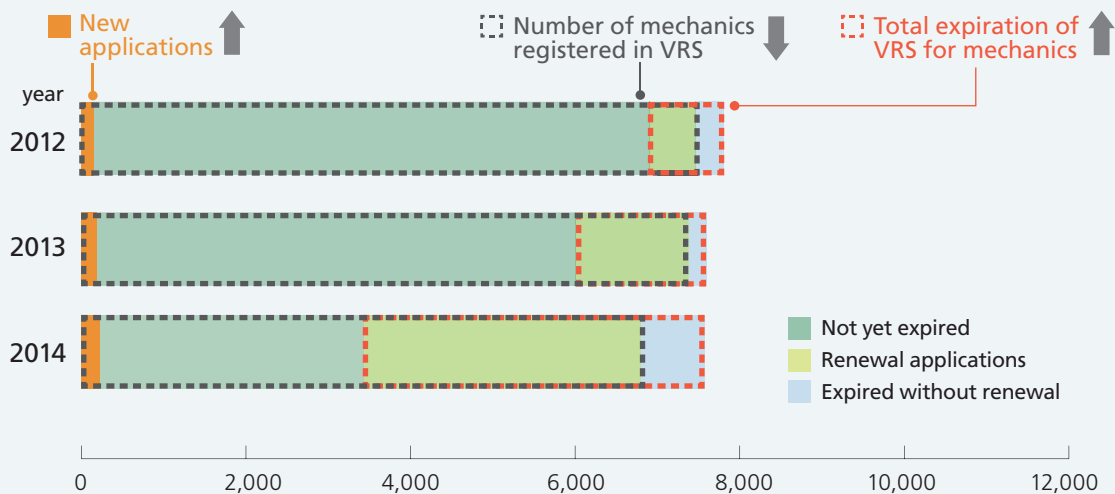
Decline in participation in VRS of vehicle mechanics is mainly attributed to the expiration of registration

Factors like a declining interest in VRS application or the failure to achieve the renewal requirements<sup>66</sup> (relevant in-service and CPD record within the previous three years) can be ruled out with the statistics below. According to the EMSD, there was an increasing trend in numbers of new applications and successful renewal of VRS for vehicle mechanics (see Table 8). The aforementioned decline in participation rate could solely be attributed to the expiration of registration of the existing mechanics (see Figure 5). Procrastination in implementing a mandatory registration scheme for vehicles mechanics can possibly be the reason for it, as they may perceive the registration unnecessary for their work at the moment.

Table 8: Applications and rejections of VRS applications in 2012-2014<sup>67</sup>

Year	Number of new applications issued with certificates	Number of renewal applications issued with certificates	Number of applications rejected
2012	154	572	54
2013	216	1,385	51
2014	219	3,380	38

FIGURE 5: Causal relationship of registration in VRS



$$\begin{array}{c} \downarrow \\ \text{Number of} \\ \text{mechanics} \\ \text{registered in} \\ \text{VRS in this year} \end{array} = \begin{array}{c} \uparrow \\ \text{New} \\ \text{Application} \end{array} + \begin{array}{c} \text{Number of} \\ \text{mechanics} \\ \text{registered in} \\ \text{VRS in last year} \end{array} - \begin{array}{c} \uparrow \uparrow \\ \text{Expiration}^* \end{array}$$

\* Expiration included all the registration to be expired during the year; mechanics who renewed their registration were also included in the number of Expiration.

It is expected that the mandatory registration will be launched when VRS is widely accepted by the trade

With the incremental approach proposed from the very beginning, the voluntary scheme is expected to be transformed into a mandatory scheme when it is accepted by the trade in general. In the RVM Newsletter (issue no.9) published in July 2014, the chief editor (who is also a member of VMTAC) explicitly mentioned the aim of legislating mandatory registration by 2016, when the participation rates of VRS for both vehicle mechanics and vehicle maintenance workshops could achieve 70 per cent at the same time as a sign of trade consensus.<sup>68</sup>



The Charter helps uplift the working standards of workshops to a more professional level

### 2.3.4 Vehicle Maintenance Workshops Charter

Before launching a similar VRS for maintenance workshops, the EMSD set up a Vehicle Maintenance Workshops Charter in 2013 in order to test the reaction from the trade. Under the charter, if workshop owners agree to comply with the *Practice Guidelines for Vehicle Maintenance Workshops*,<sup>69</sup> they can apply on behalf of the workshop to add their name to the Charter Subscriber List. About 450 workshops had made this pledge and were being listed as Charter Workshops.<sup>70</sup> The latest information on the Vehicle Maintenance Workshops Charter Scheme is stated in Table 9:

**Table 9: Latest information on the number of workshops which have become signatories to the Vehicle Maintenance Workshops Charter Scheme<sup>71</sup>**

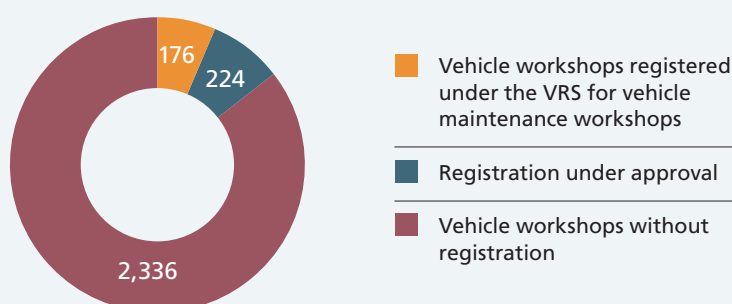
Number of workshops which have applied to join the charter scheme (as at March 2015)	606
Number of workshops which have successfully become signatories to the charter (as at June 2015)	448

### 2.3.5 Implementation of Voluntary Registration Scheme for vehicle maintenance workshops

VRS for vehicle maintenance workshops was launched in mid-2015

To further enhance the service provision and professional image of the trade, the VRS for vehicle maintenance workshops was also launched in July 2015.<sup>72</sup> Under the Scheme, having a valid business registration certificate and at least one vehicle working bay with permanent cover are some prerequisites for workshop registration. Another prerequisite is about the qualifications of mechanics; workshop owners now have to employ at least one registered mechanic in their workplace, which gives them the responsibility to make sure their licensed mechanics have access to relevant CPD opportunities. As at August 2015, there were 176 workshops registered for VRS, which accounted for 6.4 per cent of the total vehicle workshops (2,736) in Hong Kong.

**FIGURE 6: Number of vehicle maintenance workshops as at August 2015**



As with the VRS for vehicle mechanics, each registration and renewal will last for three years. The registered workshops are categorised into the following four types (see Table 10):

**Table 10: Types of VRS for vehicle maintenance workshops<sup>73</sup>**

Type	Description
I	<ul style="list-style-type: none"> <li>• “Franchised Bus Company Workshop” or “Vehicle Dealer Workshop”, employing at least one registered vehicle mechanic under the VRS for vehicle mechanics; and</li> <li>• Operators must comply with and abide by the <i>Practice Guidelines for Vehicle Maintenance Workshops</i>.</li> </ul>
II	<ul style="list-style-type: none"> <li>• Vehicle workshops employing at least five vehicle mechanics, with at least one being a valid registered vehicle mechanic, and the vehicle mechanics collectively are qualified for at least two different major registered service classes (i.e. Mechanical [M], Electrical [E], Body Repair [B1] and Body Painting [B2]); and the vehicle workshop should have at least five vehicle working bays; and</li> <li>• Operators must comply with and abide by the <i>Practice Guidelines</i>.</li> </ul>
III	<ul style="list-style-type: none"> <li>• Vehicle workshops employing at least one valid registered vehicle mechanic and having at least one vehicle working bay; and</li> <li>• Operators must comply with and abide by the <i>Practice Guidelines</i>.</li> </ul>
IV	<ul style="list-style-type: none"> <li>• Vehicle workshops only pledge to endeavor to abide by the <i>Practice Guidelines</i>; or</li> <li>• Vehicle workshops situated at a residential building or a composite building with domestic part.</li> </ul> <p>Note: No new application for this type of registration will be considered three years after the launch of the VRS, whilst those already registered vehicle workshops under this type will be retained in the registration list subject to their compliance with the renewal registration requirements.</p>

## Challenges faced by training institutions

With the understanding of the training and development of I/M personnel in Hong Kong, the following sections elaborate on the difficulties and challenges faced by the training institutions, in offering TVET to I/M personnel:

### 3.1 Decline in applicants entering Technical Vocational Education and Training

#### 3.1.1 Supply and demand of Inspection and Maintenance personnel in automotive industry

The ATB of VTC conducts manpower survey every two years to understand the labour market of the trade

In Hong Kong, manpower surveys have been conducted biennially by the ATB of the VTC.<sup>75</sup> The updated information collected by these surveys is used for industry assessment and strategic planning. The ATB has classified jobs in the vehicle servicing sector into five different categories, including technologist, technician, craftsman, specific services and the unskilled. The latest survey was completed in 2014 and a breakdown of employees and trainees by job level can be seen in Table 11 below:

**Table 11: Distribution of Employees and Trainees by Job Level of the Vehicle Servicing Sector** (ATB VTC Manpower Survey of Automobile Industry 2014)<sup>76</sup>

Job Level	Employees		Trainees	
	Number of Employees	Percentage of Total Employed	Number of Trainees <sup>#</sup>	Percentage of Number of Employees at the Same Level
Technologist	287	2.2%	3 (0)	1.0%
Technician	2,103	16.2%	16 (3)	0.8%
Craftsman	7,952	61.4%	617 (308)	7.8%
Specific Services	2,065	15.9%	9 (146)	0.4%
Unskilled	551	4.3%	0 (0)	-
<b>TOTAL</b>	<b>12,958</b>	<b>100.0%</b>	<b>645 (457)</b>	<b>5.0%</b>

<sup>#</sup> The numbers in brackets are employers' estimation on the number of apprentices to be recruited in the coming 12 months.

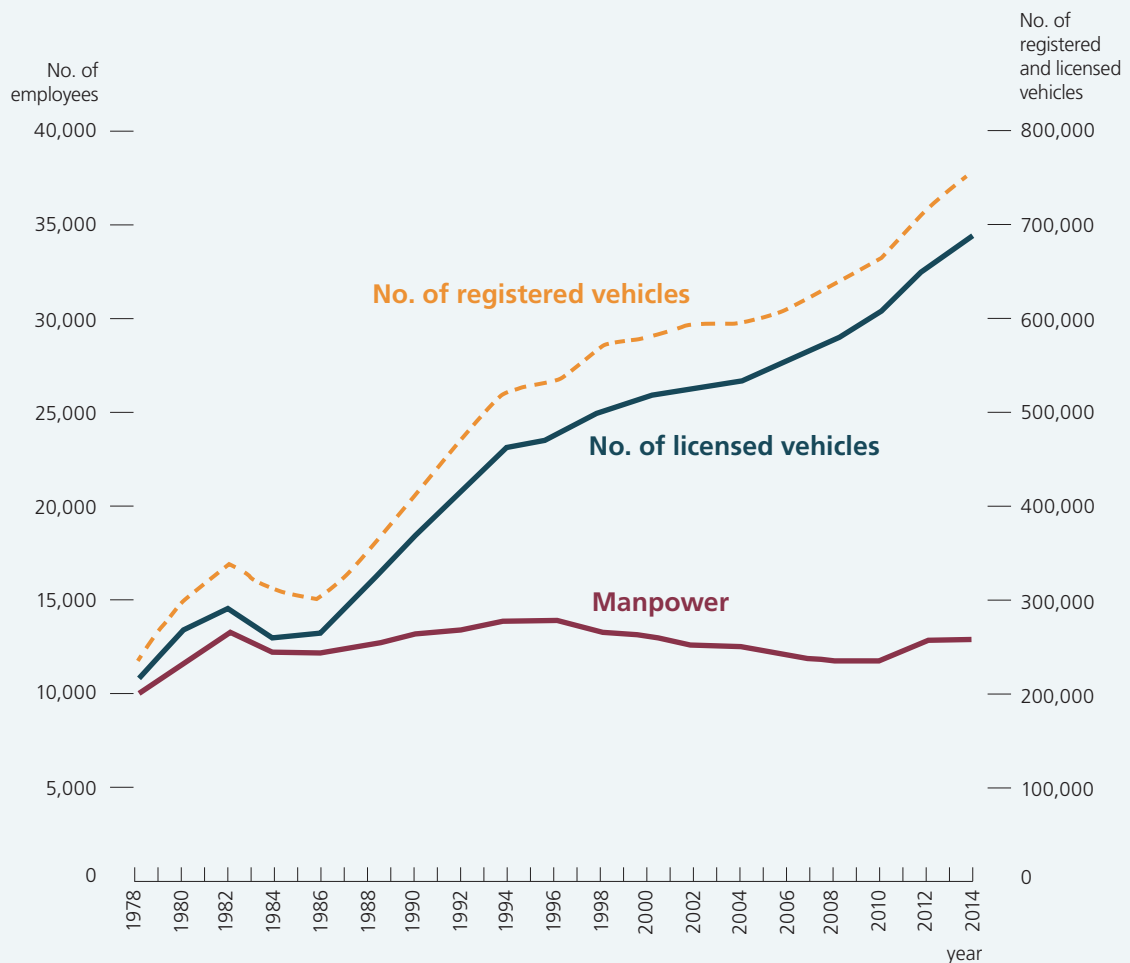
Limited trainees may possibly lead to labour shortage in the future

In terms of job level classification, craftsman (including vehicle mechanic, electrician, body repairer and painter) comprises the largest working group in the current industry landscape. With the ageing workforce and succession gap found in the industry lately, it is worth-noting that the total number of trainees across job levels equals only five per cent of the employees in the trade. The low proportions of trainees at some job levels indicate a general reluctance to enter the labour market, which might intensify the labour shortage in the foreseeable future.

**Increased vehicle number puts pressure on human resources of the trade**

The manpower survey illustrates the predicament that the industry is currently facing: while the number of licensed vehicles has increased substantially (2.7 times to its original number of licensed vehicles) over the past 30 years, the manpower of the vehicle servicing sector grew by 6.1 per cent, showing a huge mismatch between services demanded from and supplied to the vehicle maintenance sector.<sup>77</sup> The *Report on Study of Road Traffic Congestion in Hong Kong*<sup>78</sup> also pinpoints the same matter of growing vehicle population. From 2003 to 2013, the number of total licensed vehicles skyrocketed from 524,000 to 681,000, averaging an approximate 3.4 per cent growth rate annually. The burgeoning ownership of vehicles in Hong Kong implies a greater demand for vehicular services, together with all associated business opportunities.

**FIGURE 7: Registered and Licensed Vehicle Population and Manpower in the Servicing Sector of the Automobile Industry<sup>79</sup>**



**Changes in Hong Kong's education system made TVET less popular among both secondary school graduates**

### **3.1.2 Changing education system**

A steady shrinkage has occurred, over the last two decades or so, in the number of school leavers applying for TVET courses and apprenticeships. This appears to be, in part, due to a shift from the elitist university system of the past. Reforms in basic and post-secondary education in the past decades contributed to fundamental changes in the education system of Hong Kong.<sup>80</sup> Up until the mid-1990s, university places were only available to a small percentage of school leavers. As a result, the quantity and quality of school leavers entering TVET courses and apprenticeships were relatively high. The enrolled full-time students in VTC increased substantially from 3,700 in 1982 to more than 12,000 in 1992.<sup>81</sup> Since that time, there has been a rapid expansion of the higher education sector in Hong Kong, resulting in an increasing number of school leavers with the expectation of entering university.

**University is more preferred, which drives potential talents away from the TVET sector**

Many secondary school leavers now seek a university education, encouraged by their peers, parents and careers teachers, at the expense of the TVET sector and apprenticeship system. A knock-on effect results in a stagnation in the number of mechanics and technicians who would normally have passed on their knowledge and skills to the next generation of apprentices. This represents a serious imbalance in society, causing industry to express growing concerns that TVET institutions are no longer producing the quality of graduates they did in the past.

**TVET is generally perceived as negative among teachers and students**

According to a questionnaire on the perception of TEVT in Hong Kong carried out by the Task Force on Promotion of Vocational Education in 2014, about 57 per cent of secondary school teachers and 21 per cent of students in Hong Kong felt TVET had a fairly negative or very negative image.<sup>82</sup> Bringing back the necessary high quality apprentices by changing the attitude of society, school leavers, parents and careers teachers towards TVET and apprenticeships, will be challenging and not likely to happen overnight.

**Students are looking for a new type of learning experience**

### **3.1.3 Changing perceptions of the young generation**

The perceptions of today's younger generations seems to be due to changes in the parenting culture, emergence of new teaching methodologies, more virtual and less teacher-centred classroom activity, availability of video games, more freedom of expression and an explosion in the number of social media websites.

Young people seem to expect "edutainment" and an increasing number of them exhibit deficits in areas such as literacy, numeracy and information technology. Furthermore, the success of schools, colleges and universities is increasingly based on "student satisfaction" surveys rather than academic attainment. No matter what, it is critically important that any generational change is taken into account when designing the curriculum of education and training systems, for all ages of learner.

The high drop-out rate in the Pilot Training and Support Scheme suggests that students have not clearly thought about what they want for career

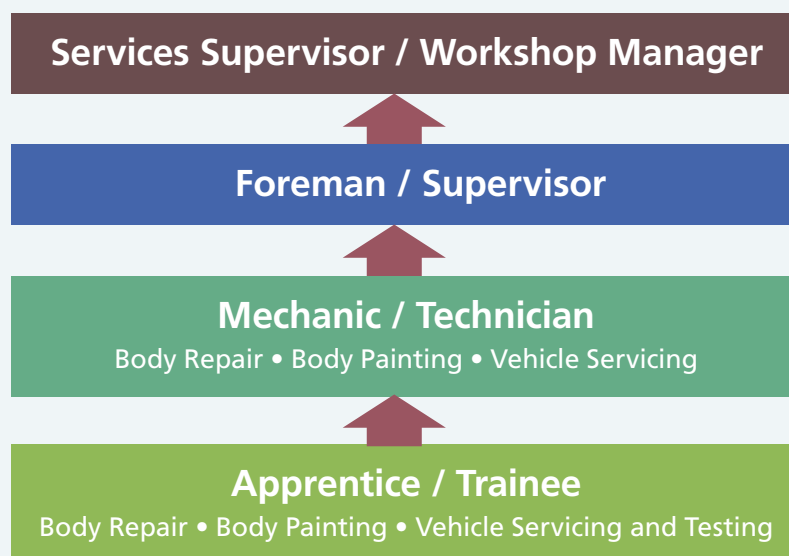
Uncertainty and insecurity of career entrants from entering the labour market

Even though some youths can obtain the Basic Craft Certificate (BCC) and enter the maintenance trade as an apprentice, the drop-out rate is high. Taking the Pilot Training and Support Scheme as an example, about 40 per cent of the intake in the 2014/15 cohort dropped out from the programme within the first year, right before on-the-job training was due to begin.<sup>83</sup> Some of them switched to other industries where they could earn a higher salary or with a better working environment.

