Overview of Driving Automation

Contents

2-3. Overview of Driving Automation

According to the Society of Automotive Engineers (SAE), driving automation is classified into six levels, i.e. L0-L5, based on the level of vehicle intelligence:

- Level 0 (No Driving Automation): The driver fully drives the vehicle.
- Level 1 (Driving Automation Assistance): The assistance system can perform a function of either acceleration, slowing down, or controlling the steering wheel based on specific environment. In other circumstances, the driver controls the vehicle.
- Level 2 (Partial Driving Automation): The assistance system can perform multiple functions such as acceleration, slowing down, and controlling the steering wheel based on specific environment. In other circumstances, the driver controls the vehicle.
- Level 3 (Conditional Driving Automation): The driving automation system performs all driving operations. The driver responds to system requests and makes relevant decisions.
- Level 4 (High Driving Automation): The driving automation system performs all driving operations. The driver may not need to respond to system requests in specific scenarios.
- Level 5 (Full Driving Automation): The driving automation system performs all driving operations. The driver may not need to respond to system requests in any scenario.

Structure of a driving automation system includes level of environmental awareness, level of decision planning, level of control and level of execution.

- Level of environmental awareness uses sensors with light detection and ranging (LiDAR) technology, mm Wave radar technology, ultrasonic radar technology, in-vehicle cameras, night vision system, Global Positioning System, gyroscope, etc., to obtain the environmental information of the vehicle and its operation information such as carriageway detection, traffic light identification, traffic sign identification, pedestrian detection, vehicle detection, obstacle identification, vehicle positioning, etc.
- Level of decision planning includes task planning, action planning and route planning. It conducts planning on the next specific driving task (e.g. stay in the same lane, change to another lane, follow a vehicle, overtake, avoid collision, etc.), action (accelerate, slow down, make a turn, brake, etc.) and route (driving route) based on the configured route, the environment, vehicle conditions, etc.
- Level of control and level of execution perform action control such as driving the vehicle, braking, steering, etc., based on vehicle dynamic system model, so that the vehicle follows the configured route.

As the new trend of vehicle development, driving automation technology involves technologies from various fields, including artificial intelligence (AI), high-performance chips, communication technology, sensor technology, vehicle control technology, big data technology, etc. Transport infrastructures in compliance with the requirements of driving automation technology are necessary for the implementation of driving automation technology. We also have to take into consideration the statutory requirements for driving automation.

