

OVERVIEW OF THE LATEST REGULATORY CONTROL FOR LIFT AND ESCALATOR SAFETY IN HONG KONG

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ABSTRACT

Safe and reliable lifts/escalators are essential for maintaining high accessibility and functional vertical transportation to help preserve the vitality of a city like Hong Kong which is renowned of its densely packed skyscrapers. The Electrical and Mechanical Services Department (“EMSD”) of the Hong Kong Special Administrative Region Government (“the Government”) is responsible for regulating the safety of lifts/escalators in Hong Kong by enforcing the Lifts and Escalators Ordinance (Cap. 618) (“LEO”) through a multi-pronged approach with assessment of the design and construction of lifts/escalators to be installed in the territory, tailored inspection programmes, prosecution and disciplinary actions, registration and audit of trade practitioners, collaborative operation with stakeholders in publicity and education for lift/escalator safety, promotion and facilitation of trade development activities, etc. Under the legislative regime, users, facility management personnel, servicing practitioners, equipment suppliers, training institutions and regulators are required to take their shared responsibilities in the upkeep and ensuring of safe and smooth operation of lifts/escalators.

To address the escalating expectation of lift/escalator safety and quality services from the community, the EMSD has been strengthening its regulatory control over lift/escalator safety with more effective, smart and innovative approaches. In addition to issuing the Code of Practice for Lift Works and Escalator Works (2018 Edition) (“Works Code”) and Code of Practice on the Design and Construction of Lifts and Escalators (2019 Edition) (“Design Code”) to introduce new design and works requirements, the EMSD has been actively promoting and facilitating application of innovative technologies to the industry with a view to bringing improvements to operational effectiveness as well as enhancement of lift/escalator reliability and availability. This paper gives an overview of the latest regulatory functions and activities for ensuring lift/escalator safety in Hong Kong.

LATEST REGULATORY CONTROL OVER LIFT AND ESCALATOR SAFETY

Hong Kong is a city with the most skyscrapers in the world¹. There are over 900 completed buildings in which more than 350 buildings are taller than 150 meters. Reliable and safe operation of the 69 200+ lifts and 9 900+ escalators² is crucial for such a vibrant and vertical city with a population in excess of 7.5 million³ and an annual overall visitor arrival in excess of 65 million⁴. The regulatory control over lift/escalator safety in Hong Kong is logically required to

¹ The Council on Tall Buildings and Urban Habitat, <http://www.skyscrapercenter.com/cities?list=buildings-150>, accessed on 16 January 2020.

² As at end December 2019.

³ Provisional population as at mid-2019 according to the Census and Statistics Department, https://www.censtatd.gov.hk/press_release/index.jsp, accessed on 16 January 2020.

⁴ 2018 result from the Tourism Commission, https://www.tourism.gov.hk/english/statistics/statistics_perform.html, accessed on 16 January 2020

be sufficiently stringent to cope with the large number of installations with varying configurations and differing ages, where aged lifts/escalators have taken up a very large portion⁵. Examples of stringent requirements are that escalators in the territory are required to have periodic examination done half yearly and full load test every five years whilst many escalators overseas⁶ require periodic examinations to be done annually and there is no full load test requirement. In Hong Kong, the registered lift/escalator contractors (“RCs”) are obliged to conduct thorough examination of lifts/escalators within two weeks from the time they take over the maintenance of the installations and submit the T&E reports⁷ to the EMSD. The RCs need to retain photos to record the conditions of ropes, sheaves, and drive chains of lifts/escalators following periodic examinations. The RCs need to regularly report their manpower situation and the number of lifts/escalators being maintained. Justifications need to be put up for situations where a registered lift/escalator engineer (“RE”) examines more than eight lifts/escalators in a day and a work gang, making up of at least a registered lift/escalator worker (“RW”), is required to undertake routine maintenance for more than six lifts/escalators a day.

THE NEW LEGISLATIVE FRAMEWORK

To resolve the deep-rooted problem such as comparatively more lenient control towards lift/escalator owners⁸ while property management companies who borne full responsibility for managing the facilities had no liability for the proper upkeep of lifts/escalators under the legislation, and penalty levels being too low to offer sufficient deterrent effect against malpractice or non-performance, hampering enforcement for lift/escalator safety, the Government took the initiative to transform the regulatory regime over lift/escalator safety about 10 years ago.

Following public consultation and the necessary legislative processes, the LEO was enacted and repealed the Lifts and Escalators (Safety) Ordinance (Cap. 327) on 17 December 2012. A series of enhanced control measures including extending the coverage of the legislation to both public and private sectors such that lifts/escalators belonging to the Government and the Housing Authority are subject to the regulatory control under the LEO. The registration regime of personnel engaged in lift/escalator works has been strengthened to require RCs and REs to seek renewal for their registrations every five years. The qualification requirements for registration as a RE uplifted from higher certificate in relevant disciplines to bachelor degree and is to be migrated to registered professional engineer in time. A registration system for lift/escalator workers was introduced to replace the career-bound competent worker arrangement. RWs are also required to renew their registrations every five years.

To offer sufficient deterrence against non-compliance by parties including the trade, the penalty levels of offences have been increased with maximum pecuniary punishment lifted from \$10k to \$200k while maximum imprisonment term maintained at 12 months. The concept of responsible persons⁹ (“RPs”) was brought on board. It has been stated in clear and simple language that the RPs have the statutory duty to ensure their lifts/escalators are kept in a proper state of repair and in safe working order, where RP covers, in addition to the owners, those people who has the management or control of the lift/escalator concerned. This has brought the property management companies performing day-in and day-out management functions for the common facilities on board to work jointly with other stakeholders for better upkeep of lifts/escalators.