### 3.1.4 Unclear career pathway

It is crucial to provide rewarding career pathways which enable apprentices to become mechanics, then technicians and eventually automotive engineers. As proposed by the Automotive ITAC, there is a four-level progression pathway for the vehicle servicing and testing trade (see Figure 8). However, it seems that a critically important link in the chain of developing automotive engineers and service supervisors for top management has been weakened and perhaps broken. This has happened during a time when the intellectual challenges associated with automotive engineering have continued to grow. In general, it takes over ten years, without any guarantee, for a mechanic to become fully productive and much longer to become competent in managing a workshop, after which he or she can contribute to the training of the next generation of I/M personnel. The potential labour in Hong Kong, especially the younger generation, refuse to enter into an trade that takes a long time for them to get promoted, or in which the future cannot be clearly foreseen.

FIGURE 8: Progression pathways of Vehicle Servicing and Testing<sup>84</sup>



## 3.2 Difficulties in current curriculum development and delivery

### 3.2.1 Teaching staff and connection with the industry

Teaching staff may not be able to closely connect with the industry and get updated on the latest vehicle technologies frequently

The vehicle industry is in a state of rapid change which trainers, who are responsible for transferring knowledge and skills, must be kept abreast of. What is learned today often becomes redundant within a short period of time. Educators or trainers also need access to CPD and life long learning, which have become critically important for keeping personnel up-to-date, during their working lives.

Confidential vehicle technologies prevents vehicle manufacturers provide internal training or disclose product secrecy to TVET teaching staff

However, TVET institutions have struggled to keep teaching staff up to date with emerging new technologies and related processes. Some industry players do not invite outsiders to attend internal training sessions due to secrecy surrounding new product developments. In simple terms, trainers have not always been able to find opportunities to keep up with rapid technological changes.

It might be too expensive to invite practitioners to teach the course, and their teaching quality is not guaranteed

It is a given that academic staff salaries account for a large percentage of the budget of any institution in the further and higher education (F&HE) sector. Many TVET institutions, due to a lack of funding, have resorted to teaching core content and not the detailed product technology found in the workplace. Attempts to rely on industry practitioners to teach students may not be successful as industry practitioners are rarely trained in the art of teaching. Furthermore, industry practitioners are busy maintaining their businesses; the labour cost involved would be high or they may even not be willing to devote their time to teaching at all.

Proportion of automotive engineering teachers in the Department of AE could drop significantly because of more transfer-in staff for teaching generic courses

Due to the transfer-in of staff to the Department of AE used to teach generic modules combined with the expected natural attrition, the proportion of experienced automotive engineering teachers in the Department of AE could drop significantly. One of the highest priorities for the VTC is to place students in the care of suitably qualified and well-experienced teaching staff. Allowing the Department of AE's staff expertise to fall to such an all-time low, can only move the industry backwards in terms of the TVET of the much needed manpower for specific sectors.

Transfer of key operations and the relocation of the Department of AE also drew experienced staff and stakeholders away

One other cause of the shortage of expert teachers has been the transferring out of parts of the Department of AE's operations, such as the police courses it offered, the Jockey Club Heavy Vehicle Emissions Testing and Research Centre (JCHVETRC) it originally developed and the AEDBC it successfully operated in the past. Furthermore, moving the Department of AE from Kowloon Tong to Tsing Yi Island in 2011 made it more remote to a number of its key stakeholders.

**Academic focuses of training is carried at the expense of students' practical abilities**

VTC academic departments come under the purview of the Technical Education Division (TED) whereas Training Centres are managed by its Industry Training Division (ITD). One significant advantage the ITD has, compared with the TED, is its more direct linkage with industry, not least through the training boards it oversees. The TED put more weight on academic qualifications and its policies lacked support and sufficient dynamic input from industry. This could be one of the reasons why graduates of academic departments fail to fully satisfy industry's needs and have taken longer to come up to speed in the workplace.

### **3.2.2 Choice of teaching modes and content**

Training institutions have to provide various types of training to suit the needs of the industry; "off-the-job" and "on-the-job" training are the most common training modes that can be found in vocational education nowadays.

**In general, off-the-job training is expensive and hard to maintain**

An example of off-the-job training is when a TVET institution provides courses in its own facilities, using its own resources and trainers. Institutions worldwide have found it increasingly difficult and expensive to create and maintain practical environments in line with and close to industry workplaces. Another difficulty with offering such courses is the variation in design and complexity of the same system across a large number of makes and models of vehicle; it is rather difficult for teaching staff to design a "one-size-fits-all" teaching module that caters everyone's interest.

**Apprentice can have a more comprehensive learning experience through on-the-job training**

On the contrary, an example of on-the-job training is when a technician is assigned an apprentice and is required to teach the apprentice how to do the work on the company premises. Providing it is a good quality company, the apprentice will be working in a modern environment with current equipment, tools and information support subjected to continual updating. Most of the major vehicle dealers are required to have their own training departments, in order to carry out in-house product training and related processes. Some local dealerships would even make use of their own factory trained technicians to service clients' vehicles. However, having learners practice on customer's vehicles can be risky in the sense that improper maintenance may endanger vehicle safety.

**TVET students are less preferred by employers as the investment to bring them up to speed is huge**

One specific challenge faced by off-the-job training is that, fewer companies now prefer employing graduates from local TVET providers because the time and cost are huge in bringing such graduates up to speed. The companies not investing in the training of their own staff simply poach trained personnel from others. This has been an unsustainable model which should be replaced with a fairer system. The UK, for example, is planning to introduce a levy on all companies, in order to pay for the training of apprenticeships.



**Too many generic courses and the lack of streaming of courses covered affect graduate quality**

In terms of course content, all two-year HD courses currently offered by the Department of AE are designed under the basic principle introduced by a former Senior Deputy Executive Director. The top-down policy, which is subject to revision, decided that the teaching content had to be wide ranging but less in-depth. Coupled with a total course teaching hour reduction of around 20 per cent, and the inclusion of generic modules, insufficient time is now available for in-depth teaching of technology subjects. Any reduction in the time allowed for teaching technology subjects would have adversely affected the utilisation of technology teaching laboratories or workshop facilities. Also, student motivation and graduate quality may be dampened by this policy.

There is also no streaming for types of vehicle, instead only three elective modules satisfy with the requirements of students on further study, with careers in management or servicing. The Department of AE started its life providing TVET for the heavy vehicle sector and later for both light and heavy vehicle sectors. The lack of streaming for light and heavy options is disappointing but could be due to a fall in the demand for heavy vehicle I/M personnel and the fact that the PAAU now offers light and heavy streams. Today's more reliable modern vehicles could also be a factor.

# Challenges faced by Inspection and Maintenance personnel

## 4.1 Advance vehicle technology

### 4.1.1 Changing technologies

A combination of technical knowledge and shop floor experience are needed to become competent and effective in the workplace. This is as true today as it ever was and perhaps more so. The more sophisticated vehicle systems continue to create intellectual challenges for I/M personnel. After completing TVET or an apprenticeship, much of these challenges have to be met with CPD courses or life long learning, in the absence of other means. Industry, as a major stakeholder, owns the technology and must therefore support the VTC and invest in the ongoing development of I/M personnel, to ensure I/M staff remain current and productive. However, not all companies invest in training to the same degree as others because of its cost implication to businesses.

It should be stressed that, as in many other sectors, changes in these technologies and related processes were major drivers of change to the job nature of I/M personnel. They should have acquired certain knowledge and skills in handling these advanced vehicles. Those who did not or could not access CPD or life long learning in order to maintain their currency would eventually face the need for retraining or would have to be made redundant.

Vehicle manufacturing processes have continued to improve and the vehicle reliability in mechanical systems and electronic modules has increased, thus fewer technicians are required each year to maintain a modern fleet. In addition, the use of telematics and long-life synthetic oils has extended service intervals; in some cases to one service per vehicle per year.

New types of safety features have also been installed in all makes and models of vehicles which continue to enhance occupant safety and more lately pedestrian safety. No longer do engines periodically need stripping-down to remove carbonaceous deposits from combustion chambers, because engine components, oils and fuels have all improved. Ignition systems have become solid state and computers continually monitor and report the health of all systems. The practice today regarding light vehicle repair is to replace complete modules, whereas for heavy vehicles, modules are more often disassembled, repaired and refitted to the vehicle. Overall, the time taken to complete servicing and repair tasks has come down significantly in recent years, but I/M personnel are required to possess a more specialised set of skills to perform their work.

Technology advancement brings additional challenges to I/M personnel

I/M personnel without access to CPD activities cannot maintain their working competencies

Fewer I/M personnel are required to maintain a modern fleet, only those with better skills and qualifications will be employed

Tools and data for maintenance work are usually inaccessible to non-official workshops or being released to the trade after a certain period of time

Repair tools and information may be charged at an expensive cost which is not affordable to most workshops

Constant updates of repair tools and information make any non-official maintenance impossible

More stringent environment standards request mechanics a better understanding on vehicle emission systems

Mechanics expressed their unfamiliarity on new legislation, they may even turn down business

#### 4.1.2 Limited accessibility of tools and data for maintenance

Manufacturer's specifications, fault codes, wiring diagrams, software and specialist tools needed to repair modern vehicles are generally only available to the manufacturer's official agents. These days, a secure internet link between the official agent's workshop and the manufacturer (parent factory) is used. Manufacturers provide training to in-house mechanics or dealers exclusively on a continuous basis, the manual may only be released to the market a few years later. This may constitute anti-competitive behaviour of the manufacturers which needs to be legislated against.

Even if the information is accessible to others, repairers from unauthorised workshops may still have to pay, usually a high price, for the use of such data or information. The computerised diagnostic tools are also expensive and not affordable by a typical small-to-medium maintenance workshop. For these workshops, the need to find updated technical information or tools is market-driven: workshop owners are only willing to make a huge investment when there is sufficient demand for particular maintenance services foreseen in the market.

In addition, the manuals are constantly updated and the contents are mostly complicated. Trainers need time to familiarise themselves with the latest technical tools and information before teaching others. In short, it is extremely hard for any workshop to duplicate the whole set of tools and knowledge held by dealers or manufacturers. Without technical information, software and special tools on hand, mechanics cannot properly perform and complete the I/M services on modern vehicles. Under this situation, small-to-medium workshops can only offer subordinate maintenance services to the market.

## 4.2 Tightening vehicle emission standards

### 4.2.1 Raising demand for knowledge and techniques of vehicle emission control

Every registered vehicle is required to be serviced annually, including an accurate emission check, as a precondition of relicensing. Proper servicing would ensure that vehicles operate according to manufacturer's specifications, and emissions checks would help the EPD to collect data for managing and securing continual improvement regarding vehicle related air pollution. At the same time, however, this could create demands on I/M personnel with the knowledge and techniques to control vehicle emissions.

### 4.2.2 Unfamiliarity with emission standards

In Hong Kong, the EPD has implemented the Strengthened Emission Control for Petrol and LPG Vehicles since April 2015. The Strengthened Control deploys on-road remote sensing equipment to screen out vehicles with excessive emissions. Vehicle owners are expected to carry out maintenance work before sending their vehicles to pass a dynamometer-based emission test. This emission tests differ from the long-established idling emission test

adopted by the TD, which is incapable of measuring NO<sub>x</sub>. Some mechanics in the trade expressed unfamiliarity with the new standard and rejected tune-up requests from vehicle owners.<sup>85</sup> Complaints from the public were made to the Office of the Ombudsman and a direct investigation was initiated.<sup>86</sup> The case in Hong Kong suggests tightened emission standards may present technical challenges to I/M personnel when such a standard has not been fully accessible or comprehended by the trade.

### 4.3 Requirement and convenience of continuous training

#### 4.3.1 Low threshold for Continuing Professional Development requirement

Low threshold of CPD may not help mechanics to grow at all

One major criticism of the CPD requirement is its low threshold in terms of hours required. Regulators usually, with the aim of minimising the degree of difficulty, set the requirement at a level that is easy to achieve. They consider the possibility of fulfillment as more important than the actual need of acquiring enough knowledge to handle the daily challenge.

The CPD requirement of VRS for vehicle mechanics still has a room for upward adjustment

In Hong Kong, for example, the HKIE requires its members to have at least 45 hours (about 5.6 working days) of CPD per year (see Appendix V and section 2.2.2), while looser requirements can be found in the VRS for vehicle mechanics (see Table 5 in section 2.2.1), in which the mechanics are only required to fulfill 20 hours of CPD within the previous three years for their registration renewal. The present requirement is far from sufficient for the needs of present-day mechanics, technicians and aspiring professional engineers.

#### 4.3.2 Insufficient assurance on Continuing Professional Development

Approved CPD activities have no guarantee in learning outcomes

Concerns have been expressed about the various means of fulfilling CPD requirements. Apart from attending traditional courses and seminars, mechanics in the VRS can choose to take a test in the RVM Newsletter or submit article to its editorial board once a year to claim a maximum of two CPD hours for each activity respectively;<sup>87</sup> provision of members' welfare by trade associations and unions in form of CPD activities, such as social gatherings and overseas field visits, are usually popular among their members;<sup>88</sup> the rise of the internet also encourages another type of CPD, e-learning, that can be held regardless of location and time constraints. The objective of CPD is to keep practitioners' capabilities up to standard so as to satisfy the market needs, however, the learning outcomes and effectiveness of these activities are hard to guarantee. Compared to conventional modes, the quality of CPD delivered through these channels cannot be easily monitored.

**Without an authorised body to approve and assess CPD content, the effectiveness of CPD is in doubt**

Training providers have no guidelines to follow in organising their own CPD activities at present; from their perspective on the CPD content, attractiveness and breakeven of an event may outweigh the intended learning outcomes to be delivered in the process of designing a CPD activity. Since there is no authorised body responsible for CPD approval and its quality assessment, CPD activities in general are not scrutinised appropriately. In other words, the CPD currently available may not be able to significantly improve the performance and efficiency of the industry.

**Inconvenient CPD may discourage mechanics from joining eventually**

#### **4.3.3 Inconvenience of Continuing Professional Development training**

Another major challenge regarding CPD is the difficulties in attending CPD activities faced by I/M personnel. In Hong Kong, most of the vehicle maintenance workshops are small in scale, which have neither in-house training nor much internal technical support. These workshops will face operating difficulties when their employees attend external training during working hours or time off. From the perspective of mechanics, they may have trouble attending training that requires attendance at courses delivered in daytime or at a distant training venue.

## International Best Practices

Overseas experiences in nurturing mechanics and technicians, including I/M personnel, would be a useful reference for Hong Kong's TVET. The following two examples, an apprenticeship training scheme in New Zealand and the Dual Vocational Educational and Training System (Dual VET System) in Germany, are regarded as successful cases in training experts and professionals in the automotive maintenance trade.

### 5.1 Apprenticeship training scheme in New Zealand

In New Zealand, the Motor Industry Training Organisation (MITO)<sup>89</sup> oversees I/M apprenticeship training schemes on behalf of the Government of New Zealand. Regarding commercial vehicle I/M apprenticeship courses, a relatively small number of institutions offer this qualification. Apart from MITO itself, polytechnics, colleges of technology and private trainers provide apprenticeship training for the industry. Waikato Institute of Technology and Wellington Polytechnic are the main providers of this specialism. For colleges and private providers, the larger footprint of workshop space and up-scaled resources (equipment and vehicles) may make this option too expensive.

**MITO adopts clearly specified unit standards for its vocational training**

#### 5.1.1 Unit standards

A list of unit standards, which was derived directly from industry and regularly reviewed, forms the backbone of the curriculum. A unit standard with a specific assessment guide is designed and written for each topic considered necessary for an apprentice to learn and become competent in. Each unit standard is prescribed a credit value, according to the duration of learning required.

**Units can be delivered after assessment is done**

Unit standards may be delivered at the employer's premises (on-the-job) or at a training provider's premises (off-the-job) or both. The apprentice has to learn the background theory and apply that to a related task, which is assessed by a qualified person. Once any given unit standard has been assessed and successfully secured, the apprentice may then move on to other unit standards.

**Students can choose courses according to their own interests**

When the qualification was first introduced, certain unit standards had their own prerequisites, which had to be successfully completed prior to progression to subsequent unit standards. This feature has reportedly been abandoned so that there are now only "recommended prior unit standards"; students are free to select any order and any number of unit standards to take. However, should a student fail a unit standard three times, re-enrolment would likely be resisted in order to avoid excessive enrolments and poor success rates, for which financial penalties exist for training institutions.

**The provision of two stand-alone courses offers more specific training to the students according to their aspirations and interests**

In order to become a qualified light vehicle automotive technician (National Certificate Automotive), approximately 140 unit standards are required to be completed. To become a qualified automotive electrical technician (National Certificate Automotive Electrical), 110 unit standards need to be completed. These two courses are stand-alone depending on which career path (automotive or electrical) the apprentice wishes to follow. The measure of a complete qualification is based on the total number of credits, so the exact number of unit standards is somewhat flexible, depending on the unit standards chosen. A student must meet the minimum number of credits in both the compulsory and elective sections. There is no reward or penalty for exceeding the credit number and often it is impossible to avoid going over the minimum credit value by a couple of credits.

**Apprentices need to pay a fee for their apprenticeships**

### **5.1.2 Price of apprenticeship**

As at the beginning of 2015, Unitec Institute of Technology charges NZ\$39.50 per unit standard, regardless of credit value. An additional charge of NZ\$1.58 per credit is paid to the New Zealand Qualifications Authority (NZQA).<sup>90</sup> If a student attends a class on Unitec premises, a further charge of NZ\$2.64 per credit is collected by Unitec as a student service charge.

MITO, in contrast, charges each apprentice an annual fee. The quantity of unit standards is managed within this fee. It should be noted that some employers reimburse the fees and some do not. As may be appreciated, there is no fixed duration for an apprenticeship; however there have been some new rules and limitations introduced, over recent years, so as to meet more stringent government throughput and success rate targets.

**Students in New Zealand come from a diverse background**

### **5.1.3 Quality of intake**

A significant number of school leavers, entering F&HE, have deficits in literacy, numeracy and IT skills. Some have attitudinal problems. Such deficits can seriously hamper a student's ability to make headway, once enrolled on a F&HE programme or an apprenticeship. One common way of dealing with this is to introduce generic modules, to correct perceived areas of deficit. Unfortunately, the inclusion of generic modules has necessitated the need to make technical modules less intensive, at a time when technology has been rapidly becoming more intellectually challenging. Given the absence of an input filter based on students' qualities, slow learners or students exhibiting some or all of the aforementioned deficits need special treatment and more time, if they are to catch up. In light of the need to produce graduates who match or even exceed industry's expectations, such deficits would best be corrected before they are allowed to enter a main stream TVET course.