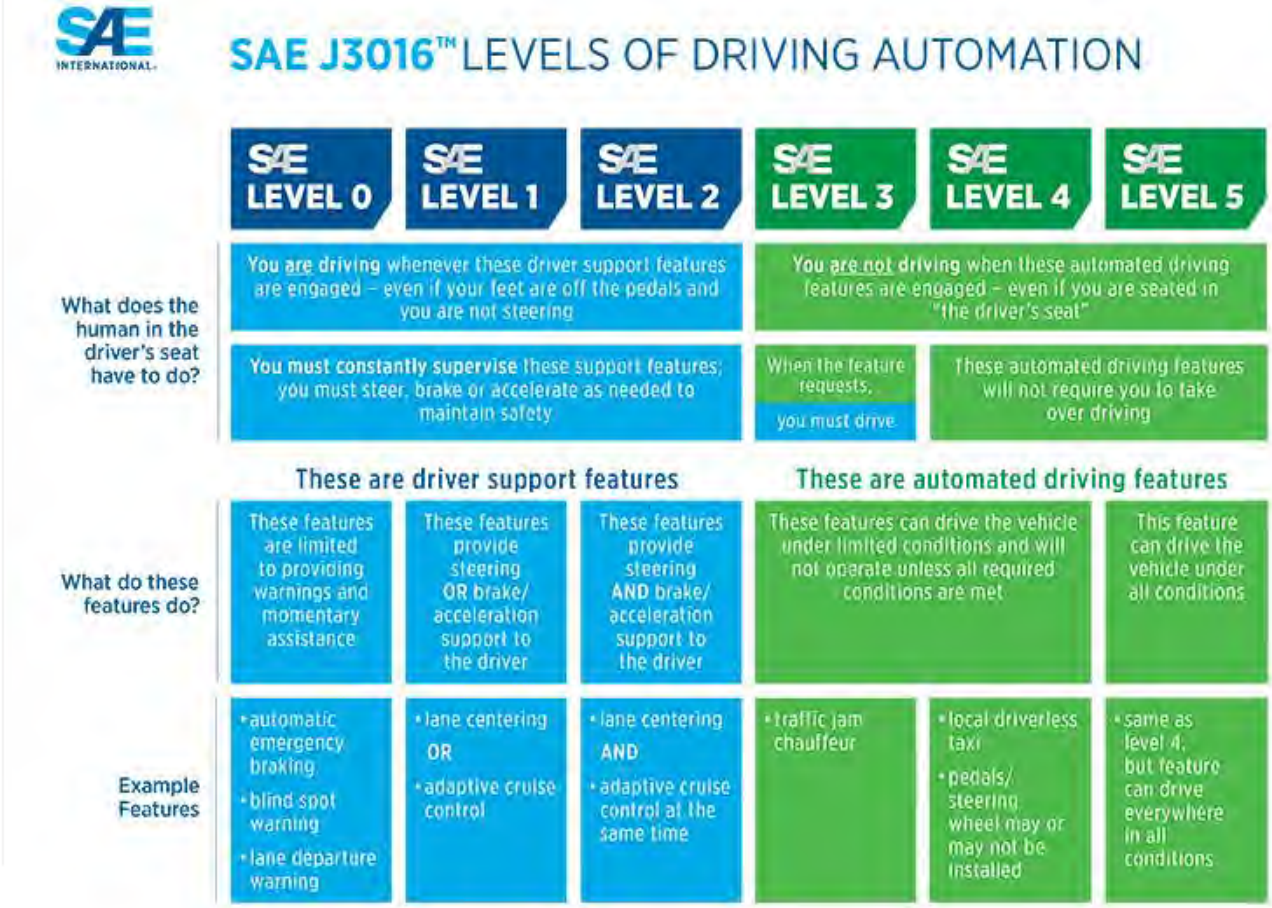
As regards the development of driving automation, the Automotive Platforms and Application Systems R&D Centre under the Hong Kong Productivity Council adopted the drive-by-wire vehicle developed by Streetdrone, a UK company, and used Autoware, an open-source software on driving automation, as the foundation for development. The driving automation development platform is equipped with drive-by-wire system, AI platform, eight high-resolution cameras and 3D LiDAR technology. China Mobile installed on the development platform 5G receivers, so as to enable remote driving automation with 5G signal. The development platform also provides multiple back-up operating system to ensure safety of driving automation. Drivers can control the vehicle in any circumstances. The driving automation development platform can be applied to:

- Autonomous taxi, bus and towing vehicle
- Low-latency remote driving control and traffic management
- Other indoor autonomous vehicles

As regards the application of smart driving technology, the Automotive Platforms and Application Systems R&D Centre has developed a smart remote automated parking system performing fully automated parking from the entrance of a car park to the parking space without driver's interference. The features of the automated parking system are as follows:

- Perform various functions with precision, such as setting up of maps, vehicle positioning, identification of marking lines in parking space and monitoring of obstacles near the vehicle with multi-sensor integration technology (3D LiDAR, visual, ultrasonic radar, etc.);
- Perform route planning from the entrance of a car park to the parking space with advanced control algorithm; and
- Control the route set up by the driving, braking and steering system with precision, perform tracking and fully automated parking, and automatically give way to other vehicles and pedestrians.

The automated parking system also helps overcome difficulties of parking at a small parking space in car parks of residential buildings or commercial car parks.



Hong Kong Productivity Council

4-6. On-board Diagnostics

On-board diagnostics (OBD) is a diagnostic system installed on vehicles to monitor the operating system of vehicle engines and other electronic components in operation, report abnormalities and generate trouble codes and warning signals to remind vehicle owners and maintenance staff to conduct diagnostics and maintenance as appropriate when faults occur in any sub-system of the vehicles.

Early OBD systems could only notify users of any faults with signaling lights. With the advancement of computer technology, OBD systems nowadays can report various types of real-time data and standardised diagnostic trouble codes, leading to drastic changes in the diagnostics and maintenance of malfunctioned vehicles.

OBD system was first developed in the 80s in the US. Driven by the abnormal values commonly recorded by the oxygen sensor of the air-fuel mix ratio control system installed on the vehicle when emission level was higher than the normal value, engineers developed a system devised to monitor various emission-control components, thereby identifying problematic vehicles with emission level exceeding the pollutant standards.

As required by the US Administration, all vehicles manufactured in the US have to be equipped with the second-generation OBD system, making the US the earliest nation to set up statutory requirements of OBD system for vehicles. According to the European vehicle emission standards set by the European Union (EU), all petrol vehicles have been required to be equipped with a European On-board Diagnostics (EOBD) system since 2001. In 2003, EOBD system became a statutory requirement for diesel vehicles in the EU.

The HKSAR Government adopted the European emission standards to regulate the emission of new vehicles in recent years. As a result, the EOBD system became more popular along with the introduction of EU vehicles.

EOBD System

Since 1 January 2001, the EU has required all first registered vehicles of M1 category used for the carriage of persons (with no more than eight passenger seats and a gross vehicle weight of no more than 2500 kg), i.e. vehicles with petrol engine in EU member states, to be equipped with the EOBD system, which is equivalent to fulfilling the requirement of the second-generation OBD system in the EU. Newly registered vehicles with diesel engine in EU member states have been required to be equipped with the OBD system since 1 January 2004.

For new car models, the regulation came into force one year earlier than the above dates, i.e. 1 January 2000 for petrol vehicles and 1 January 2003 for diesel vehicles.

For vehicles used for the carriage of persons with rated gross vehicle weight exceeding 2500 kg and light commercial vehicles, the effective dates of the requirement for petrol vehicles and diesel vehicles were 1 January 2002 and 1 January 2007 respectively.

The technologies commonly used in the EOBD system are similar to those used in the second-generation OBD system, both of which used the same SAE J1962 diagnostic connector and signaling protocol.

According to the emission standards of Euro V and Euro VI, the EOBD set lower limits of emission levels compared to those of Euro III and Euro IV.

Trouble Codes of EOBD System

Maintenance staff may use scanners to read the trouble codes to identify mechanical failures of various types of vehicles, so as to perform proper maintenance. The trouble codes consist of five characters. The first character is a letter, while the remaining characters are numbers. The letter represents the enquiry system used. For example, "Pxxxx" refers to the powertrain system. If the standards are met, the following character would be "0". Therefore, a trouble code should read like "P0xxx". The next following character refers to the sub-system.

- P00xx-Fuel and Air Metering and Auxiliary Emission Controls
- P01xx- Fuel and Air Metering
- P02xx- Fuel and Air Metering (Injector Circuit)
- P03xx- Ignition System or Misfire
- P04xx- Auxiliary Emissions Controls
- P05xx- Vehicle Speed Controls and Idle Control System
- P06xx-Computer Output Circuit
- P07xx-Transmission
- P08xx-Transmission

The following two characters refer to the individual faults in each sub-system.

There are also trouble codes that begin with "B", "C", and "U":

- B- Body Code (includes air conditioning and airbag) (1164 codes)
- C- Chassis Code (includes ABS) (486 codes)
- P- Powertrain Code (engine and transmission) (1688 codes)
- U- Network Code (wiring bus) (299 codes)

OBD Trip Data Recorder

The electronic systems on vehicles are more complicated nowadays. Apart from traditional engine power system, there are new electronic transmission system, anti-skid braking system, emission monitoring system, assisted driving system, multimedia dashboard message system, etc. For instance, electronic control unit uses the latest technology to record a series of driving-related data of the vehicle or individual system. This function is called trip data recorder.

Operators may use the OBD tools to retrieve driving data from the diagnostic interface.

The processed data can also be accessed and analysed with a regular computer, which will greatly reduce the time needed for diagnostics, in particular in handling mechanical issues that occur from time to time.

To learn more about the latest vehicle inspection technology, please contact our secretariat. We will organise various vehicle inspection courses of diverse content for our members, covering basic operation theories of different vehicle systems and complex analysis of maintenance data, so as to enhance the competitiveness of trade members. For enquiries, please contact our secretariat (email: info@hkcvma.org), or Mr LAU (tel.: 9020 3083).

Inspection port of the OBD system

Scanner of the OBD system

Professional data analysis of the OBD system

MA Sing-wai and LAU Kam-wa

Vice Presidents of the Hong Kong Commercial Vehicle Maintenance Association

7-8. Latest Updates of Vehicle Maintenance Registration Unit

Award Presentation Ceremony of the Voluntary Registration Scheme for Vehicle Maintenance Poster Design Competition

The award presentation ceremony of the Voluntary Registration Scheme for Vehicle Maintenance Poster Design Competition was held online via ZOOM on the afternoon of 26 August 2020. Director of Electrical and Mechanical Services, Mr PANG Yiu-hung, attended the ceremony as the Guest of Honour. President of the Subcommittee on Management and Review under the Vehicle Maintenance Technical Advisory Committee, Ir TANG Wing-hong, Madison, and members of the judging panel, Mr YIP Sui-pong, Mr YEUNG Ka-wo and Mr LEE Hong-yip, also attended the ceremony.