Students are given chances to provide services under close supervision

#### 5.1.4 Provision of on-the-job training

The Bay of Plenty Polytechnic, in New Zealand, operates a training workshop. This facility operates like a normal car repair company which invites the public to bring vehicles in for servicing and repair. Students are involved in repairing vehicles, but under close supervision. A training workshop goes some way towards creating an on-the-job training environment within an off-the-job campus. Feedback suggests that the space required and costs involved in building, manning and operating a training workshop can be prohibitive, particularly to small-scale training providers or those located in urban settings.

MITO stated the TRoQ in New Zealand and helped improve the provision of vocational training

#### 5.1.5 Targeted Review of Qualifications

In 2010, the NZQA announced that New Zealand had far too many qualifications on its framework and that a review was needed. The MITO, one of a number of industry training organisations spanning the trades, started working on what have become known as “Targeted Reviews of Qualifications” (TRoQ)<sup>91</sup>:

“The Targeted Reviews of Qualifications (TRoQ) have been mandated by NZQA and aim to reduce the number of qualifications on the New Zealand Qualifications Framework (NZQF). The aim is to make educational and career pathways clearer to learners, employers, industry and other stakeholders. The key outcome is a suite of New Zealand Certificates that are fit for purpose, reflecting industry’s current and future education and training needs.”

Each TRoQ comprises three stages

Each TRoQ comprises three stages, these being:

- **Stage 1: Identify qualifications need**

Identify qualifications to be removed from the framework, which have either become redundant or are considered no longer suitable. Enquiries made suggest that over 4,000 qualifications had clogged up the NZQA framework and that something needed to be done about it.

- **Stage 2: Develop qualifications that meet industry needs**

In automotive engineering and technology, 14 qualifications have been approved for development. Feedback is being invited on the proposed collision repair and automotive refinishing qualifications. The heavy vehicle working group is meeting to complete the qualification development work. A specialist engineering working group is developing three proposed New Zealand Certificates in automotive engineering (specialist) (levels 4 and 5) in auto electrical, auto machining and diesel fuel injection.



- **Stage 3: Develop suitable training programmes that lead to qualification awards**

It should be stressed that NZQA requires all technical content in the curriculum to be sourced from industry experts and that such feedback must be formally confirmed as fit for purpose by industry.

Ineffective apprenticeship can be attributed to irrelevant curriculum, old-fashioned teaching staff or insufficient funding

#### 5.1.6 Connection with the industry and teaching resources

There follows examples of new programmes which failed to produce impressive graduates, due to:

- The curriculum having been developed too remotely from industry and the target participants;
- Teaching staff having been out of touch with modern technology and related practices;
- A lack of funding to procure the modern resources needed; or
- A combination of these.

One strength of the New Zealand system is that what the apprentice learns is decided by industry. Furthermore, in the New Zealand system, MITO coordinates teaching packages for all unit standards. This process has been found to be problematic, due to internal politics and insufficient industry involvement.

Sourcing curriculum content from industry and having industry confirm its fitness for apprentices can ensure a best-fit training provided

New Zealand training providers have written programme documents, which have been put on the NZQA framework and accepted as fit for purpose. The Government of New Zealand have recognised that training providers often lag behind industry and are therefore unable to produce curriculum content which is in close alignment with industry needs. In addition to this, industry has been complaining that graduates exhibit a number of serious deficits, mainly relating to technical knowledge and job skills. The repairers who are working at tier II and III levels, as in a number of western countries, find it difficult to secure relevant CPD courses and life long learning opportunities. By sourcing curriculum content from industry and having industry confirm its fitness for purpose, it is thought that all new courses should be fit for purpose and should not attract criticism from industry.

## 5.2 Dual Vocational Educational and Training System in Germany

Vocational Education and Training (VET) is a respected and prevailing option for lower secondary school graduates in Germany. In particular, the Dual VET System that combines benefits of both on-the-job and off-the-job training has been widely adopted to provide working and learning experience to trainees at the same time. As a leader in the global automobile market, Germany considers the Dual VET System as a successful model to develop a pool of professional technicians for the automotive industry.

Several Federal organisations are involved in delivering vocational education in Germany

### 5.2.1 Sound institutional setup

The Federal Ministry of Education and Research (BMBF) is the authority in charge of VET policy in Germany. BMBF has obligations to coordinate and supervise VET in different industries; while another federal-level institution – the Federal Institute for Vocational Education and Training (BIBB) was set up on the basis of the *Vocational Training Act*.<sup>92</sup> BIBB conducts research and offers advice to the Federal Government on VET matters.<sup>93</sup> An important function of BIBB is to review the training regulations regularly and keep them in line with the latest industry developments.<sup>94</sup> Industry representatives can raise their concerns about the Dual VET System in both the BIBB Board and the Examination Board respectively.<sup>95</sup>

KMK helps implement the VET policies in different states in Germany

A Sub-committee for Vocational Training and Further Education was also established under the Standing Conference of the Ministers of Education and Cultural Affairs (KMK), to ensure VET policies are implemented in a synchronised manner across federal states.<sup>96</sup>

Dual VET System is a favourable option among German youth

### 5.2.2 Competition for admission

The Dual VET System is seen to have a promising prospect in the eyes of youth. In 2012, more than half (55.7 per cent) of the German age cohort chose dual VET over the general education as their next step.<sup>97</sup> Given the VET has been tagged in a positive light, there are often thousands of applicants competing for very few apprenticeship vacancies. German firms are targeting talented youth to join their own dual VET programmes and enter the industry at an early age. They consider youth as a valuable asset to their business in the future, so extra effort has been put in selecting quality youth to undergo the training process.

With the competitive admission, one-year transition programmes are being developed for the unsuccessful applicants who are substandard or have physical or social disadvantages. After taking the transition programme, they can proceed to the second year of dual VET apprenticeship and continue their training accordingly.

Both working and learning components can be found in the dual VET programme

### 5.2.3 Comprehensive learning experience

Apprenticeships are done on-the-job four days per week with the fifth day plus two evenings spent attending off-the-job courses at college. Dual VET is attractive because trainees can utilise the knowledge and skills learned from off-the-job training, while their working experience can facilitate their learning process in the classroom. The seamless learning process helps trainees to get familiar with different work habits and corporate culture and to become professional within a short period of time.

Students receive core technology associated aspects off-the-job and dedicated product technology on-the-job in a carefully synchronised manner

The main potential for this is that the learner receives core technology and associated aspects off-the-job, together with dedicated product technology on-the-job in a carefully synchronised manner. Apart from the knowledge of the profession, trainees also get the chance to learn languages, mathematics and sciences as others in the general education stream do.<sup>98</sup> The major challenge today for adopting Dual VET System remains in the coordination between on-the-job and off-the-job training content and activities. If there is no synchronisation of activities and close communication with industry, the Dual VET System is simply not functional.<sup>99</sup>

Students usually take two to four years to complete the dual VET programme

#### 5.2.4 Duration and cost

Dual VET is far more than just a short-term course; vocational education trains apprentices not only in technical skills but also in problem solving attitudes and capabilities. It usually takes two to four years to complete the entire programme; the exact length of training varies across sectors.

Businesses involved in dual VET programmes have to invest a lot in their apprentices, which in return could bring a more stable quality labour

Training costs involved in dual VET can be high. Companies have to invest EUR15,000 on each apprentice per year on average, in which half of the investment goes to the apprentice directly in the form of a training allowance. Though such an arrangement may cost more from the industry point of view, it brings a more stable pool of quality labour to the employers in return. Based on previous data, businesses can expect to recover 76 per cent of the total investment from apprentices' productive contributions during the apprenticeship.<sup>100</sup>

Replicating the industry workplace environment is also an expensive undertaking. By working closely together with industry, the German Dual VET System, for example, can ensure that the training and development of I/M personnel is shared and more cost-effective.

Apprentices are given the flexibility to select streams and they are offered diverse options at different stages of their career paths

#### 5.2.5 Flexibility in stream selection

Children in Germany have to pick their education track at the age of 15; they can choose between attending an academic high school (following a general education stream), training in a particular vocation (following a VET stream), or even something in between.<sup>101</sup> More importantly, they are given the option to change their track later. In 2009, KMK passed a resolution to help vocationally qualified people to pursue higher education even without school-based qualifications. The extended eligibility encourages low secondary school graduates to depart from the traditional education pathway and gives them greater flexibility to join the apprenticeship programme.<sup>102</sup>

#### Box 4

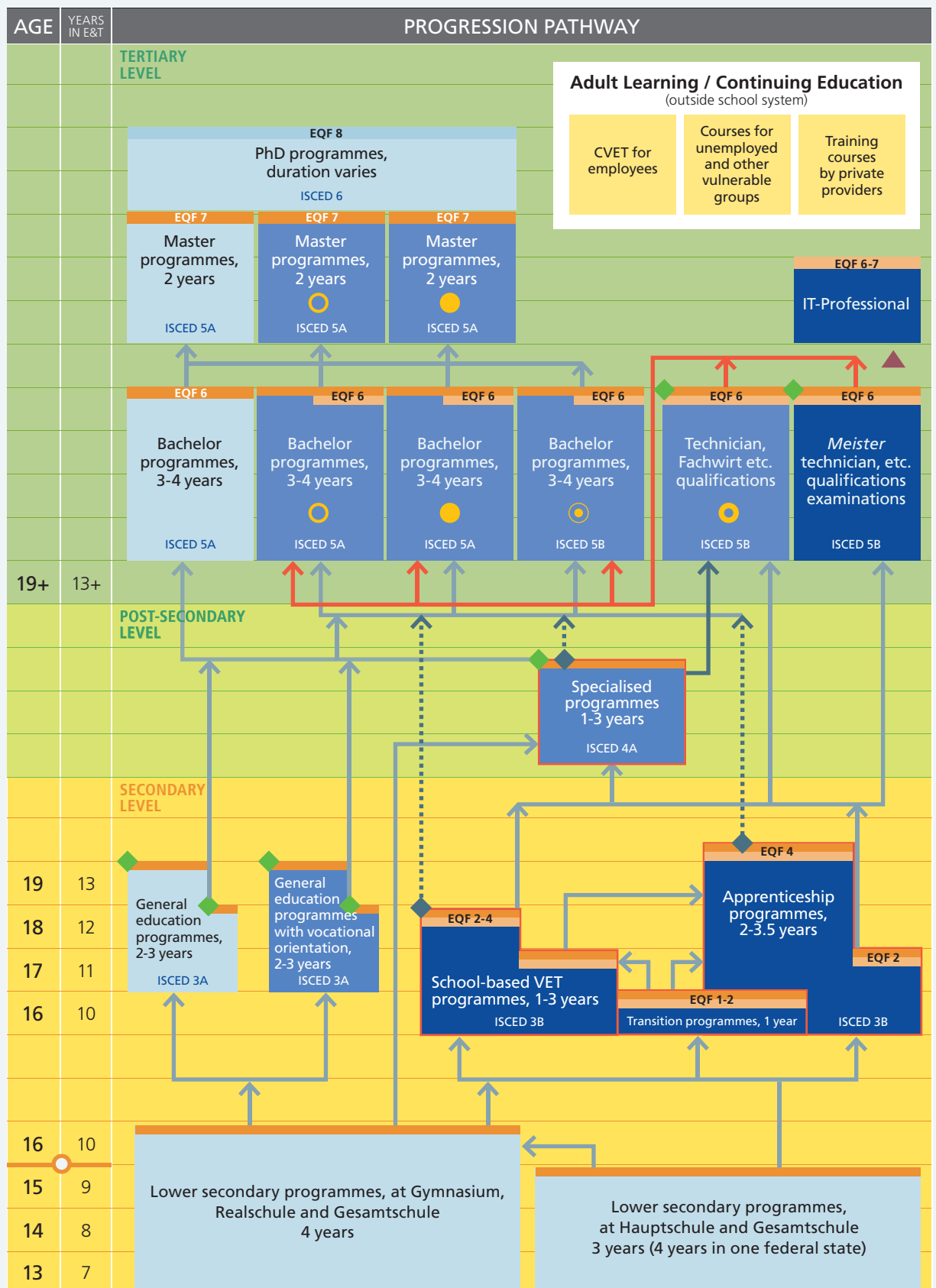
##### Options for dual VET graduates<sup>103</sup>

Stay as a skilled worker with recognition from the state examination,

Pursue a vocational education master craftsman qualification within the VET stream; or

Pursue tertiary education (e.g. a Bachelor's degree in applied science) in the general education stream.

**FIGURE 9: VET in Germany's education and training system<sup>104</sup>**



- General education programmes
- VET programmes
- Programmes containing VET and general education
- Also available to adults
- Officially recognised vocational qualifications
- Qualifications allowing access to the next educational level
- Giving access to higher education
- Access to HE is limited, only from/to some programmes
- At universities of applied science
- At *duale Hochschule*
- At *Berufsakademien*
- At *Fachschule/Fachakademie*, duration varies
- End of compulsory education
- Possible progression route
- prior education may be recognised affecting the duration of the programme
- Access restricted to certain related subjects
- Professional experience required to enter

## Recommendations

This section contains proposals aimed at improving the training and development of future vehicle I/M personnel in Hong Kong.

### 6.1 Reviewing and strengthening the Inspection and Maintenance curriculum

Good quality graduates and manpower are very important in order to realise all intended goals. I/M curriculum plays a substantial role in moulding apprentices into good quality graduates and preparing them for industry.

The German Dual VET System should be considered as a role model on which to base the future training and development of I/M personnel. Furthermore, New Zealand's targeted review of qualifications have merit, especially regarding the way the contents of the curriculum are extracted from and endorsed by industry as being fit for purpose. A combination of these two systems can provide a robust solution to overcome industry's present concerns about the quality of TVET graduates.

#### 6.1.1 Promoting Technical Vocational Education and Training and apprenticeships among the youth

The HKSAR Government needs to make the necessary changes to the education system so that more able school leavers are attracted to the TVET sector and apprenticeship scheme. Societal attitudes need to be somewhat reversed so that the public may better respect and value manual work as the start of a worthwhile career. To help drive a step change in public opinion, employers need to give their full support by providing attractive pay, impressive working environments, good prospects and general satisfaction. The motor industry needs to provide competitive remuneration rates, good career prospects and generally attractive positions to graduates. The HKSAR Government and the industry need to boost the apprenticeship system or put in place a new Dual VET System, to move this initiative forward. Hong Kong needs more specialists and engineers, especially in the vehicle I/M field.

The absence of choices at equivalent QF levels in the vocational education stream, as compared to the academic education stream, could be the major reason for students to shrink back. ApL courses are the first in-depth opportunity for the youth to have a glimpse of vocational training and occupations. If the ApL for Automotive Technology can be registered in the Qualifications Register to grant students QF level 3 certificates upon the completion of the course,<sup>105</sup> this could incentivise applications for ApL and attract more youth to join the automotive industry in the future.

TVET qualifications are commonly associated with QF levels 2, 3 and 4 and yet the intellectual challenges for I/M personnel could be claimed to be equal to that embodied in undergraduate courses. It is possible that HD and Higher Certificate qualifications could eventually be replaced with degree level qualifications. If this was found to be viable then it would certainly lift the status of personnel engaged in the vehicle I/M trade.

Changing the education system, providing competitive remuneration and boosting the apprenticeship system may attract more youth to join

Register ApL for Automotive Technology in Qualifications Register could appeal to more people

Developing HD into vocational degree is an option to increase recognition of vocational courses

**People at all ages in the society should know the prospect of vocational training, including the I/M trade**

The HKSAR Government needs to see that its people, particularly younger generations, are informed and well educated. It is important that people of all ages gain a full understanding of the prospect of I/M trade, so that they may exhibit a desire to contribute to reversing negative trends. Those working in the vehicle I/M trade, for example, will likely benefit by knowing why it is critically important to maintain and operate vehicles to the highest possible standards.

**Generational culture change should be incorporated into the consideration of curriculum**

The HKSAR Government should take steps to ensure that generational culture change is tracked. It should take steps to ensure that concerning trends are robustly addressed. The values, attitudes, needs and wants of learners need to be taken into account when developing the school or college curriculum and during academic or career counselling. Imbalances in society, which may adversely affect industry's competitiveness, need to be righted at the earliest opportunity.

**Teachers and the HKSAR Government should take more actions to develop and support the development of TVET**

Schools and colleges need to ensure that students gain an in-depth understanding and deep empathy for all aspects of sustainability. Teachers must change their mindsets and advise their students that a number of career paths exist, including the option of a career starting from TVET or an apprenticeship, which are worthwhile in terms of remuneration, status, promotion prospects and general satisfaction. There is no reason why this should not result in strong multiple drives aimed at the creation of new industries dedicated to making a positive difference to the health and wellbeing of the public. There will be a wide range of employment opportunities in the future, in presently unknown new industries, as old industries quickly fade away. The HKSAR Government should invest heavily in supporting and driving such initiatives.

### **6.1.2 Cooperating with industry closely**

Industry will need to play a key role in ensuring that attractive remunerations, good promotion prospects and general satisfaction can be realised. The Executive Director of the VTC opined that any TVET schemes would need to provide a guaranteed income which is competitive to lure young people into trades with severe manpower shortages due to tough working environments. In the mid-1990s, a training manager from Jaguar Land Rover was invited to give a presentation to the staff and students of the Department of AE. At that time, the company put a sum of money into a savings and investment account for each apprentice every month, which could only be accessed by the apprentice about five years after completion. This created an incentive for the apprentice to stay with the company and tended to prevent poaching by other companies, not investing in their own training of apprentices.

**Close connection with the industry is needed as shown in the German Dual VET System**

As highlighted by the German Dual VET System, training activities need to be synchronised to the labour market and skills inculcation must be close to match the demand of firms. Front-line teachers, like lecturers or trainers, need to maintain continual contact and close communication with industry partners. This can only be achieved by the existence of a dynamic working relationship, close synchronisation and excellent communication between training providers and industry-based trainers.

**The industry and VTC or other TVET providers must work closely to make the Dual VET System work in Hong Kong**

For the Dual VET System to work in Hong Kong, industry and VTC or other TVET providers would need to work closely together in a highly synchronised manner. VTC should ensure that the relationship between its TVET institutions and industry is as close and effective as possible; to better ensure the student experience matches industry's needs. Furthermore, this needs significant human and financial investment by industry in the process of developing I/M personnel.

**Industry should also take part in setting the curriculum to ensure that graduates meet the expectation**

Curriculum development is also a critically important part of creating and maintaining a programme at the cutting edge. A programme is designed by its parent teaching team, the members of which must have maintained close liaison with industry. The programme document needs to pass through a rigorous system of committees and boards before it can be accredited. Key to this process will always be the quality of the feedback solicited from industry because, no matter how good the teaching team might be, they will normally lag behind industry practices. The industry should take precedence over programme leaders, regarding decisions relating to the curriculum. Programme leaders may be overly influenced by internal politics.

Once the curriculum has been developed and formally endorsed by a broad range of employers in industry, the next step will be an analysis of what physical and human resources are needed to ensure success, especially for off-the-job training providers. Visualising the long-term benefits to the industry players of having a curriculum aligned with their expectations is important, so that they will be more eager to take part in the feedback or endorsement process to continually improve the curriculum.

**Institutional policies should reflect opinions from the industry**

Also, institutional policies can sometimes work against what might be best for the graduates and industry. An example of this is the insistence of the inclusion of generic courses, across a number of disciplines, which can water down the effectiveness of a given programme from an industry perspective. Furthermore, generic modules may suit one discipline but seldom suit all. Opinions from industry must be secured, endorsed and respected in order to improve the content of curriculum and its delivery.

### 6.1.3 Improving the quality of teaching staff

**The qualifications and working experience of teaching staff and trainers must be ensured**

Front-line teaching staff or trainers, including heads of departments, should be appropriately qualified and experienced in order to carry out their work in a professional and effective manner. Their qualifications and working experience must be in the area of expertise they are assigned to teach and they should be active in terms of CPD and life long learning. They should have:

- Technical qualifications at an appropriate level;
- A teaching qualification;
- Professional membership of a relevant learned society; and
- Industry experience.

**Teaching staff should provide higher degree of face-to-face teaching to students to help them work and learn with confidence**

Feedback suggests that a growing number of fresh graduates do not have the confidence to work and to learn independently. They therefore need to be taught how to learn and for this, the formative years of any programme should include a higher degree of face-to-face teaching about how to become an independent learner. Well-trained and dedicated teaching staff need to manage the learning environment and are necessary to ensure students receive the support they need.

**Frequent meetings between programme staff to review and update the curriculum and teaching content, in order to deliver the most suitable content to students**

A teaching team is responsible for the operation of a programme and should meet frequently, say weekly or fortnightly, with the aim of maximising the quality of the student experience with the sole intention of creating excellent graduates for industry. After all, teaching staff are the experts who normally write the technical details contained in the curriculum or course document. Consent of all programme leaders and programme board members is necessary before making changes.

**Active participation in decision-making can empower staff and improve their delivery of teaching content**

Academics need to be passionate and proactive, with regards to the mission embodied in their chosen vocation. They need to be given a good balance of responsibility and authority, in order for them to be effective and lively. In particular, all front-line academics need to share in decision-making in order to empower their sense of being important, internal stakeholders in the organisation. Academics spend most of their time serving the needs of students and are therefore well placed to collect important feedback which is needed to inform the decision-making process.



#### 6.1.4 Providing funding and investment for Inspection and Maintenance training

The UK rolled out apprenticeship programme together with related protective measure to prevent poaching of apprenticeship

In 2014, the UK started an education reform and increased the number of apprenticeships to three million, according to George Osborne, the Chancellor of the UK Exchequer, in the 2015 UK Budget.<sup>106</sup> The trained apprentices are further protected by the imposition of an apprenticeship levy. The companies have to compensate the firms that offer apprenticeship once they poach apprentices from others. The compensation is usually large enough to cover the monetary input invested by the companies that offered the apprenticeship programme. This implementation of a levy encourages firms to train up in-house apprentices for own use, and discourages vicious acquisition of human resources from other firms.

The HKSAR Government may consider applying the UK experience in Hong Kong

The HKSAR Government needs to urgently provide a boost to the apprenticeship system, similar to that announced by the UK Government.<sup>107</sup> A similar levy could also be introduced by the HKSAR Government so as to more robustly meet industry and societal needs and ensure that a sufficient number of good quality apprentices are nurtured and trained.

The HKSAR Government's investment in training facilities can help the Department of AE or other TVET providers sustain its training quality

The Department of AE has been in decline in the past decade. Shrinking student numbers in the TVET sector has led to teaching staff reductions. This trend appears to be starving the marketplace of much needed expertise. The nature of the work carried out by I/M practitioners continues to change, due to the technological innovations which have occurred in vehicle systems. The HKSAR Government needs to invest in a continual updating of training systems to prevent the current critical mass of expertise from falling below the unsustainable levels it has presently reached.

The HKSAR Government may also adopt the dual VET to attract more young people to join the vocational stream at appropriate age

As deemed from both the international cases, dual vocational education is becoming a major worldwide trend. The HKSAR Government should consider adopting policy from these places so as to bring in a more comprehensive and student-oriented TVET to young people. Efforts should be made to trial new teaching methodologies when conventional methods appear to be failing. If successful, in terms of improved retention and success rates, dual VET should then be introduced at full scale. Associated with this is the need to make sure that funding follows, so that students can procure better learning, teaching and facilities.

Scholarships or other subsidy schemes should also be provided to students taking automotive engineering courses

Given that students in the vocational education stream face enormous difficulties in switching to the general education stream with higher QF levels, such as Bachelor's degree, the HKSAR Government should consider a more proactive allocation of funding in assisting students with good academic results to do so. One possible way is to set up undergraduate degrees in automotive engineering or related fields and to extend the Study Subsidy Scheme for Designated Professions / Sectors to these self-financing programmes. Students will have greater flexibility to make progression decisions while more opportunities will be given to shift between the academic education stream and the vocational education stream.

**Reviewing VTC's structure is needed**

Regarding the structure, for over 30 years, the VTC has been operating an ITD which oversees industrial training as well as a TED which oversees technical education. When comparing present VTC training centre activities with technical education departments, there appears to be significant overlaps and similarities. A review is needed to better deploy the resources of these two divisions, via a merging, in order to free up the necessary funds to move to the dual training system, and ensure that financial investment by the VTC would be more effectively applied.

## **6.2 Strengthening current initiatives to enhance professional standards and recognition**

### **6.2.1 Launching a mandatory registration scheme for Inspection and Maintenance personnel with a defined timeframe**

**A clearer career pathway can encourage people to enter the trade**

Regarding professional standards in I/M work, there should be a clear career pathway from unskilled apprentice all the way up to workshop manager, as proposed by the Automotive ITAC (see Figure 8). It is obvious that the declining interest in entering the I/M sector will mark a significant threat to the industry in the near future, and that can be attributed to the existence of the present imprecise pathway.

**Delayed adoption of mandatory registration scheme may harm practitioners' confidence in the industry**

The VRS for vehicle mechanics is an important foundation for rationalising the pathway, and giving I/M personnel a definite understanding of their qualifications, rights and obligations. With the scheme, the public also establishes confidence in the industry. However, it is believed that the delayed in the adoption of a mandatory registration scheme contributes to the notable decline in the participation rate of the VRS for vehicle mechanics, as shown in the data from section 2.3.3.

**The HKSAR Government should consult the industry on the implementation of mandatory registration scheme**

The HKSAR Government should, as soon as possible, consult the industry and related professional bodies regarding the implementation of the mandatory registration scheme for vehicle mechanics, for which there is an urgent need to set the timeframe for implementing the mandatory registration scheme accordingly. It will help increase the recognition for the whole trade. The timeframe should not be too aggressive; the industry has to pragmatically agree on the step forward together, otherwise adverse impacts such as the market bias to larger-scale workshops may happen, as smaller workshops may not be able to afford mechanics' training costs.

## 6.3 Review of Continuing Professional Development system

There exists a clear and growing need to ensure that personnel, not least those working in the vehicle I/M trade, are kept abreast of technological innovation, operational developments and changes in regulations. This could be achieved via CPD or conventional courses, learned society activities, life long learning and upskilling sessions. Universities, training institutes and professional societies should all be involved in this important initiative.

### 6.3.1 Updating Continuing Professional Development content and requirements regularly

The CPD system should be reviewed and updated regularly

I/M personnel need to be continually updated on all new regulations and safety developments; it makes CPD a more crucial component affecting their work capability. CPD has to be reviewed and updated, in the best interest and need of the trade from time to time, by professionals and experts who follow the market closely. Communication with industry is also required to secure agreement on what topics should be the subject of present and future CPD courses.

The increasing number of vehicles and more tightened emission regulation force the mechanics to enhance their skills and knowledge to perform their work

For instance, as tighter emission standards are enforced from time to time and the rising number of vehicles in Hong Kong, there could be more vehicle maintenance work demanded in the market for passing the service and emission check, which is proposed to be a prerequisite for vehicle relicensing. Mechanics and technicians in workshops should understand the fundamentals of emission standards (e.g. Euro IV, V and VI) and be able to perform maintenance work on emission systems. Such supplementary practical skills on emission systems could best be provided through in-house training, or by attending CPD courses or learning activities arranged by relevant professional institutions, so that I/M practitioners may satisfy clients' requests on emission compliance upon request. Rigorous training, in parallel with the introduction of tightened legislation, should be the standard practice in the future.

Professional groups should consider providing more courses as CPD to their members

The VTC's PAAU offers a number of popular in-service courses (see Appendix IV). It is also particularly helpful, to those it serves, that the HKIE invests heavily in organising a wide range of CPD activities. In addition to the HKIE, the local chapters of automotive engineering professional bodies (e.g. SAE, Society of Operations Engineers-Road Transport Sector, Hong Kong Institute of the Motor Industry) should also be providing learned society activities or CPD courses, to help nurture and develop I/M personnel (e.g. mechanics, technicians and engineers) throughout their careers. It will be useful, if professional bodies associated to the industry can provide tailor-made learned society activities or CPD courses for those undergoing apprenticeships and beyond.

**More aggressive targets should be set by VMRU and other CPD regulating bodies in a gradual manner**

In terms of the requirement for CPD, as CPD is useful in maintaining the currency of I/M personnel in practice over their entire careers, VMRU and other CPD regulating bodies could be more aspirational, and raise their CPD hour requirements gradually to ensure the quality of services provided would not be undermined.

**I/M personnel should participate in CPD courses actively**

### **6.3.2 Encouraging I/M personnel to take part in Continuing Professional Development**

Vehicle I/M personnel at all levels should be incentivised to attend regular CPD and life long learning courses. They should be encouraged to attend CPD activities and be rewarded for the time and effort they invest. A combination of CPD and life long learning would result in personnel learning new knowledge and skills, enhanced problem solving, good work habits, ethics, responsibility, thoughtfulness, self-reliance, personal sustainability and so forth.

**Employers should encourage their employees to join CPD activities, which will be beneficial to the business in long run**

I/M personnel need to have the strong support and encouragement of their employers to ensure they receive regular product and technology updates. Under normal circumstances, this should be arranged by the company's training department or, in the absence of a training department, by a well-experienced external provider. The company should also frequently send personnel on relevant in-service courses or factory training. I/M personnel wishing to undertake academic courses beneficial to personal career progression should be supported especially when this is in the best interests of both parties.

**CPD should be provided in a convenient manner**

Vehicle I/M personnel need to have a better access to CPD and life long learning, preferably at no cost to themselves. Furthermore, these courses should be offered in part-time day, part-time evening and weekend modes, so that the maximum number of participants may gain the intended benefits. Programme offerings in part-time modes (day-release and evening patterns) are planned to resume in the coming years. It seems good that prospective students will be able to choose from three different modes of study according to their circumstances in future. The possibility of weekend study support should also be considered if financially feasible.

## **6.4 Making maintenance data available**

Vehicle I/M personnel need to have access to vehicle manufacturer's technical information, to enable them to complete certain major items of I/M work properly. There has been a long history of vehicle manufacturers and main dealers using various means to exclude other repairers from doing I/M work on their products. Many manufacturers presently use a secure internet link with franchise dealers, so that their dealers may retrieve technical data and software updates directly. The technical data or tools are usually not available to others or are being charged at a high price, making the maintenance work exclusive to authorised dealership workshops only. The HKSAR Government should legislate against such anti-competitive behavior.

Prepaid servicing plan may help to encourage more maintenance work done by non-official workshops

#### 6.4.1 Offering grant for vehicles servicing plan

The provision of either prepaid or reimbursed servicing plans for new vehicles purchased under warranty using a grant from the HKSAR Government, could be one way of encouraging vehicle owners to have their new vehicles serviced and repaired at any high quality workshop in Hong Kong.

A number of vehicle manufacturers offer three-year free service packages with new vehicles, the cost of which has been included in the purchase price. This would ensure that I/M work is carried out in accordance with the manufacturer's specifications and that no substandard spare parts are fitted to the vehicle. Vehicles will then be operated at peak efficiency levels resulting in the minimum exhaust pollution emitted.

The UK is planning to ask the vehicle manufacturers to make their maintenance data available

#### 6.4.2 Latest European practices

The UK Government is currently exploring ways to encourage manufacturers and main agents to make their technical data available to other repairers.

Furthermore, the European Union (EU) is going to make it mandatory to make repair information and technical data available in three years' time, but the supplier may charge a fee for providing it. The European Commission implemented competition rules to increase technical information accessibility in the market; it provides more choices of vehicle maintenance to drivers so that they are not restricted to carry out the maintenance work in authorised workshops.<sup>108</sup>

EU is moving in the same direction as the UK in making the repair information available at a cost charged

As practitioners who cannot access technical information are forced to avoid certain items of repair work, there are three important issues about the new EU rule:

- Robust measures should be put in place to ensure that substandard parts are not installed on vehicles;
- Access to the vehicle manufacturer's software needs to be secured when certain new parts are installed or for updating; and
- All I/M personnel and physical resources must be maintained to the desired level of quality.

The HKSAR Government should seriously consider to make vehicle maintenance information available

#### 6.4.3 Forcing disclosure of maintenance information

The HKSAR Government needs to ensure that technical information is made widely available to all repairers, possibly at a cost to the user. This will likely need to be mandated. Another possible way to make sure the information is disclosed, with reference to the previously mentioned case of LPG taxis, is to urge the vehicle manufacturers to disclose their maintenance information to some creditable third parties or TVET providers (e.g. VTC in Hong Kong). This has happened before when LPG manufacturers were asked to provide maintenance information for the fuel system to VTC during their license approval process. The HKSAR Government should actively consider the possibilities of executing similar programmes, for the development of the vehicle maintenance trade in the long run.

#### 6.4.4 Relaunching the Automotive Engineering DataBase Centre

In Hong Kong, the AEDBC was originally set up to provide local tier II and III repairers, who are the paying members, access to technical data and associated support but recent concerns regarding copyright issues have impeded the development of the centre.

**The AEDBC should continue to provide upskilling sessions on demand**

In order to provide the aforementioned technical data to I/M practitioners, at least in the short-term, the AEDBC (i.e. the existing HKAIC) should be relaunched by resolving the copyright. VTC academics and trainers should be missioned to provide support to member-practitioners who experience difficulty in using the data in their operations. The AEDBC should continue to provide upskilling sessions on demand just as in the past, with the aim of securing practitioner upskilling, improving consumer protection, enhancing vehicle efficiency and reducing vehicle emissions.

### 6.5 Setting up a communication platform among key stakeholders

#### 6.5.1 Establishing a continuous communication platform for stakeholders

**A communication platform should be formed among the stakeholders to drive the progress of the trade**

The HKSAR Government should take the lead to initiate a platform for discussions with the industry and TVET providers regularly. The Education Bureau of the HKSAR Government, training institutes, I/M labour unions, societies and advisory committees should meet from time to time to discuss ways to promote professional standards and recognition among the industry. This continuous discussion can better promote the industry, introduce more labour, ensure the provision of training is aligned with expectation from industry, and execute long-term plans for enhancing the professional image of the trade.

**The platform should represent interests of different groups in the sector**

Ways and means should be explored in order to encourage stakeholders to work together towards a set of common aims and objectives. Stakeholders need to be represented on this platform in order to promote discussion and to guide the work of such bodies to satisfactory conclusions. Those selected need to have the character and determination to seek continual improvement across the industry.

**The training for I/M personnel should come first to effectively implement the I/M programme**

The aforementioned platform should endeavour to deliver the benefits of vehicle maintenance, at least from the environmental perspective, to society. While equipping mechanics with adequate knowledge and techniques is the cornerstone of the I/M regime in the city, it is important to oversee and make sure sufficient training is provided on emission control. Only if the entire maintenance trade has a high awareness on the connection between emission control and mechanics training, the efforts spent in roadside pollution control will not be in vain. More effective implementation of vehicle emission control measures, improved roadside air quality and minimised health risks to pedestrians can then be achieved.

### 6.5.2 Major stakeholders

The following table was constructed in order to identify the main stakeholders in the TVET field, whose voices should be represented in the communication platform (see Table 12).

**Table 12: Key stakeholders in I/M TVET in Hong Kong**

Students*	HKSAR Government*	Parents
Academics*	Automotive ITAC*	Society
TVET Providers*	VMTAC*	Feeder schools
ATB*	HKIE*	Universities
Industry*	Other professional societies*	Administration and support Staff

The following briefly summarises the power wielded by each stakeholder marked with an asterisk (\*) in the preceding table:

- **Students**  
Students should be accorded a high importance as stakeholders who have a stake in the fitness for purpose of the course, the employability of graduates and the quality of assessment. It was found that part-time day-release (PTDR) students provided more useful feedback to trainers to adjust training content according to the industry practices, compared with full-time students. This was likely because PTDR students were already gaining experience in the world of work and as such, were relatively more mature.
- **Academics**  
Academics should also be regarded as important stakeholders. They invest their time and energy into teaching, student wellbeing, extracurricular activities, curriculum development, research and development (R&D), etc. They are the voice and conscience of their students and may exercise power individually or through unions. As front-line service providers, they should maintain close and useful dynamic links with industry and positively market the institution employing them.
- **TVET providers**  
TVET providers are key stakeholders who have the responsibility of putting in place a system of TVET which satisfies the needs and expectations of students and produces graduates which fully meet industry expectations. They wield power internally but are mostly reactive regarding external influencers. They have a shared duty of care, with industry, towards students.

- **ATB**

The ATB is an important stakeholder which provides directional strategies and recommendations to the I/M training providers at the VTC. The ATB will also conduct related manpower survey reports, provide key information for the industry's reference, and formulate the teaching content accordingly. Another major function of the ATB is to promote automotive training to society and liaise with relevant bodies in the HKSAR Government and professional groups.<sup>109</sup>
- **Industry**

Industry is a major stakeholder which employs graduates from TVET providers. It wields considerable power in that it can sanction TVET providers and even take the HKSAR Government to task over matters related to the quality and quantity of the manpower supply. It has the shared responsibility for ensuring graduates meet or exceed employer's expectations. As a major stakeholder, vehicle suppliers through their official maintenance teams should strengthen their cooperation with the training providers, to help train and develop I/M personnel.
- **HKSAR Government**

The HKSAR Government, on behalf of society, is a major stakeholder which invests heavily in the process of training future workers to power the economy. It oversees the process of TVET and may wield the power of sanction against providers, at any time it sees fit. Other government departments, like EPD, TD and EMSD, should also be involved in the platform to provide opinions in regard to their duties on roadside emission reduction, vehicle licensing, VRS for vehicle mechanics and maintenance workshops, etc.
- **Automotive ITAC**

Automotive ITAC is a multi-representative advisory body formed by the Education Bureau in 2005, acting as a platform for employers, employees and professional groups to exchange their ideas in promoting QF and SCS in the industry. It has the role of improving the professional image of the trade by adopting the Qualifications Register, SCS and Recognition of Prior Learning (RPL) mechanism.<sup>110</sup>
- **VMTAC**

VMTAC is a specialised advisory group which provides opinions on the implementation, promotion and monitoring work of VRS for both vehicle mechanics and maintenance workshops. It contributes significantly to raise the recognition of the trade by introducing a work-qualification to practitioners. VMTAC is considered as an important stakeholder because of its leading role in planning the mandatory registration scheme as the continuation of the VRS, which can certainly help assure the quality of services provided by mechanics.<sup>111</sup>



- **The HKIE**

The HKIE accredits a number of TVET programmes and as such wields power over TVET providers. It has a shared responsibility in ensuring that programme documents are of a high quality and that programmes are fit for purpose. It also oversees specialist groups such as the HKIE Automotive Engineering Special Group (AESG). Furthermore, it plays a key role in supporting the development of aspiring I/M personnel and automotive engineers.