The Voluntary Registration Scheme for Vehicle Maintenance Poster Design Competition aimed to enhance public understanding of the Voluntary Registration Scheme for Vehicle Mechanics and the Voluntary Registration Scheme for Vehicle Maintenance Workshops as well as promoting the quality services of registered vehicle maintenance workshops and mechanics. There is one champion and two runners-up in the competition. The brief introduction of the winning entries are as follows:

Champion: If you want to repair your beloved vehicle, learn about the Voluntary Registration Scheme for Vehicle Mechanics launched by the EMSD! Registered vehicle mechanics would be issued a recognised registration card, which certifies the mechanics' qualifications and skills. Skillful and capable, the all-round registered vehicle mechanics would be able to provide reliable and professional services to vehicle owners. Looking forward, we hope to enhance the professional image of vehicle mechanics through this scheme, thereby achieving the promotional target of "be a multi-skilled vehicle mechanic, get registered".

1st runner-up: An important component in our daily life, vehicles allow us to travel with ease. Proper maintenance for vehicles could enhance our personal safety. How do we know if the maintenance service is up to standard? Worry not! Vehicle mechanics holding a Registration Card for Vehicle Mechanic issued by the EMSD are participants of the Voluntary Registration Scheme for Vehicle Mechanics. Skilled in vehicle maintenance, they would be able to provide quality and efficient maintenance services to vehicle owners. Look for the registration card and rest assured that a registered vehicle mechanic will provide you with the services you need.

2nd runner-up: The poster depicts a number of vehicle mechanics working on the maintenance of a vehicle, each demonstrating specific maintenance skills. Looking closer, you will identify four categories of services in vehicle maintenance. To certify your professional skills as a vehicle mechanic, apply for registration for any of the categories at the EMSD website shown at the bottom of the poster.

Champion: Mr LEUNG Chung-ho
1st runner-up: Ms CHEUNG Cho-sha
2nd runner-up: Ms LEUNG Ka-pi

9. Voluntary Registration Scheme for Vehicle Maintenance Promotional Video Competition

Competition Content

Participants are required to produce a creative and compelling video (no longer than one minute) to introduce and promote the Voluntary Registration Scheme for Vehicle Mechanics or the Voluntary Registration Scheme for Vehicle Maintenance Workshops. The video may introduce the two Schemes, their objectives and the benefits to the trade and the public. Slogan(s), chant(s) or song(s) may also be added to the video to further deliver the message.

Eligibility

Participants must be Hong Kong permanent residents and may enter the competition as an individual or a team of two to five members. Each participant or team can submit only one entry. Participants who submit multiple or incomplete entries will be disqualified, and all of their other submissions will be rendered void.

Prizes

There will be a champion, a 1st runner-up, and a 2nd runner-up in each category (open category, universities and tertiary institutions category, secondary school category and primary school category), and a Most Supportive School Award.

Open category	Champion: cash coupons of HK$5,000 1st runner-up: cash coupons of HK$3,500 2nd runner-up: cash coupons of HK$1,500
Universities and tertiary institutions category	Champion: cash coupons of HK$4,000 1st runner-up: cash coupons of HK$2,500 2nd runner-up: cash coupons of HK$1,000
Secondary school category	Champion: book coupons of HK$3,000 1st runner-up: book coupons of HK$2,000 2nd runner-up: book coupons of HK$1,000
Primary school category	Champion: book coupons of HK$3,000 1st runner-up: book coupons of HK$2,000 2nd runner-up: book coupons of HK$1,000
Most Supportive School Award	Book coupons of HK$2,500 and a trophy

✻ Each winner will be awarded a merit certificate

Details and Submission of Entries

Please refer to:
https://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/index.html

✻ Results will be announced on the EMSD website in June 2021.

✻ Participants who, upon submission of entries, upload the submitted video on their personal social media platforms (e.g. Facebook, Instagram, etc.) may make an appointment with the VMRU of the EMSD at 2808 3545 to redeem a souvenir during office hours (from 9:00 am to 4:30 pm on Mondays to Fridays, except public holidays) on or before 31 May 2021. Participants will be required to present the information on their personal social media platforms for confirmation.