- **Other professional societies**

Other professional societies (e.g. the Society of Operations Engineers (HK), the SAE Hong Kong, the Institute of the Motor Industry Hong Kong) may formally recognise TVET programmes relevant to their statutes but do not wield anything other than the power of influence. As they all have active chapters in Hong Kong, it is in their best interests to play an active role in helping develop aspiring mechanics, technicians and technician engineers (potential members) through the provision of learned society activities, CPD and life long learning.

## Conclusion

**The quality of mechanics will affect the effectiveness of roadside emission control programmes and its related health risk**

Sufficient availability of high-calibre vehicle I/M personnel affects the effectiveness of any roadside emission control programme in the city. A lack of I/M specialists may lead to improper vehicle maintenance and excessive emissions, which in turn pose additional health risks and costs to the public. In fact, I/M are closely connected components of emission control in practice, while emission inspection is usually of subordinate importance in the local automotive training as compared to vehicle maintenance. It is believed that the knowledge and techniques of emission control and inspection will be one of the emphases in the future automotive engineering curriculum, in an age in which public health and sustainability are highly promoted.

**A new brand image for the trade is needed to bring in new entrants with the help from the HKSAR Governments**

The deep-rooted negative perceptions of students, their parents and teachers of TVET remain as the major hindrance to I/M or any other vocational training in Hong Kong. To attract new blood to join the trade, existing practitioners must revitalise the trade with a new brand image. Better prospects and opportunities have to be foreseen by young people and other potential entrants. The HKSAR Government and training institutions should actively promote the positive values and contribution of automotive engineering TVET to the society.

**Vocational training is losing popularity in Hong Kong, the TVET providers must enrich the learning experience**

With the gradual transition to the 3-3-4 New Academic Structure, vocational training is becoming a popular choice among secondary school graduates. VTC, as the official organisation specialising in TVET, has provided diversified training to vehicle mechanics and underpinned the sustained progress of the local automotive industry over the past 30 years. Training institutes should continuously make every endeavour to enhance their training by enriching the student experience, producing excellent graduates and keeping staff up to date.

**Maintenance workshops must keep strengthening their capacities to cope with the challenges faced**

The vehicle maintenance trade is undergoing other multi-dimensional challenges, such as a growing vehicle population, continuous advancement of vehicle technologies, inaccessible maintenance data and tools, changing regulations and more. Maintenance workshops and their employees must continually be strengthening their capabilities, in order to withstand all these transformations and to stay competitive in the market.

**The HKSAR Government can play a significant role in revitalising the industry through the allocation of resources and implementation of supportive policies**

Some of the difficulties faced by the industry are more resource-based; it requires courage and vision from the HKSAR Government bureaux and departments to take an initial step. The HKSAR Government should offer more education and funding support to the training and education of I/M personnel. Vocational education and academic education should be promoted in secondary school education in a balanced manner. Life planning could be a useful tool to encourage students to plan their career path and establish a better self-understanding at an appropriate age, enabling students to discover their own interests and aspirations.

**Vocational education contributes to the society by offering upward mobility to the youth**

Hong Kong is growing as a knowledge-based society, where there is need for good quality craftsmen, technicians and engineers in the automotive profession. TVET should be viewed as an important social mobility catalyst in driving young people up the social ladder. Changes in education and people's mindsets have to be made today as they take time to be effective in informing and preparing people at all generational levels. This will be a long-term process which requires immediate actions and cooperation from all stakeholders.

# Appendices

## Appendix I Hong Kong: Vehicle Related Air Pollution: In Support of the HKSAR Government Chief Executive's Action Blue Sky Initiative<sup>112</sup>

### Hong Kong: Vehicle Related Air Pollution In Support of Action Blue Sky

A set of measures aimed at alleviating air pollution caused by road vehicles

#### Maintenance

1. All vehicles must be properly maintained, no matter what fuel they use. The manufacturers' recommended, preventive maintenance scheme and all related specifications should be closely adhered to. A properly maintained vehicle will burn less fuel, release less pollutants to the atmosphere and be safer. It is therefore important that ways and means be found to ensure that all vehicles receive regular, good quality maintenance. It is also important that an effective system be put in place which bans the use of poorly maintained vehicles. It is not just a legal requirement but also a moral duty incumbent on all vehicle owners to properly maintain their vehicles.

N.B. It should be noted that the HKSAR Government Construction and Maintenance Regulations (Cap 374) requires owners to properly maintain their vehicles.

#### Mechanics Licensing

2. One of the possible measures to ensure good quality vehicle maintenance, and enhanced consumer protection, would be to license motor mechanics / technicians. Through a well-designed licensing scheme, mechanics / technicians should (i) be required to hold a relevant minimum qualification; (ii) be appropriately skilled and experienced; (iii) behave in an ethical way; (iv) practice life-long learning and (v) be continually kept up-to-date regarding the latest product technology / related workplace processes. Disciplinary procedures would also need to be included in order to ensure compliance. A compulsory licensing scheme would likely be more effective compared with a voluntary one.

N.B. It should be noted that the EMSD is developing a Mechanic's Licensing Scheme, to be launched when ready.

### **Registration of Garages**

3. Another possible measure aimed at protecting the public and vehicle owners alike would be to register vehicle repair enterprises (garages / workshops). The register would ensure that garages / workshops:
  - (i) Employ properly qualified and skilled (licensed) mechanics / technicians;
  - (ii) Have adequate levels of equipment and tools;
  - (iii) Apply appropriate maintenance related data (Manufacturers Specifications) to suite the vehicle types under repair, at any given time;
  - (iv) Provide regular upgrading courses for their mechanics and technicians;
  - (v) Maintain ethical standards and all health, safety and environment protection regulations; and
  - (vi) Maintain premises which are suitable for the purpose (space, location etc.).

### **Vehicle Related Emissions Data Collection / Management System**

4. Once the Mechanics' Licensing and the Garage Registration Schemes are operating satisfactorily, nominated garages could be enlisted to join a scheme to upload service / emissions related data to a central (HKSAR Government) computer. The results of HKSAR Government TD and EPD exhaust emission test data may also be uploaded to the same database.
5. At any given time this data could be analysed, using appropriately designed software, to produce a profile of the emissions created by the various types of vehicle registered for use in Hong Kong. This system could become an important tool for managing vehicle emissions and identifying "hotspots" (polluters) for appropriate corrective measures and to minimise the environmental footprint created by Hong Kong's mobility industry.
6. This system could be expanded to include roadworthiness data so that inadequately maintained vehicles may be banned from the roads perhaps when applications for relicensing are submitted to the TD. This could easily be achieved by using the aforementioned service / emissions data (on an individual vehicle basis) to flag-up vehicles which fail to meet requirements related to safety / roadworthiness and environmental sustainability.

### **Enforcement of Existing Regulations & Tightening of Future Regulations**

7. Effective enforcement of all vehicle related regulations must be ensured. Hong Kong currently has good vehicle related regulations, across most of the necessary domains. However, these regulations can only be as good as the enforcement mechanisms put in place. The relevant authorities must therefore explore ways of maximising the enforcement of all current regulations. Furthermore, regulations should be considered to be “living documents” in that they can be quickly updated, so as to respond to rapid changes in technology and related processes and also to any unexpected change or deterioration in the environment or safety on the road.

### **Hong Kong Institution of Engineers: Automotive Engineering Special Group**

8. The HKIE needs to create an AESG, which would provide a forum for experts to identify and discuss areas of concern and to provide advice when called upon, so to do. It is anticipated that the AESG would comprise of representatives from HKSAR Government departments such as; TD, EPD, EMSD, Hong Kong Police Force Traffic Section, non-governmental officers from the light and heavy vehicle industry and other interested parties, as thought fit by the Mechanical, Marine, Nautical and Chemical (MMNC) Divisional Committee. Members would normally be professional engineers in their respective specialisations or of equivalent / similar status.
9. The AESG would also give much needed support to future aspiring Professional Automotive Engineers. Furthermore, AESG members would be expected to network themselves with experts around the world in order to help in prescribing solutions to quickly resolve vehicular-related concerns, as and when these arise. Learned society activities would flow from these processes.

N.B. The introduction of an AESG is currently being explored by the MMNC Division of the HKIE. The support of the HKIE President, LegCo Engineering Constituency Representative and the MMNC Chairman, have been secured.

### **Jockey Club Large Vehicle Testing and Emissions Centre (Pended)**

10. The HKJCCT has donated the sum of HK\$16.61 million in order to build and equip the captioned new centre. The centre will enable the study of all systems on large vehicles and is to be a shared resource between the Department of AE and local technological universities with 50 per cent of its resources dedicated to testing, R&D and Emissions related projects and the other 50 per cent to the education and training of students, from any of the aforementioned institutions. It should be borne in mind that large vehicles (trucks and buses) pollute our atmosphere to a much greater extent than private cars. Every means should therefore be employed to reduce the environmental footprint of large vehicles, which is a significant part of the mission of this new centre.

11. It should be noted that no matter what needs to be done to clean up our environment, we need good quality graduates / expert manpower, specifically trained in key specialist areas, in order to realise all intended goals. To this end, the JC Large Vehicle Testing and Emissions Centre would make a hugely worthwhile contribution to the community, for many years to come.
12. In early 2006, the funding of this new centre was frozen by the HKJCCT due to understandable concerns relating to a possible relocation of the parent campus; IVE (Lee Wai Lee) to Tseung Kwan O. Now that details related to the relocation of the Lee Wai Lee campus have apparently been settled, it would be beneficial to the local community if the funding were now unfrozen and architectural / building related work recommenced.

#### **Public Education**

13. A change in the mindset / culture of the public at large is urgently needed. If the public fails to gain an understanding and a strong empathy towards environmental protection it will be extremely difficult, if not impossible, to secure any significant improvements. This is particularly important regarding the need amongst the business community to invest in environmental protection media in order to sustain our resource base.
14. The most important action would be to educate all concerned, especially teachers, who may then cascade information to the pupils / students in their care, to encourage a much stronger empathy for environmental protection.
15. Also, driver-training manuals need to include the topics of (i) eco-driving and (ii) environmental protection. Furthermore, learner drivers need to be trained in the ways they may get the best out of any given vehicle in terms of minimising fuel consumption and harmful emissions at the same time as maximising road safety.

#### **Commercial Vehicle Sector**

16. The HKSAR Government currently closely monitors the quality of maintenance applied to buses operated by franchise companies. However, this seems not to be the case regarding the vast number of commercial vehicles, apart from the annual statutory vehicle examination presently enforced. A comparable set of high quality and effective controls therefore needs to be applied across all vehicles used for the purpose of hire or reward. It seems evident that commercial vehicles need to be organised into groupings, which can be placed under the authority of Registered Professional Automotive Engineers who would be made responsible for all safety and environmental aspects. Once better organised, "home grown" Professional Automotive Engineers

may more effectively help steer transport companies towards seeking continual improvement regarding challenges associated with the operational effectiveness, safety and environmental protection issues confronting the industry today.

N.B. It should be noted that the Department of AE of the IVE (LWL) is currently producing high quality graduates who [it is hoped] are destined to become tomorrow's new breed of Professional Automotive Engineers. However, changes in workplace quality, remuneration and career structure etc., are needed to attract and retain such precious human resources in the industry.

### **Age of Vehicle Stock**

17. The average age of the vehicle fleet (all types) in Hong Kong needs to be kept as low as possible. This will better ensure that the community gains the intended benefits from the most recent vehicle technologies designed to (i) make vehicles safer for both occupants and pedestrians; (ii) economise on fuel and (iii) counter harmful (both regulated and unregulated) emissions (including CO<sub>2</sub>). Euro IV is one good example of the latest regulations and associated technologies imported into Hong Kong from Europe.

### **Aggressive Driving**

18. Aggressive driving, such as rapid acceleration, speeding and severe braking need to be discouraged. Using eco-driving techniques, fuel consumption can be greatly improved, emissions minimised, road safety enhanced and "wear and tear" on the vehicle systems and tyres hugely reduced. All of these benefits lead to lower operating costs and possible future reductions in insurance premiums. For all drivers, eco driving will save costs / significantly enhance profit margins (for the commercial sector) and reduce exhaust emissions.
19. The relevant authorities need to more effectively enforce speed limits by more widespread application of the wide range of modern technologies designed for the purpose. Other countries are applying such technology to great effect for making roads safer and also reducing fuel consumption and exhaust emissions across the fleet.

N.B. The Department of AE has carried out an interesting study on Vehicle Fuel Consumption and Eco Driving and a report has been released.

### **Driver Selection, Training and Development**

20. It is critically important for commercial transport / bus companies to employ drivers who are suitable, from a psychological point of view, to become good drivers. By using psychometric testing, drivers who have the tendency to drive aggressively should be weeded-out for special training and if such training / retraining fails, they should be advised to seek alternative employment. Methods applied for the selection, monitoring, training and professional development of drivers should therefore be a requirement and should be enhanced over time.



### **Motor Fuels**

21. Ways and means must be employed to ensure that diesel vehicles running in and around Hong Kong (including cross-border vehicles) use only high quality ultra-low sulphur diesel (ULSD) fuel readily available in Hong Kong. Methods need to be employed to neutralise any financial gain presently enjoyed by certain drivers using, or bringing into Hong Kong, poor quality, high sulphur fuel. Modern vehicles with sophisticated engine and emission control systems need to run on high quality fuel (e.g. ULSD / City-diesel) in order to operate smoothly and efficiently and to realise designed emission levels.
22. Having already converted taxis use to the well-proven LPG technology benefits have been realised. LPG also needs to be applied to light buses and vans as quickly as possible. Furthermore, it should be made possible to convert privately owned gasoline vehicles to run on LPG.
23. The use of bio-fuels (e.g. bio-diesel) and blending of bio-fuels with fossil fuels, where this has been proved to be beneficial, should be actively promoted by the HKSAR Government.

N.B. Diesel engine manufacturers in the World (European Automobile Manufacturers Association, Alliance of Automobile Manufacturers, Engine Manufacturers Association, Japan Automobile Manufacturers Association) as declared in the World-Wide Fuel Charter (December 2002), approve the mixing of bio-diesel into fossil diesel fuel up to a five per cent content level.

### **Hybrid & Electric Vehicles**

24. The use of hybrid and electric vehicles should be encouraged by providing financial incentives. For example, such as lower (or zero) first registration tax and lower (or zero) annual license charges. However, to fully benefit from hybrid technology, drivers also need to be trained on how to apply eco-driving techniques to get the best fuel economy. Very importantly, battery-electric vehicles, which create zero pollution at the roadside, will need an infrastructure of charging points to support their use / viability. In Germany and the Netherlands (and some other European countries) charging points are being installed at the roadside and within car parks.

### **Vehicle Specifications**

25. We need to ensure that new vehicles are able, not simply to meet present standards (Type Approval), but to continue meeting these over the service life of the vehicle. New vehicles may meet the new standards but after a few years of service may fall below the required levels. One way to achieve this is ensure proper maintenance is applied and also to introduce more frequent roadworthiness / emissions checks (perhaps annually) for all vehicles, including private cars.

### **Availability of Vehicle Technical Data**

26. Vehicle manufacturers should be required to make all repair manuals openly available to the Hong Kong public. Access to good quality data will enable small and medium sized repairers achieve a better level of quality when servicing / repairing vehicles.
27. The **Automotive Engineering Department** has introduced the HKSAR Government-sponsored AEDBC located at the IVE (LWL) campus. This centre is dedicated to serving the needs of small and medium sized repairers, with the data, advice and consultancy services they must have, in order to satisfactorily diagnose service and repair vehicles. This centre is dedicated to driving incremental improvements in the quality of vehicle servicing.

### **Vehicle Sharing**

28. Car and taxi sharing should be encouraged to reduce both traffic congestion and pollution, especially in urban areas. The fuel consumption per person, of a vehicle carrying two persons instead of one, is effectively almost halved. A car or taxi carrying five occupants is therefore an optimal arrangement. Furthermore, a bus carrying 100 passengers will enjoy greatly reduced fuel consumption, per person, compared to a private car or taxis carrying one or two persons. However, a bus carrying only a handful of passengers would incur a higher fuel consumption rate, so bus companies need to pay attention to route loadings, peak and off-peak times.

### **Actions to Mediate Against Poor Visibility / High Pollution in Urban Areas**

29. There are a number of ways to minimise the number of vehicles entering the urban area and hence reduce urban pollution levels. In London, Mayor Livingstone has introduced a "traffic congestion" charge to great effect and is now considering the introduction of low emission zones.
30. In Paris, on days when the pollution index is high, the authorities only allow "even" numbered (license plate) vehicles one day and "odd" numbered vehicles the next day, into the urban areas, thereby lowering congestion by encouraging vehicle sharing.
31. In Germany, only vehicles installed with Government "low pollution" badges may be used on the roads when pollution levels are high. Also, bio-fuels are widely available and promoted in a number of European countries.

### **Zero Roadside Pollution Levels**

32. The famous Hong Kong Trams emit zero pollution at the roadside although the power station, from which they source their electricity, pollutes the atmosphere. However, to source the motive power of the whole fleet of trams from a single power station is much more environmentally friendly, compared with the case of diesel buses, where each bus has its own engine, exhausting copious amounts of gaseous and raw heat pollution at the roadside and adversely affecting the health of the public. In the case of the power station, if it is converted to produce cleaner emissions, then trams, light rail cars and trolley buses would, in turn, become even more environmentally friendly than they are today.
33. The Citybus Trolley Bus project (covered by a report published on the website of the AE department needs careful consideration / reconsidered, as these, similar to trams and light rail systems, emit zero emissions at the roadside. The modern Citybus Trolley Bus, as can be seen in the report, is the first "Made in Hong Kong" double-deck, air-conditioned, zero roadside emission bus capable of accommodating more than 100 passengers. This "first" for Hong Kong could be exported to the Mainland as a useful "green" technology for use in other urban areas (which presently pollute the whole of the PRD).
34. Diesel buses, operating in urban areas, should be replaced by hybrid buses or modern trolley buses. Hybrid buses provide the operator with better fuel consumption and lower emissions levels at the roadside. Such vehicles may even exhibit lower operating costs, especially trolley buses, and are normally much more energy efficient compared with present-day diesel buses.

### **Retrofitting / Upgrading**

35. Older vehicles need to be modified / retrofitted to upgrade all technical equipment relating to emissions and safety standards.

N.B. It should be noted that the EPD are currently requiring the retrofitting of certain types of commercial vehicles and buses.

### **Commuter Logistics**

36. Low priced (subsidised) car parking should be made available near to suburban MTR, KCRC, Bus and Ferry stations / piers to encourage drivers to use mass transport as the preferred means to enter and leave urban areas.

### **Idling Engines**

37. Severe penalties should be applied to penalise drivers who idle their engines for excessive periods of time, whilst the vehicle is stationary. A stationary vehicle with its engine idling is 100 per cent inefficient because it is not moving. Tour buses and coaches may be installed with auxiliary engines to drive the air conditioning plant of the vehicle

while it is stationary. This auxiliary equipment could be powered by roadside charging points at locations where tour buses need to stand for extended periods of time, thus negating the need to run the main diesel engine. Finally, on this point, there needs to be much higher penalties for drivers caught idling their engines, in enclosed places such as underground car parks.

### **Traffic Congestion**

38. The authorities should strive to reduce traffic congestion. Stationary vehicles waste 100 per cent of their fuel and heavily pollute the surrounding environment. Likewise, slow moving vehicles (caught in traffic congestion) suffer low fuel efficiency and hence pollute more than faster moving vehicles. Such congestion is usually associated with the urban areas where there are often masses of pedestrians adversely affected by the pollution and heat released to the atmosphere by slow moving traffic.
39. Traffic control / road planning systems must be put in place aimed at keeping vehicles on the move and if possible to provide information to drivers regarding the best routes to take to avoid serious congestion. Satellite navigation / internet / traffic information systems (which inform drivers of alternatives – under real time conditions) may be applied to assist drivers to avoid congested places. Taxi and car sharing can reduce congestion. Allowing drivers to leave their cars on the outside the urban areas and catch the train, is another way to help reduce congestion.

### **Pedestrian Zones**

40. A wider application of pedestrianisation of busy urban, shopping areas needs to be introduced to provide a safe, more comfortable and healthier environment for people to freely walk about. Restaurant and café owners may provide services such as alfresco dining, within these vehicle-free areas, which would then become more attractive to both tourists and shoppers alike. Pedestrian areas are now very popular in many cities around the world for shopping, resting and other leisure / dining activities.

N.B. Some small-scale projects have been tried but these now need to be extended and multiplied.

### **Smokey Vehicle Spotter Programme**

41. The smoky vehicle spotter programme could be expanded and the penalties against the polluters greatly increased. However, means to ensure stricter compliance levels when carrying out opacity tests, with the aid of a dynamometer, must be realised. Eventually, roadside monitoring, using electronic equipment, will more efficiently and effectively spot polluting vehicles.

### **Best Practice**

42. A set of Best Practices needs to be developed by the HKSAR Government so that those involved in operating / driving vehicles (or whatever) may access such a guide, adopt best practice and become more environmentally responsible persons.

### **Concluding Remarks**

43. It must be mentioned here that there is no such thing as an “Environmentally friendly I/C engine”. All I/C engines suck in large amounts of air and exhaust larger and much hotter amounts of gaseous substances, which are harmful to our environment. The sooner we stop combusting, and find a replacement for the I/C engine, the better the chance we will have to secure the goals embodied in our CE’s Blue Skies Initiative.
44. Hybrid vehicle technology, with its electric drive system matched to an I/C engine, takes us closer to the prospect of a viable All-electric vehicle, but is only a first step towards this goal. Apart from battery-electric systems, the HFC technology is also in the pipeline and could be the future preferred motive power for “zero pollution” (at the roadside) vehicles.
45. Even if most of these initiatives were quickly implemented, we would still need to continue our best efforts to find more sustainable alternatives to counter / replace our current bad practices. We must put in place sustainable policies to ensure that our children and their children’s children may enjoy a pleasant and safe environment.
46. We all must breathe the air, which has been badly polluted by vehicles, planes, ships, restaurants (cooking) and power stations, etc. The evidence that Global Warming is being accelerated by human activity is now quite overwhelming.
47. If you think about it carefully, we have NO CHOICE but to mend our ways or else our collective future will quickly become severely limited. Every single person needs to take action in order to save our race.
48. This list of initiatives is by no means exhaustive and will need to be updated from time to time.

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## Appendix II

### Development undertaken in training provided

#### Acquisition of Training Facilities

##### (i) Fuel Injection Servicing and Diagnostics Facility

The Department of AE's equipment for fuel injection phasing, calibration and diagnostics was upgraded in 1998. At about the same time, this facility was air-conditioned and made dust-free, as required by modern industry standards. It should be noted that, by this time, most I/M companies had stopped repairing fuel injection systems. If a vehicle had a defect, the complete unit would be replaced with a factory-reconditioned or new one. The trend of fitting new units and not repairing defective ones quickly spread to all vehicle systems, with regard to light vehicles. Heavy vehicle units still tend to be repaired or overhauled.

Students needed to understand the details of how fuel injection and other systems worked so the practice of stripping units down and familiarising students with all the parts followed by reassembly and testing was continued. This approach was considered as an empowerment to students who would need to appreciate the internal details of units, for the purpose of accurately diagnosing faults.

##### (ii) Technology Concepts Learning and Teaching Laboratories

From the outset, teaching teams were encouraged to experiment with new ways of engaging with students. Student retention and success rates had started falling in the early 1990s, surprisingly in the area of modern automotive technologies. A teaching space was redesigned and equipped with technology trainer sets in 1998, creating what came to be known as a "Technology Concepts Learning and Teaching Laboratory". Once moved from a standard lecture room into a technology laboratory, students picked up technology concepts and worked through the syllabus more quickly. Equally important to this, students were more motivated whilst in the new "student-centred" environment of a technology laboratory.

The basic concept was to engage the natural inquisitiveness of the learner in a specially designed and enriched learning and teaching (L&T) environment. Professional trainer sets were supplemented by home-made sets and cutaway models constructed by students and staff. Mini-lectures were used, followed by student-centred investigations on the trainer sets under guidance from specially designed software. The software package included management elements which enabled the teacher to monitor the progress of individual learners. Lucas Nuelle is a company considered to be the "gold standard" for vehicle technology training systems.<sup>113</sup>

It should be noted that the term “Teaching and Learning” has been reversed to “Learning and Teaching” to put more emphasis on student learning. The morale of teaching staff was raised appreciably and industry and parents alike were impressed with the high-tech L&T resources exhibited by the Department of AE, during institute open days. One amazing observation was that many students preferred to continue their investigations within the technology laboratory rather than go for tea breaks. Within a few years, three technology laboratories were in operation which all proved successful regarding improved student retention and success rates.

**(iii) LPG Taxis Research and Development Bay**

About the time the HKSAR Government provided funding for its entire diesel taxi fleet to be replaced with new LPG-fuelled taxis, the Department of AE applied for and secured funding to build an LPG Bay. This had to be built to standards set by the Fire Services Department, EPD, and EMSD. This facility provided a safe working place for students to learn and practise on LPG fuel systems.

**(iv) Vehicle Electrical and Electronics Laboratory**

Road vehicles of all types and sizes have increased in sophistication ever since the first vehicle was invented. More recently, this trend has continued to accelerate seeing a great deal more electronics elements added across all vehicle systems. Traditional wiring systems have been replaced with much lighter communication systems such as CANbus. This laboratory was developed in 2003 to track the evolution of hybrid or EV technologies and driverless vehicles, as well as to keep students up to date with the latest electrical and electronics technologies.

**(v) Light Vehicle Emissions Test Cell**

Through a normal capital equipment acquisition process, the Department of AE purchased a laboratory standard suite of signal exhaust gas measuring equipment in 1998. It also sent two members of staff for Emissions Test Cell (ETC) training in the UK. The aforementioned equipment along with a refurbished Froude dynamometer enabled the Department of AE to create a light vehicle ETC. The ETC served to deepen the students’ understanding of vehicle exhaust emissions, how the various gases are accurately measured and controlled, and their impact on society.

**(vi) Light Vehicle Transient Chassis Dynamometer**

A transient chassis dynamometer for light vehicles was consigned to the Department of AE in 1999 to enable more sophisticated student projects to proceed and to carry out R&D work for the EPD.

### **(vii) Jockey Club Heavy Vehicle Emissions Testing and Research Centre**

From the outset, the workshops of the Department of AE were not big enough to accommodate large vehicles. The need to provide a modern practical environment, in which students would be able to safely investigate all systems on large vehicles, was pressing. A business plan was created and refined, by adding the R&D and Emissions components, with the guidance of a Project Steering Group (PSG) which was comprised of representatives from key external stake-holders (see Box 5).

#### **Box 5**

##### **PSG of JCHVETRC**

- |                                  |                  |
|----------------------------------|------------------|
| (a) PolyU;                       | (e) KMB;         |
| (b) HKU;                         | (f) Citybus; and |
| (c) HKUST;                       | (g) HKIE.        |
| (d) EPD of the HKSAR Government; |                  |

In 2006, the Hong Kong Jockey Club Charities Trust (HKJCCT) donated HK\$16.61 million for the building and equipping of the JCHVETRC. In order to fully realise the intended benefits for students, staff and all other stakeholders, a condition agreed was that the centre would be attached to and managed by the Department of AE.

In 2005, it was confirmed that the Lee Wai Lee campus in Kowloon Tong would have to be vacated. This had made it extremely difficult to execute plans for the building of the JCHVETRC, as it no longer made any sense to continue to develop its “built” environment, until a new site had been identified. In 2011, the JCHVETRC was eventually established adjacent to the Tsing Yi Technical College campus, certified to the latest Euro V standard.<sup>114</sup>

### **Enrichment of Teaching Approaches**

#### **(i) Private Vehicle Repair Scheme**

The vast majority of TVET off-the-job providers struggle to keep up to date and in touch with industry practices. It is important that students work on current vehicle models, modern equipment, and tools similar to those found in the workplace. From time to time, the Department of AE was offered donations of vehicles and components, most of which were found to be out of date and had to be rejected. Due to budgetary constraints, the Department of AE could not afford to purchase sufficient new or recent second-hand vehicles, for students’ on-car projects. This was not simply because of the high cost of such vehicles but also the high cost of the dedicated off-board diagnostic equipment needed to service and repair such vehicles. Students were keen to work on current models because the skills they learned would be most beneficial to their careers.



Consideration was given to a vehicle repair scheme. The scheme would invite members of the public to bring their vehicles to the Department of AE for servicing and repair. During discussions with the industry, feedback received was that this scheme would take work away from local practitioners. More importantly, another concern was what might happen if a college-repaired vehicle were to be involved in a road accident.

A modified scheme was eventually launched which was restricted to the vehicles of VTC staff. This was eventually withdrawn, mainly because vehicle owners were not prepared to wait for long periods of time whilst part-time students (attending one day per week) worked to complete the repair. Another problem was matching the nature of the repair to the flow and depth of topics in the curriculum. Students needed to have studied the related topic to the appropriate depth before practising what they had learned on a "live" vehicle. Furthermore, full-time students were not sufficiently up to speed (in terms of manual dexterity) to be able to benefit from this scheme.

#### **(ii) Stock Vehicles for Hands-on Practical Projects**

The Department of AE will consider purchasing vehicles each year to keep the training vehicles up to date, and write older vehicles off once they are no longer fit for purpose. KMB donated a single-deck bus and Citybus frequently loaned fairly new vehicles on which students could practise their diagnostic skills. The Department of AE purchased a new hybrid car (Toyota Prius) and a number of motorcycles.

Students showed great interest when the Department of AE agreed to build a brand-new Lotus Seven racing car. They gained valuable hands-on experience with the owner checking every stage of the construction.

The Department of AE applied every possible means to procure a broad fleet of current and new training vehicles in order to ensure students benefited, especially regarding the acquisition of a useful set of key employment skills and related technological concepts.

#### **(iii) Student / Staff Industry Attachment Scheme**

Providing realism to students and keeping academics up-to-date with industry are major challenges faced by the off-the-job training providers. Both students and staff were therefore sent on attachments to trade. Industry members were given a list of learning outcomes that needed to be achieved for each attendee. A supervisor, in each company,

was selected to ensure that all intended outcomes were realised. The attachment scheme was also purposely designed to enhance the soft skills of students. Unlike hard skills, which tend to be specific to a certain type of task or activity, soft skills are personal attributes that describe one's ability to interact with others.

Teaching staff are encouraged to attend activities like courses and professional lectures, in order to keep abreast of the quickly changing technology. Industrial attachment is an important source of staff development. Fortunately, support from the Department of AE's industry network is strong. Staff development has always been a high priority for the Department of AE. It is good to be given the impression that support for the Department of AE, from industry, remains strong.

#### **(iv) Expert Visits Initiative**

This project involved bringing one well-established international automotive engineering experts to Hong Kong each year. Experts stayed for five working days and were paid a daily honorarium, plus travel and living expenses. The Department of AE scheduled experts to experience, wisdom and key skills to all concerned. Experts also met and worked closely with students and staff with the aim of transferring real-world major external stakeholders, in order to improve networking for the Department of AE and accrue additional benefits for all concerned.

In July of 2007, four of the Department of AE's past visiting experts, led by Dr. Michael Coyle, came to Hong Kong at their own expense to make presentations at a workshop titled *Safe and Fuel Efficient Road Transport* held at the Lee Wai Lee campus.

#### **(v) Automotive Engineering DataBase Centre**

The AEDBC became a reality as a direct result of witness testimony provided to the LegCo, on the vehicle related reasons for poor air quality in Hong Kong. At that time, tier II and III local repairers had provided evidence to the effect that they could not access the necessary data, from vehicle manufacturers or their agents.

A solution was proposed, designed to overcome this lack of access to data. With VTC funding of HK\$250,000, the AEDBC was set up in 2002. The main aim of the AEDBC was to provide free advice, training and consultancy support for local practitioners who had joined it as paying members. Its objectives included strengthening consumer protection, enhancing air quality, enriching the student experience and involving

teaching staff in income-bearing consultancies. The AEDBC provided new income streams for both the Department of AE and VTC. However, PAAU launched a restricted form of the AEDBC, namely the HKAIC, and due to copyright concerns the new HKAIC is now only used for internal purposes.

The website of the AEDBC was also used to raise awareness of environmental protection, sustainability and climate change issues with students, stakeholders and the public. Further development of the AEDBC business plan is outlined in Box 6.

#### Box 6

##### Further Development Plan of AEDBC

- (a) Improved support for student projects;
- (b) Marketing of AEDB services and in-service short courses;
- (c) Communicating developments and news items to interested parties; and
- (d) Benefiting both local practitioners and academics by providing “teaching” consultancies in the form of CPD.

##### **(vi) Automotive Engineering Special Group of Hong Kong Institution of Engineers**

The concept of the HKIE Specialist Groups was to create special groups, which would support aspiring, young engineers through learned society activities, CPD and life long learning, tailored to suit their needs. The AESG was formed in 2006 to 2007 and is still holding meetings today.

##### **(vii) Graduate Enhancement Initiative**

Feedback from past graduates indicated they were being hampered by a range of deficits, which appeared to be affecting their ability to fully impress potential employers. A meeting was arranged with industry representatives to brief them on the perceived problem and to solicit feedback.

Industry representatives were formed into small groups and asked to brainstorm a list of the attributes they felt a graduate should have. The feedback was submitted to the course committee and embedded in the curriculum. A presentation was given to final year students to inform them of this important initiative and special workshops were arranged for final year students. A great deal was learned about the importance of closely liaising with industry regarding such curriculum development initiatives.

## Research Work

### (i) Joint Research with Local Universities

As the Department of AE modernised its equipment with facilities and increased staff training, local universities started to take an interest in carrying-out joint R&D projects into vehicle related topics. None of the local universities had automotive engineering in their curriculum. The marriage of the technology expertise of the Department of AE with the analytical prowess of university partners brought together the complete range of key skills needed to better ensure the success of joint R&D projects.

Joint R&D projects, by default, were aimed at ways of improving the efficiency of road vehicles, reducing harmful exhaust emissions and enhancing the health and wellbeing of the people of Hong Kong and the region. Students, academics, support staff and society all benefited from these ventures.

#### Box 7

##### Examples of income bearing R&D projects

- (a) The Department of AE and the HKU (Chemistry Department) worked together on testing bio-diesel fuel samples making use of the Department of AE's light vehicle ETC;
- (b) The Department of AE and the HKUST (Environmental Sciences Department) worked together on the design of the suspension of a mobile emissions measuring platform;
- (c) The Department of AE supported the CBC (Engineering Department) Trolley Bus Project and advised the company on a number of ways to increase operational efficiency;
- (d) The Department of AE supported the KMB (Engineering Department) by advising the company on a number of ways and means to increase operational efficiency; and
- (e) The Department of AE and the EPD worked closely together on a number of committees, boards and on the planning for the building and equipping of the JCHVETRC.