Submission Deadline

30 April 2021 (Friday)

10. Latest Developments of the Registration Schemes

1. Registered vehicle mechanics who have switched to work in another vehicle maintenance workshop should notify the VMRU by e-mail (vmru@emsd.gov.hk) or fax (3968 7646) the name, address and telephone number of the new workshop.

2. If there is any change in the information of the vehicle maintenance workshop (such as name of the workshop, registration number of the workshop, address, contact number and business registration certificate, etc.) or alteration in the type of workshop being registered, the person-in-charge of the workshop must, within 14 working days from such change, notify the VMRU of the change in writing, and submit the relevant documents for processing.

Information on the Voluntary Registration Scheme for Vehicle Mechanics:	
Total number of vehicle mechanics	10 303 Note 1
Number of registered vehicle mechanics (as at end-October 2020)	8 223
Information on the Voluntary Registration Scheme for Vehicle Maintenance Workshops:	
Total number of vehicle maintenance workshops	2 783 Note 2
Number of registered workshops (as at end- October 2020)	2 053

Note 1: 2019 Manpower Survey Report (updated on 13 January 2020) by the VTC and the Automobile Training Board.
Note 2: Database of the VMRU (updated in July 2019)

If you wish to help protect our environment by receiving the electronic version of RVM Newsletters and leaflets, please send us the completed reply slip by e-mail: vmru@emsd.gov.hk or WhatsApp: 9016 3185. We will contact you by means of e-mail or mobile communication as far as possible.

Reply Slip

I/My company would like to receive the RVM Newsletters and other information leaflets by

□ e-mail / □ WhatsApp.

Please provide the relevant contact details based on the above selected means of communication:

E-mail address: _____ WhatsApp: _____

The electronic version of is also available at the EMSD website:

https://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/publications_and_circulars/rvm_newsletter/index.html

Online Continuing Education

To further promote online self-learning, the VMRU has released **(two sets of)** new online reading materials, so as to enable participants to continue their self-learning easily at home given the volatility of the epidemic. Participants who answer 5 questions correctly will earn one hour of continuing professional development (CPD). Participants answering all questions correctly will earn two CPD hours. Vehicle mechanics who have not registered or whose registration has expired can also participate to obtain CPD hours for registration purpose.

Learning material 1

After reading How to Apply for Registration and Renewal of Registration as Vehicle Maintenance Workshops, vehicle mechanics can access the following link (https://forms.gle/yh8qkxbJefDbEzhG7) via the QR code and answer the questions to earn hours of continuing professional through online self-learning.

How to Apply for Registration and Renewal of Registration as Vehicle Maintenance Workshops can be downloaded from the following website:
https://www.emsd.gov.hk/filemanager/en/content_651/How_to_Apply_Rgstrtn_Rnwl_RVMW.pdf

Learning material 2

After reading Proper Maintenance of Diesel Commercial Vehicles: an Overview on Emission Tests, vehicle mechanics can access the following link (https://forms.gle/7boeggRg2UG8zL5y8) via the QR code and answer the questions to earn hours of continuing professional through online self-learning.

Proper Maintenance of Diesel Commercial Vehicles: an Overview on Emission Tests can be downloaded from the following website:
https://qrgo.page.link/GqpG1

— Participants who answer 5 to 9 questions correctly can earn one CPD hour.
— Participants who answer all the questions correctly can earn two CPD hours.
— The VMRU will notify successful participants by e-mail within 1 month after the end of the quiz
— Only registered vehicle maintenance mechanics or relevant working personnel in vehicle maintenance industry may participate, each not more than once.
— If there are duplicate submissions, the system will recalculate the scores of each submission. Only the last submission before the end of the quiz will be accepted.
— The decision of the VMRU on the quiz will be final.
The event will end on 31 January 2021.

11. Prize Quiz Issue No.31

Q1. As mentioned in the article, what are the levels of driving automation under the classification of the Society of Automotive Engineers (SAE)?

A. L0-L2, 3 levels
B. L0-L3, 4 levels
C. L0-L5, 6 levels
D. L0-L10, 11 levels

Q2. As mentioned in the article, which of the following, apart from level of environmental awareness, level of decision planning and level of control, is also included in the structure of a driving automation system?

A. Level of execution
B. Level of front wheel drive
C. Level of the bus upper deck
D. Level of driving automation

Q3. According to the European vehicle emission standards, in which year did the EU require all petrol vehicles to be equipped with the EOBD system?