## Appendix III

Table 13: Curriculum - Higher Diploma in Automotive Engineering 2015/2016<sup>115</sup>

Semester	Course Title
1	English and Communication: Workplace Interaction
	IT Essentials – Services
	Engineering Science
	Fundamentals of Science and Calculations
	Mathematics for Mechanical Engineering
	Occupational Safety and Health
	Engineering Materials
	Automotive Technology I
	Automotive Practical Training A
	Whole Person Development: Self-efficacy Enhancement
2	English and Communication: Workplace Correspondence
	Vocational Chinese Communication: Putonghua Conversation and Reports
	Engineering Drafting and CAD
	Electrical and Electronic Principles
	Engineering Mechanics
	Automotive Technology II A
	Automotive Practical Training B
	Automotive Electrical and Electronic Systems
	Automotive Operations Management
	Whole Person Development: SMART in Action
3	English and Communication: Persuasive Presentations
	Automotive Technology II B
	Automotive Business Management A
	Whole Person Development: Global Vision
	Vehicle Body Design and Building / Automotive Thermofluids
	Enrichment Module
4	English and Communication: Promotional Materials
	Vocational Chinese Communication: Putonghua Presentations, Administrative and Technical Text Writing
	Engine Performance and Emission Control
	Advanced Automotive Technology
	Automotive Control System
	Automotive Engineering Design
	Automotive Practical Training C
	Whole Person Development: Integrated Career Development
Automotive Fault Diagnosis (Light Vehicle) / Mechanical Technology	
5	English and Communication: Report
	Industrial Attachment
	Industry-Based Student Project
	Automotive Testing and Standards / Automotive Fault Diagnosis (Heavy Vehicle) / Automotive Business Management B

## Appendix IV

**Table 14: Pro-Act Training and Development Centre (Automobile) In-Service Training Courses in 2015/16 academic year<sup>116</sup>**

Course Code	Course Title	Duration (Hours)	Mode <sup>*#</sup>
AU2103399	Programme for Assistant Mechanics	390	FTS
AU2106416	Programme for Assistant Craftsman in Vehicle Body Repair	180	FTS
AU5103180	Automatic Transmission System Servicing	25	PTE
AU5105110	LPG Vehicle Servicing	51	PTE
AU5106220	Vehicle Electric / Electronics Servicing Fundamental	24	PTE
AU5106230	Vehicle Electric / Electronics System Servicing and Repair	30	PTE
AU5106240	Vehicle Air-conditioning System Servicing	30	PTE
AU5106310	Automobile Testing and Measuring Equipment	30	PTE
AU5106330	Paint Spraying and Paint Defects	30	PTE
AU5106340	Petrol Engine Management System (Basic)	15	PTE
AU5106350	Petrol Engine Management System (Upgrading)	15	PTE
AU5106360	Vehicle Electrics Systems	27	PTE
AU5106380	Hybrid Vehicle Power Train	9	PTE
AU5106390	Refresher Course for Vehicle Mechanics	30	PTE
AU5106405	Introduction to Electric Vehicle	12	PTE
AU5106406	Automotive Electronics Circuit Fabrication	24	PTE
AU5106409	Vehicle Aluminum Welding	18	PTE
AU5106412	Fault Diagnostics on Hybrid Vehicle	24	PTE
AU5106413	Diesel Engine Management (with Common Rail System)	21	PTE
AU5106414	Heavy Vehicle Inspection and Maintenance (with EBS system)	24	PTE
AU5106415	Fault Diagnostics on Vehicle systems (Computer Simulation)	21	PTE
AU5126419	Certificate for Vehicle Mechanic Repairing (QF Level 2)	309	PTE
AU5126420	Certificate for Vehicle Body Repair and Painting (QF Level 2)	291	PTE
AU5106428	LPG Vehicle Mechanics (CP6) Recapitulation	6	PTE
AU5106429	LPG Vehicle Mechanics (CP6) Enhanced	9	PTE

\* FTS: Full-time short course (less than 6-month duration)

# PTE: Part-time (Evening)

## Appendix V

### Hong Kong Institution of Engineers: Definition of Continuing Professional Development

CPD has its own definition of CPD which applies to both Corporate Members and to engineers in the pre-Corporate Member stage.

#### Box 8

##### The HKIE CPD Definition<sup>17</sup>

“CPD is the systematic maintenance, improvement and broadening of relevant knowledge and skills, and the development of these qualities necessary for the successful carrying out of professional duties throughout an engineer’s career. In this it is aimed at enhancing individual worth and thus corporate performance.”

CPD is an ongoing necessity in the ever-changing technological world in which we live. Practicing professional engineers should aim to remain competent throughout their working careers so that they can properly carry out their various duties. To this end engineers need to take opportunities to update their depth and breadth of knowledge / expertise and to develop those personal qualities required to fulfil their roles in industry and in society. CPD covers matters of direct technical relevance as well as broader studies also of importance to the HKIE members in the furtherance of their careers such as communication, environmental matters, financial management, leadership skills, legal aspects, marketing, occupational safety and health and professional ethics.

The format of CPD activities can include but not limited to participating and organising of courses, lectures, seminars / symposia, conferences, presentations, workshops, industrial attachment and visits, e-learning and professional activities.

They may be provided by the HKIE divisions, the engineering industry itself, and a variety of other organisations.

The HKIE specifies a minimum formal CPD requirement for those at the pre-Corporate Member stage and its policy is to strongly encourage CPD thereafter. The CPD record will be taken into account when considering any application for Fellowship.

The benefits of CPD are not easily quantifiable but none-the-less real. The HKIE CPD policy is based on the conviction that CPD is of value to its members, to the profession, to industry and to society.

**Role of HKIE**

The HKIE policy recognises that HKIE should act as a CPD coordinator and facilitator in the way to better serve its members. In this:

- To first and foremost find out what kinds of CPD are needed by our members;
- To give a lead in the promotion of CPD;
- To act as a focal point in the collection and dissemination of CPD information; and
- To organise CPD activities such as lectures, seminars and workshops to meet the needs of our members and the society.



# Endnotes

1. Environmental Protection Department, *2013 Hong Kong Emission Inventory Report*, EPD/TR 2/14, June 2015, Hong Kong: HKSAR Government, [http://www.epd.gov.hk/epd/sites/default/files/epd/2013EIReport\\_eng\\_1b.pdf](http://www.epd.gov.hk/epd/sites/default/files/epd/2013EIReport_eng_1b.pdf) (accessed 15 December 2015).
2. Boseley, S., "Air pollution can cause cancer, says World Health Organization", *The Guardian*, 17 October 2013, <http://www.theguardian.com/environment/2013/oct/17/air-pollution-causes-cancer-world-health-organisation-who> (accessed 15 December 2015).
3. Wong, C.M. et al. (2015), "Satellite-Based Estimates of Long-Term Exposure to Fine Particles and Association with Mortality in Elderly Hong Kong Residents", *Environmental Health Perspectives*, <http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2015/4/ehp.1408264.acco.pdf> (accessed 15 December 2015).
4. Tsang, E., "Air pollution in Central and Causeway Bay exceeds WHO levels 280 days in a year", *South China Morning Post*, 30 April 2015, [http://www.scmp.com/news/hong-kong/health-environment/article/1781677/air-pollution-central-and-causeway-bay-exceeds-who?utm\\_source=edm&utm\\_medium=edm&utm\\_content=20150501&utm\\_campaign=scmp\\_today](http://www.scmp.com/news/hong-kong/health-environment/article/1781677/air-pollution-central-and-causeway-bay-exceeds-who?utm_source=edm&utm_medium=edm&utm_content=20150501&utm_campaign=scmp_today) (accessed 15 December 2015).
5. Environment Bureau, *A Clean Air Plan for Hong Kong*, March 2013, Hong Kong: HKSAR Government, [http://www.enb.gov.hk/en/files/New\\_Air\\_Plan\\_en.pdf](http://www.enb.gov.hk/en/files/New_Air_Plan_en.pdf) (accessed 15 December 2015).
6. Environmental Protection Department, "Strengthened Emissions Control for Petrol and LPG Vehicles", 31 July 2015, Hong Kong, [http://www.epd.gov.hk/epd/english/environmentinhk/air/guide\\_ref/remote\\_sensing\\_Petrol\\_n\\_LPG.htm](http://www.epd.gov.hk/epd/english/environmentinhk/air/guide_ref/remote_sensing_Petrol_n_LPG.htm) (accessed 15 December 2015).
7. Fung, F. and Suen, B., *A Review of the Hong Kong Inspection and Maintenance Programme for On-road Vehicles*, August 2013, Civic Exchange, <http://civic-exchange.org/en/publications/164986987> (accessed 15 December 2015).
8. Fung, F. and Suen, B., *Improving Hong Kong's Emission Inspection Programme for On-road Diesel Commercial Vehicles*, September 2014, Civic Exchange, <http://civic-exchange.org/en/publications/4816935> (accessed 15 December 2015).
9. Vocational Training Council, "Corporate Information", [http://www.vtc.edu.hk/html/en/about/corp\\_info.html](http://www.vtc.edu.hk/html/en/about/corp_info.html) (accessed 15 December 2015).
10. Research Office of Legislative Council Secretariat, *Review of development of vocational education in Hong Kong*, IN15/14-15, p.1, 13 August 2015, HKSAR Government, <http://www.legco.gov.hk/research-publications/english/1415in15-review-of-development-of-vocational-education-in-hong-kong-20150813-e.pdf> (accessed 15 December 2015).
11. Vocational Training Council, "Governance Structure – Automobile Training Board – Terms of Reference", [http://www.vtc.edu.hk/html/en/about/train\\_com.html](http://www.vtc.edu.hk/html/en/about/train_com.html) (accessed 15 December 2015).
12. Vocational Training Council, "Governance Structure – Training Boards and General Committees", [http://www.vtc.edu.hk/html/en/about/terms\\_of\\_reference3035.html](http://www.vtc.edu.hk/html/en/about/terms_of_reference3035.html) (accessed 15 December 2015).
13. Society of Automotive Engineers, "SAE Homepage", <http://www.sae.org/> (accessed 15 December 2015).
14. Pro-Act Training and Development Centre (Auto), "About PAAU", <http://www.proact.edu.hk/proact/html/tc/centres-and-programmes/automobile/about/index.html> (accessed 15 December 2015). (Chinese Only)
15. See note 9; Seymour-Hart, I., "Welcome Address", p.11, Department of Automotive Engineering of Hong Kong Institute of Vocational Education, <http://www.slideserve.com/Ava/welcome-address> (accessed 15 December 2015); Pro-Act Training and Development Centre (Automobile), "About Us", [http://paa.vtc.edu.hk/about\\_us.php?lang\\_id=1](http://paa.vtc.edu.hk/about_us.php?lang_id=1) (accessed 15 December 2015); The Hong Kong Institute of Vocational Education, "IVE opens the Jockey Club Heavy Vehicle Emissions Testing and Research Centre", press releases, 5 December 2011, [http://www.vtc.edu.hk/html/en/media/press\\_1094.html](http://www.vtc.edu.hk/html/en/media/press_1094.html) (accessed 15 December 2015).
16. Vocational Training Council, "S3 Full time – Diploma in Vocational Education Programme (Automotive Technology) – Basic Information", <http://www.vtc.edu.hk/admission/en/programme/fs113332-diploma-in-vocational-education-automotive-technology/> (accessed 15 December 2015); Vocational Training Council, "S6 Full time – Diploma of Vocational Education Programme (Automotive Technology) – Basic Information", <http://www.vtc.edu.hk/admission/en/programme/fs113662-diploma-of-vocational-education-automotive-technology/> (accessed 15 December 2015); Vocational Training Council, "Post-S3 Qualifications – Craft Certificate in Automotive Technology – Basic Information", <http://www.vtc.edu.hk/admission/en/programme/fs312931-craft-certificate-in-automotive-technology/> (accessed 15 December 2015); Vocational Training Council, "Post-S3 Qualifications – Craft Certificate in Vehicle Body Repair – Basic Information", <http://www.vtc.edu.hk/admission/en/programme/fs312932-craft-certificate-in-vehicle-body-repair/> (accessed 15 December 2015).

17. Communication with Mr. Ponthey Yip and Mr. Jason Yung of the Pro-Act Training and Development Centre (Automobile) on 8 December 2015.
18. Leung, Y.S., "Introduction to Subject Choices and Multiple Pathways", p.19, 30 April 2010, Vocational Training Council, [http://334.edb.hkedcity.net/doc/eng/20100430/3\\_VTC.pdf](http://334.edb.hkedcity.net/doc/eng/20100430/3_VTC.pdf) (accessed 15 December 2015).
19. Vocational Training Council, "Programmes Offered by Pro-Act Training and Development Centres", pp.300-303, <http://www.vtc.edu.hk/~vtccal/2012-2013calendar/files/pdfs/p300-328.pdf> (accessed 15 December 2015); See note 17.
20. Vocational Training Council, "Higher Diploma in Automotive Engineering – Basic Information", <http://www.vtc.edu.hk/admission/en/programme/eg114705-higher-diploma-in-automotive-engineering/> (accessed 15 December 2015).
21. See Vocational Training Council "S6 Full time – Diploma of Vocational Education Programme (Automotive Technology) – Basic Information" in note 16.
22. See Seymour-Hart, I. in note 15.
23. The Hong Kong Institution of Engineers, "Qualifications & Membership – List of Higher Diploma and Equivalent Programmes Accredited/ Recognised by the HKIE as at 7 October 2015 (Sydney Accord)", 7 October 2015, <https://www.hkie.org.hk/eng/html/qualNmembership/HighDipProg.asp> (accessed 15 December 2015).
24. Vocational Training Council, "S6 Overview: Progression pathways of VTC Programmes for secondary school (S6 or HKDSE) graduates", Hong Kong, <http://www.vtc.edu.hk/studyat/en/s6/s6-overview/> (accessed 15 December 2015); Vocational Training Council, "S3 Overview VTC offers diversified progression pathways for school leavers from Secondary 3 to 5", Hong Kong, <http://www.vtc.edu.hk/studyat/en/s3/s3-overview/> (accessed 15 December 2015); Vocational Training Council, "S3 Progression Ladder and Tuition Fees", <http://www.vtc.edu.hk/admission/en/s3/progression-ladder/> (accessed 15 December 2015); See note 10, p.5.
25. Automotive Industry Training Advisory Committee – Qualifications Framework (QF) Secretariat, "Recognition of Prior Learning (RPL)", 2011, Hong Kong: HKSAR Government, <http://www.hkqf.gov.hk/ind/en/automotive.aspx> (accessed 15 December 2015).
26. Education Bureau, "Major Functional Areas of the Automotive Industry", Hong Kong: HKSAR Government, [http://www.hkqf.gov.hk/guie/SCS\\_list\\_Automotive.asp](http://www.hkqf.gov.hk/guie/SCS_list_Automotive.asp) (accessed 15 December 2015).
27. Education Bureau, "Qualifications Framework – Units of Competencies for the Automotive Industry – 13. Vehicle Servicing and Testing", Hong Kong: HKSAR Government, [http://www.hkqf.gov.hk/guie/SCS\\_tab\\_automotive.asp?A=13#](http://www.hkqf.gov.hk/guie/SCS_tab_automotive.asp?A=13#) (accessed 15 December 2015).
28. Automotive Industry Training Advisory Committee – Qualifications Framework (QF) Secretariat, "QF Implementation", 2011, Hong Kong: HKSAR Government, [http://www.hkqf.gov.hk/ind/en/images/auto/ind\\_info3.png](http://www.hkqf.gov.hk/ind/en/images/auto/ind_info3.png) (accessed 15 December 2015).
29. Chief Executive, *The 2014 Policy Address – Support the Needy, Let Youth Flourish, Unleash Hong Kong's Potential*, 15 January 2015, Hong Kong: HKSAR Government, <http://www.policyaddress.gov.hk/2014/eng/pdf/PA2014.pdf> (accessed 15 December 2015).
30. Vocational Training Council, "VTC Highlights – VTC "Earn & Learn" Pilot Schemes", [http://www.vtc.edu.hk/html/en/about/vtc\\_pilot\\_scheme.html](http://www.vtc.edu.hk/html/en/about/vtc_pilot_scheme.html) (accessed 15 December 2015).
31. Vocational Training Council, "VTC partnership with automobile industry will offer training and funding while increasing recruitment to expanding sector", press releases, 28 November 2014, [http://www.vtc.edu.hk/html/en/about/press\\_3406.html](http://www.vtc.edu.hk/html/en/about/press_3406.html) (accessed 15 December 2015).
32. Education Bureau, "LCQ15: Earn and Learn Pilot Scheme – Annex 2: Numbers of Student Intakes and Drop-outs of Various Programmes under the Earn and Learn Pilot Scheme", press releases, 2 December 2015, [http://gia.info.gov.hk/general/201512/02/P201512020637\\_0637\\_156046.pdf](http://gia.info.gov.hk/general/201512/02/P201512020637_0637_156046.pdf) (accessed 15 December 2015).
33. Li, V., "汽車學徒訓練 車迷變維修專家", *Education Post*, 23 April 2015, <http://www.educationpost.com.hk/resources/vocational/150423-vocational-higher-diploma-in-automotive-engineering> (accessed 15 December 2015). (Chinese only)
34. Education Bureau, New Item "Grant to the Vocational Training Council for implementing the Pilot Training and Support Scheme", FCR(2014-15)4, 2 May 2014, Hong Kong: HKSAR Government, <http://www.legco.gov.hk/yr13-14/english/fc/fc/papers/f14-04e.pdf> (accessed 15 December 2015).
35. See note 34, p.3.
36. Education Bureau, "LCQ13: Vocational education", press releases, 24 June 2015, <http://www.info.gov.hk/gia/general/201506/24/P201506240556.htm> (accessed 15 December 2015).
37. Vocational Training Council, "Student Industrial Attachment Programme", Hong Kong, [http://www.vtc.edu.hk/html/en/partnership/about\\_vtc\\_students.html](http://www.vtc.edu.hk/html/en/partnership/about_vtc_students.html) (accessed 15 December 2015).

38. Education Bureau, "Business-School Partnership Programme – Overview", Hong Kong: HKSAR Government, [http://careerguidance.edb.hkedcity.net/edb/opencms/bspp/aboutus/?\\_\\_locale=en](http://careerguidance.edb.hkedcity.net/edb/opencms/bspp/aboutus/?__locale=en) (accessed 15 December 2015).
39. Education Bureau, "Business-School Partnership Programme – The Kowloon Motor Bus Co. (1933) Ltd.", Hong Kong: HKSAR Government, [http://careerguidance.edb.hkedcity.net/edb/opencms/bspp/partners/kmb/?\\_\\_locale=en](http://careerguidance.edb.hkedcity.net/edb/opencms/bspp/partners/kmb/?__locale=en) (accessed 15 December 2015); Education Bureau, "Business-School Partnership Programme – Visit to Dah Chong Hong Holdings Ltd.", Hong Kong: HKSAR Government, [https://careerguidance.edb.hkedcity.net/edb/opencms/bspp/activities/activity-detail/?\\_\\_locale=en](https://careerguidance.edb.hkedcity.net/edb/opencms/bspp/activities/activity-detail/?__locale=en) (accessed 15 December 2015).
40. Task Force on Promotion of Vocational Education, *Report of the Task Force on Promotion of Vocational Education*, 6 July 2015, Hong Kong: HKSAR Government, [http://www.edb.gov.hk/attachment/en/edu-system/other-edu-training/vocational-other-edu-program/Report%20of%20the%20Task%20Force%20on%20Promotion%20of%20Vocational%20Education%20\(ENG\).pdf](http://www.edb.gov.hk/attachment/en/edu-system/other-edu-training/vocational-other-edu-program/Report%20of%20the%20Task%20Force%20on%20Promotion%20of%20Vocational%20Education%20(ENG).pdf) (accessed 15 December 2015).
41. Education Bureau, "Applied Learning – Course Information", 10 November 2015, Hong Kong: HKSAR Government, <http://www.edb.gov.hk/en/curriculum-development/cross-kla-studies/applied-learning/course-information/index.html> (accessed 15 December 2015).
42. The Hong Kong Examinations and Assessment Authority, "2014 HKDSE Entry statistics", p.22, [http://www.hkeaa.edu.hk/DocLibrary/HKDSE/Exam\\_Report/Examination\\_Statistics/dseexamstat14\\_2.pdf](http://www.hkeaa.edu.hk/DocLibrary/HKDSE/Exam_Report/Examination_Statistics/dseexamstat14_2.pdf) (accessed 15 December 2015).
43. Education Bureau, "Applied Learning (Senior Secondary Level) 2016-18 Cohort – Automotive Technology", October 2015, Hong Kong: HKSAR Government, [http://www.edb.gov.hk/attachment/en/curriculum-development/cross-kla-studies/applied-learning/course-information/2016-2018/15a\\_Automotive\(16-18\)\\_e.pdf](http://www.edb.gov.hk/attachment/en/curriculum-development/cross-kla-studies/applied-learning/course-information/2016-2018/15a_Automotive(16-18)_e.pdf) (accessed 15 December 2015).
44. Khan, D.S. (2012), "Assessing and evaluating continuing professional development", *International Journal of English and Literature*, Vol.4, No.4, pp.184-185, [http://www.academicjournals.org/article/article1379606968\\_Khan.pdf](http://www.academicjournals.org/article/article1379606968_Khan.pdf) (accessed 15 December 2015).
45. Legislation Council Panel on Transport, *Proposed Registration Scheme for the Vehicle Maintenance Trade*, CB(1)1605/04-05(04), 27 May 2005, Hong Kong: HKSAR Government, <http://www.legco.gov.hk/yr04-05/english/panels/tp/papers/tp0527cb1-1605-4e.pdf> (accessed 15 December 2015).
46. Electrical and Mechanical Services Department, *Voluntary Registration Scheme for Vehicle Mechanics – Continuing Professional Development (CPD)*, August 2013, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_648/CPD\\_Options.pdf](http://www.emsd.gov.hk/filemanager/en/content_648/CPD_Options.pdf) (accessed 15 December 2015).
47. Environment Bureau, "LCQ21: Reduction of vehicle emissions as well as training for and shortage of vehicle mechanics", press releases, 25 March 2015, <http://www.info.gov.hk/gia/general/201503/25/P201503250439.htm> (accessed 15 December 2015).
48. See note 17.
49. Pro-Act Training and Development Centre (Automobile), "Hong Kong Automotive Information Centre – Member Enrollment Form", October 2015, [http://paau.vtc.edu.hk/u\\_file/attachments/5636c72104a8b.pdf](http://paau.vtc.edu.hk/u_file/attachments/5636c72104a8b.pdf) (accessed 15 December 2015).
50. Pro-Act Training and Development Centre (Automobile), "PAAU 卓越培訓發展中心 (汽車業)", Hong Kong, <https://www.facebook.com/vtc.paau/> (accessed 15 December 2015).
51. See note 17.
52. Employees Retraining Board, "Overview", [http://www.erb.org/erb/about\\_us/overview/en/](http://www.erb.org/erb/about_us/overview/en/) (accessed 15 December 2015).
53. Employees Retraining Board, "Industry Overview and ERB Course Roadmaps Leaflets – Transportation & Support Services", April 2015, [https://www.erb.org/authorsmith/documents/industry\\_overview/roadmap/transport.pdf](https://www.erb.org/authorsmith/documents/industry_overview/roadmap/transport.pdf) (accessed 15 December 2015). (Chinese only)
54. The Hong Kong Institution of Engineers, "Vision, Mission and Core Values", <http://www.hkie.org.hk/eng/html/AboutTheHKIE/VisionNMission.asp> (accessed 15 December 2015).
55. The Hong Kong Institution of Engineers, "Continuing Professional Development – Course Providers", 14 July 2015, Hong Kong, <https://www.hkie.org.hk/eng/html/cpd/courseproviders.asp> (accessed 15 December 2015).
56. The Hong Kong Institution of Engineers, "Continuing Professional Development – Introduction", Hong Kong, <https://www.hkie.org.hk/eng/html/cpd/introduction.asp> (accessed 15 December 2015).
57. Siu, M. and Lee, P., "Technical seminar on alternative route of the HKIE – how Associate Members become Corporate Members", Hong Kong Engineer, 11 March 2013, <http://www.hkengineer.org.hk/program/home/article.php?aid=7096&void=155> (accessed 15 December 2015).

58. Electrical and Mechanical Services Department, *RVM Newsletter*, No.9, p.12, July 2014, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_654/RVM\\_news-09.pdf](http://www.emsd.gov.hk/filemanager/en/content_654/RVM_news-09.pdf) (accessed 15 December 2015).
59. Electrical and Mechanical Services Department, *Poster for the Registered Vehicle Mechanic's Stamp*, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_648/rvm\\_stamp\\_poster.pdf](http://www.emsd.gov.hk/filemanager/en/content_648/rvm_stamp_poster.pdf) (accessed 15 December 2015).
60. Electrical and Mechanical Services Department, *Performance Monitoring Points System*, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_648/Link\\_F2.pdf](http://www.emsd.gov.hk/filemanager/en/content_648/Link_F2.pdf) (accessed 15 December 2015).
61. Mercado Solutions Associates, *Opinion Survey on the Proposed Registration Scheme for the Vehicle Maintenance Trade*, April 2005, [http://www.emsd.gov.hk/filemanager/en/content\\_598/emsd\\_survey\\_final\\_report\\_eng.pdf](http://www.emsd.gov.hk/filemanager/en/content_598/emsd_survey_final_report_eng.pdf) (accessed 15 December 2015).
62. See note 58, p.5.
63. Electrical and Mechanical Services Department, "Registration Scheme for Vehicle Maintenance: Voluntary Registration Scheme for Vehicle Mechanics", 1 September 2015, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/en/supporting\\_government\\_initiatives/registration\\_scheme\\_for\\_vehicle\\_maintenance/voluntary\\_for\\_vehicle\\_mechanics/index.html](http://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/voluntary_for_vehicle_mechanics/index.html) (accessed 15 December 2015).
64. Electrical and Mechanical Services Department, *RVM Newsletter*, No.10, p.3, October 2014, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/tc/content\\_654/RVM\\_news-10.pdf](http://www.emsd.gov.hk/filemanager/tc/content_654/RVM_news-10.pdf) (accessed 15 December 2015) (Chinese only); Legislation Council Panel on Transport, *Regulation of workshops carrying out repair and maintenance of vehicles*, CB(4)1344/14-15(01), p.3, 22 July 2015, Hong Kong: HKSAR Government, <http://www.legco.gov.hk/yr14-15/english/panels/tp/papers/tp20150722cb4-1344-1-e.pdf> (accessed 15 December 2015).
65. Electrical and Mechanical Services Department, "RVM Newsletter", Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/en/supporting\\_government\\_initiatives/registration\\_scheme\\_for\\_vehicle\\_maintenance/publications\\_and\\_circulars/rvm\\_newsletter/](http://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/publications_and_circulars/rvm_newsletter/) (accessed 15 December 2015).
66. Electrical and Mechanical Services Department, "Registered Vehicle Mechanic – How to apply", February 2015, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_648/How\\_to\\_Apply.pdf](http://www.emsd.gov.hk/filemanager/en/content_648/How_to_Apply.pdf) (accessed 15 December 2015).
67. Transport and Housing Bureau, *Replies to initial written questions raised by Finance Committee Members in examining the Estimates of Expenditure 2015-16*, THB(T)022 (a), 1 April 2015, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_1060/THB\(T\)0579-022.pdf](http://www.emsd.gov.hk/filemanager/en/content_1060/THB(T)0579-022.pdf) (accessed 15 December 2015).
68. See note 58, p.2.
69. Vehicle Maintenance Technical Advisory Committee, *Practice Guidelines for Vehicle Maintenance Workshops*, February 2015, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_651/vmrs\\_prctc\\_gdlns.pdf](http://www.emsd.gov.hk/filemanager/en/content_651/vmrs_prctc_gdlns.pdf) (accessed 15 December 2015). (Chinese only)
70. Electrical and Mechanical Services Department, "Vehicle Maintenance Workshops Charter Subscriber List A", 1 September 2015, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_651/CharterWorkshopA.pdf](http://www.emsd.gov.hk/filemanager/en/content_651/CharterWorkshopA.pdf) (accessed 15 December 2015).
71. Electrical and Mechanical Services Department, *RVM Newsletter*, No.12, p.5, April 2015, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/tc/content\\_654/RVM\\_news-12.pdf](http://www.emsd.gov.hk/filemanager/tc/content_654/RVM_news-12.pdf) (accessed 15 December 2015) (Chinese only); See Legislation Council Panel on Transport (2015) in note 64, p.4.
72. Electrical and Mechanical Services Department, "Registration Scheme for Vehicle Maintenance: Voluntary Registration Scheme for Vehicle Maintenance Workshops", 1 September 2015, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/en/supporting\\_government\\_initiatives/registration\\_scheme\\_for\\_vehicle\\_maintenance/voluntary\\_for\\_vehicle\\_maintenance\\_workshops/index.html](http://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/voluntary_for_vehicle_maintenance_workshops/index.html) (accessed 15 December 2015).
73. Transport and Housing Bureau, "LCQ17: Regulating vehicle maintenance workshops", press releases, 25 November 2015, <http://www.info.gov.hk/gia/general/201511/25/P201511250368.htm> (accessed 15 December 2015).
74. See Legislation Council Panel on Transport (2015) in note 64, Annex G, pp.1-2.
75. Automobile Training Board of Vocational Training Council, "Publications – Manpower Surveys and Information", [http://www.vtc.edu.hk/html/en/about/manpower\\_publications3035.html](http://www.vtc.edu.hk/html/en/about/manpower_publications3035.html) (accessed 15 December 2015).
76. Automobile Training Board of Vocational Training Council, *2014 Manpower Survey Report – Automobile Industry*, pp.9-10, [http://www.vtc.edu.hk/uploads/files/publications/automobile\\_training\\_board/en/2014%20AU%20MPS%20\(full%20version\)%20-%202%20Feb%202015.pdf](http://www.vtc.edu.hk/uploads/files/publications/automobile_training_board/en/2014%20AU%20MPS%20(full%20version)%20-%202%20Feb%202015.pdf) (accessed 15 December 2015).

77. See note 76, p.106.
78. Transport Advisory Committee, *Report on Study of Road Traffic Congestion in Hong Kong*, December 2014, Hong Kong: HKSAR Government, [http://www.thb.gov.hk/eng/boards/transport/land/Full\\_Eng\\_C\\_cover.pdf](http://www.thb.gov.hk/eng/boards/transport/land/Full_Eng_C_cover.pdf) (accessed 15 December 2015).
79. See note 76, p.106.
80. See note 40, p.4.
81. See note 10, p.2.
82. See note 40, p.85.
83. See note 32.
84. Automotive Industry Training Advisory Committee – Qualifications Framework (QF) Secretariat, “Progression pathways of Vehicle Servicing and Testing”, 2011, Hong Kong: HKSAR Government, <http://www.hkqf.gov.hk/ind/en/images/Auto/Post3.png> (accessed 15 December 2015).
85. “環保署廢氣測試標準少人知 車主呻被玩”, *Oriental Daily*, 19 March 2015, [http://hk.on.cc/hk/bkn/cnt/news/20150319/bkn-20150319193932753-0319\\_00822\\_001.html](http://hk.on.cc/hk/bkn/cnt/news/20150319/bkn-20150319193932753-0319_00822_001.html) (accessed 15 December 2015). (Chinese only)
86. The Ombudsman Hong Kong, “The Ombudsman probes Government’s implementation of strengthened control of exhaust emissions from petrol and LPG vehicles”, press release, 14 April 2015, Hong Kong: HKSAR Government, [http://ofomb.ombudsman.hk/abc/files/DI-376-English\\_Press\\_Release\\_Final.pdf](http://ofomb.ombudsman.hk/abc/files/DI-376-English_Press_Release_Final.pdf) (accessed 15 December 2015).
87. See note 46.
88. Hong Kong Vehicle Repairing Industry Employee General Union, “香港區地區工作坊 – 大埔大尾篤燒烤”, <http://www.vrunion.hk/wps/?p=886> (accessed 15 December 2015) (Chinese only); Hong Kong Vehicle Repair Merchants Association Limited, “2015 香港汽車修理同業商會盃小型賽車比賽同樂日”, [http://www.hkvrma.com.hk/index.php?option=com\\_content&view=article&id=195:2015-&catid=5:2013-07-24-08-07-19&Itemid=48](http://www.hkvrma.com.hk/index.php?option=com_content&view=article&id=195:2015-&catid=5:2013-07-24-08-07-19&Itemid=48) (accessed 15 December 2015). (Chinese only)
89. Motor Industry Training Organisation, “About MITO”, <https://mito.org.nz/about> (accessed 15 December 2015).
90. New Zealand Qualifications Authority, “About us”, <http://www.nzqa.govt.nz/> (accessed 15 December 2015).
91. Motor Industry Training Organisation, “Targeted Review of Qualifications”, <https://mito.org.nz/about/targeted-review-of-qualifications-troq> (accessed 15 December 2015).
92. Sondermann, T. (2005), “The German Vocational Training Reform Act of 2005: What is new, what is different?”, *Vocational Training in Research and Practice (BWP)*, Special Edition 2005, pp.18-21, [https://www.bibb.de/dokumente/pdf/a1\\_bwp\\_special-edition\\_sondermann\(1\).pdf](https://www.bibb.de/dokumente/pdf/a1_bwp_special-edition_sondermann(1).pdf) (accessed 15 December 2015); Federal Ministry of Education and Research, *Germany’s Vocational Education at a glance*, p.23, 2003, Germany, <http://www.sequa.de/uploads/files/EN-Germanys-Vocational-Education-ataglance-BMBF-2003.pdf> (accessed 15 December 2015).
93. European Centre for the Development of Vocational Training (Cedefop), *spotlight on VET GERMANY 2013/14*, p.2, 21 November 2014, European Union, [http://www.cedefop.europa.eu/files/8057\\_en.pdf](http://www.cedefop.europa.eu/files/8057_en.pdf) (accessed 15 December 2015).
94. See note 93, p.4.
95. See Federal Ministry of Education and Research (2003) in note 92, p.24.
96. Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK), “Organization and Proceedings”, European Union: Germany, <http://www.kmk.org/information-in-english/standing-conference-of-the-ministers-of-education-and-cultural-affairs-of-the-laender-in-the-federal-republic-of-germany/organization-and-proceedings.html> (accessed 15 December 2015).
97. Federal Institute for Vocational Education and Training, *VET Data Report Germany 2014*, 9 September 2015, Germany, <https://www.bibb.de/veroeffentlichungen/en/publication/download/id/7722> (accessed 15 December 2015).
98. Research Office of Legislative Council Secretariat, *Vocational education and training in Germany*, p.1, IN11/14-15, 26 May 2015, Hong Kong: HKSAR Government, <http://www.legco.gov.hk/research-publications/english/1415in11-vocational-education-and-training-in-germany-20150526-e.pdf> (accessed 15 December 2015).
99. Jacoby, T., “Why Germany is so much better at training its workers”, *The Atlantic*, 16 October 2014, <http://www.theatlantic.com/business/archive/2014/10/why-germany-is-so-much-better-at-training-its-workers/381550/> (accessed 15 December 2015).

100. German Office for International Cooperation in Vocational Education and Training, "Data Sheet – Dual VET in Germany", Germany, [https://www.bibb.de/dokumente/pdf/Datenblatt\\_Berufsbildung\\_-\\_GOVET\\_-\\_EN\(3\).pdf](https://www.bibb.de/dokumente/pdf/Datenblatt_Berufsbildung_-_GOVET_-_EN(3).pdf) (accessed 15 December 2015); German Office for International Cooperation in Vocational Education and Training, "Dual VET – Vocational Education and Training in Germany", November 2014, Germany, [http://www.bibb.de/dokumente/ppt/GOVET\\_Praesentation\\_November\\_2014\\_EN.pptx](http://www.bibb.de/dokumente/ppt/GOVET_Praesentation_November_2014_EN.pptx) (accessed 15 December 2015).
101. See note 93, p.3.
102. See note 93, p.2.
103. See note 98, p.2.
104. See note 93, p.3.
105. Education Bureau, "Applied Learning – Quality Assurance and Articulation", 3 December 2015, Hong Kong: HKSAR Government, <http://www.edb.gov.hk/en/curriculum-development/cross-kla-studies/applied-learning/quality-assurance-and-articulation.html> (accessed 15 December 2015).
106. "Budget 2015: George Osborne's speech in full", *Independent*, 8 July 2015, <http://www.independent.co.uk/news/uk/politics/budget-2015-uk-emergency-live-george-osbornes-speech-in-full-10375825.html> (accessed 15 December 2015).
107. Sole, B., "NZ needs more apprentices", *NZ Herald*, 11 July 2015, [http://www.nzherald.co.nz/education/news/article.cfm?c\\_id=35&objectid=11478970](http://www.nzherald.co.nz/education/news/article.cfm?c_id=35&objectid=11478970) (accessed 15 December 2015).
108. eub2, "Revised EU competition rules for the motor vehicle sector – briefing", *EUbusiness*, 27 May 2010, <http://www.eubusiness.com/topics/competition/car-parts.04/> (accessed 15 December 2015).
109. Automobile Training Board of Vocational Training Council, "Automobile Training Board – Terms of Reference", [http://www.vtc.edu.hk/html/en/about/terms\\_of\\_reference3035.html](http://www.vtc.edu.hk/html/en/about/terms_of_reference3035.html) (accessed 15 December 2015).
110. Automotive Industry Training Advisory Committee – Qualifications Framework (QF) Secretariat, "Industry Training Advisory Committee (ITAC)", 2011, Hong Kong: HKSAR Government, <http://www.hkqf.gov.hk/ind/en/automotive.aspx> (accessed 15 December 2015).
111. Electrical and Mechanical Services Department, "車輛維修技術諮詢委員會", May 2014, Hong Kong: HKSAR Government, [http://www.emsd.gov.hk/filemanager/en/content\\_598/VTAC\\_ToR\\_and\\_Membership.pdf](http://www.emsd.gov.hk/filemanager/en/content_598/VTAC_ToR_and_Membership.pdf) (accessed 15 December 2015). (Chinese only)
112. Seymour-Hart, I., Hong Kong: Vehicle Related Air Pollution: In Support of Action Blue Sky - A set of measures aimed at alleviating air pollution caused by road vehicles, October 2007, [http://www.hongkongcan.org/doclib/200610\\_HongKong\\_VehicleRelatedAirPollutionInSupportofActionBlueSky.pdf](http://www.hongkongcan.org/doclib/200610_HongKong_VehicleRelatedAirPollutionInSupportofActionBlueSky.pdf) (accessed 15 December 2015).
113. Lucas Nuelle, "Corporate Webpage", <http://www.lucas-nuelle.com/> (accessed 15 December 2015).
114. See the Hong Kong Institute of Vocational Education (2011) note 15.
115. Vocational Training Council, "Higher Diploma in Automotive Engineering – Curriculum", <http://www.vtc.edu.hk/admission/en/programme/eg114705-higher-diploma-in-automotive-engineering/curriculum/> (accessed 15 December 2015).
116. Pro-Act Training and Development Centre (Automobile), "2015/2016年度課程", Hong Kong, <http://www.proact.edu.hk/proact/download/application/Automobile.pdf> (accessed 15 December 2015). (Chinese only)
117. See note 56.

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