A. 1997
B. 2001
C. 2016
D. 2046

Q4. As mentioned in the article, each OBD system trouble code is consisted of five characters, with the first one being a letter. How many numbers are there following the letter?

A. 4 numbers
B. 7 numbers
C. 10 numbers
D. 20 numbers

Q5. As mentioned in the article, OBD system trouble codes begin with the letter "B", "C", "P" or "U". Which system does the letter "P" represent?

A. Body Code (includes air conditioning and airbag)
B. Chassis Code (includes ABS)
C. Powertrain Code (engine and transmission)
D. Network Code (wiring bus)

How to participate (Issue No.31)

Please submit the answers directly at the following website https://forms.gle/b5GDPHsKxaBpVhfy7 by scanning the QR code. Vehicle mechanics may also complete the form below, circle the correct answers, and send it to the VMRU by fax or e-mail (fax: 3968 7646 or e-mail: vmru@emsd.gov.hk).

Deadline: 31 January 2021

Question	Answer			
1	A.	B.	C.	D.
2	A.	B.	C.	D.
3	A.	B.	C.	D.
4	A.	B.	C.	D.
5	A.	B.	C.	D.

Name:
Vehicle Mechanic Registration No.: VM
E-mail Address:
Contact Tel. No.:

- Participants who answer all the questions correctly will earn one CPD hour and be notified by the VMRU individually.
- Only registered vehicle mechanics with valid registration may participate, each not more than once in each quiz.
- If there are duplicate submissions, only the last submitted answers before the deadline will be accepted.
- The decision of the VMRU on the quiz will be final.
- The correct answers will be announced in the next issue of the RVM Newsletter.

The answers in RVM Newsletter Issue No. 30 are as follows:

Question	1.	2.	3.	4.	5.
Answer	D	C	D	B	A

12. Training Institutes Providing Continuing Professional Development Courses for Vehicle Mechanics (in random order)

Name of Training Institute	Website/Contents	Enquiry Tel. No.	QR Code
Traffic Services Employees Association	http://www.facebook.com/tseahk	2575 5544	
Pro-Act Training and Development Centre (Automobile)	http://www.pro-act.edu.hk/automobile The Certificate in Vehicle Mechanical Repair programme# run by the Pro-Act Training and Development Centre (Automobile) may serve as another means for qualifying as registered vehicle mechanics. Mechanics who are interested in enrolling in the above programme may visit the Centre's website. # For details and latest developments of the programme, the information issued by the Pro-Act Training and Development Centre shall prevail.	2449 1310	
The Institute of the Motor Industry Hong Kong	http://www.hkimi.org.hk The Institute of the Motor Industry Hong Kong (IMIHK), formerly known as the Institute of the Motor Industry (IMI) - Hong Kong Branch, brings the mission and vision of the IMI to the Hong Kong automobile industry. After the handover in 1997, the IMI - Hong Kong Branch applied to be renamed the IMIHK in Hong Kong. Eligible members of the trade are welcome to join the IMIHK or enroll in its courses or talks.	2625 5903	
Hong Kong Vehicle Repair Merchants Association Limited	https://www.facebook.com/HKVRMA/	2399 7977	
Hong Kong Vehicle Repairing Industry Employee General Union	http://www.vrunion.hk	2393 9955	
Occupational Safety and Health Council	http://www.oshc.org.hk The Safety Handling of Chemicals course aims to provide employees with basic knowledge of the safe handling of chemicals. The course content includes hazards of chemicals, labelling of chemicals, safety precautions, personal protective equipment, emergency procedures, etc. For more course details, please contact the Occupational Safety and Health Training Centre.	2311 3322	
The Society of Operations Engineers (Hong Kong Region)	http://www.soe.org.hk	2617 0311	
Qualifications Framework recognised courses	http://www.hkqr.gov.hk	2836 1700	

Gentle Reminder

The contents in each issue help you catch up on the development of the registration schemes and enhance the quality of service. Please stay tuned! Each issue can be downloaded from the EMSD website at:

http://www.emsd.gov.hk/en/supporting_government_initiatives/registration_scheme_for_vehicle_maintenance/publications_and_circulars/rvm_newsletter/index.html

For enquiries on the contents of the RVM Newsletter, please contact the VMRU of the EMSD.
Fax: 3968 7646
E-mail: vmru@emsd.gov.hk
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