⁵ Over 50% of the lifts/escalators in Hong Kong have been put into service for more than 20 years.

⁶ Such as Singapore and United States.

⁷ Testing and examination reports.

⁸ As compared to the servicing personnel.

⁹ A responsible person for a lift/escalator is defined in the LEO to mean (i) in relation to a lift, a person who owns the lift or any other person who has the management or control of the lift; whereas (ii) in relation to an escalator, a person who owns the escalator or any other person who has the management or control of the escalator.

The enhancement measures have tremendously improved the regulatory regime, evident by the lowering in the number of equipment failure related incidents over the years. The full year number of equipment failure related incidents has come down from a high score of 57 cases (*in the year 2009*) prior to the enactment of the LEO to as low as 4 cases (*in the year of 2014*), while number of installations has risen from 57 000+ to 71 000+ lifts/escalators over the corresponding period.

INDUSTRY EXPERTISE AND COMMUNITY TALENTS FOR DRIVING BETTER DEVELOPMENTS

To canvass views and advice from the industry and community for better enforcement and administration of the LEO, and on matters including, but not limited to, manpower development and training needs in the lift/escalator trade, the EMSD sought support from the trade and various stakeholder groups to form the Lift and Escalator Safety Advisory Committee (“the LESAC”) on 9 July 2013. Since then, valuable advice and views have been collected through continuing engagement with the industry experts and community talents. Highly receptive and effective measures and initiatives have been rolled out from time to time. Further, working groups with the engagement of representatives from RPs, trade practitioners and public members have also been established under the LESAC to help review studies on specific issues, e.g. the Contractor Performance Rating mechanism and lift maintenance price survey. By a collaborative mode of operation with trade practitioners and stakeholders in publicity and education for lift/escalator safety, the EMSD could better facilitate development of the trade ecology and take appropriate initiatives to nourish trade skills and attract more youngsters to join the trade.

CODE OF PRACTICE, GUIDELINES AND CIRCULARS

The LEO empowers the Director of the EMSD to issue any code of practice that in his opinion is suitable for providing practical guidance in respect of any matter concerning the safety of lifts/escalators, including providing practical guidance in respect of the design, use and operation of lifts/escalators and providing practical guidance to persons who carry out any lift/escalator works. In this regards, the EMSD has issued two codes of practice, viz. (i) the Design Code which sets out technical details, methods, procedures and safety rules for compliance with the requirements of the LEO on the design and construction of a lift/escalator, or any associated equipment or machinery of a lift/escalator, and (ii) the Works Code, which provides guidance and sets out the minimum industry standards for satisfying the requirements under the LEO, taking into account the trade skills and risk perception of the general practitioners. In preparation of the codes, the EMSD has made references to relevant safety standards as well as local safety requirements derived from previous lift/escalator incidents happened in Hong Kong, and consultation with the trade together with relevant stakeholders.

Following updating the Works Code in August 2018 to introduce the requirement of “special



maintenance¹⁰” and revised format of log-book, the EMSD recently updated and published in August 2019 the Design Code to harmonize the local design requirements with those stipulated in EN81-20:2014. The new requirements will come into effect in February 2020.

With EN81:1/2:1998+A3:2009 superseded by EN81-20:2014 and EN81-50:2014 in September 2017, different milestones requiring type-examination certificates complying with new EN standards have been set for type approval for new and existing models of lifts as well as safety components. Through harmonization of the latest Design Code with the new EN standards, the design requirements have been updated to enhance the accessibility, safety and comfort level of new lift installations, provide extra safeguards for passenger/worker safety, and facilitate lift manufacturers to supply compatible lifts/safety components more readily, attributable to greater operational efficiency and competition.

In spite of the high safety factor, drive chains of escalators are not meant to service until failure. Chains should be replaced before breakage in order to keep escalators in safe working order. After the serious escalator flow-back incident that led to injuries of 18 passengers in March 2017, the EMSD has further tightened the requirements that a chain is required to be replaced once it attains the discard/replacement criteria given by the chain manufacturer or escalator manufacturer, whichever are more stringent. In long escalators with a vertical rise greater than 15 m, all drive chains are required to be replaced at intervals not exceeding six years of use unless otherwise stated by the chain manufacturer or escalator manufacturer. Further, the testing of the brake at intervals not exceeding five years is to be carried out. Except where the vertical rise is less than 2.5 m, a test of the stopping distance under total brake load, at rated speed, is required to be carried out to determine the performance of an escalator. Brake load test with dummy load can be replaced by a brake torque test if such test fulfills the requirements of the related international standard and supported by the original manufacturer. The requirements have been stipulated in the Works Code and released in August 2018.

GUIDANCE TO RPS

Apart from regular updating the codes of practice, the EMSD has also issued guidelines to the RPs. Adverse weather conditions may lead to trapping of passengers in lifts, lift service suspension and severe damage to lift facilities, which require extensive repair. In addition, there is a possibility of unstable power supply or flooding during inclement weather/the passage of a typhoon, under which the risk of lift service suspension and passengers being trapped may increase, while rescue operations may also be delayed due to adverse weather. The EMSD has issued guidelines¹¹ to provide recommendations for reference of RPs to enhance the management of lifts and take appropriate measures to reduce the risk of damage to lifts as well as passengers being trapped due to inclement weather.



RISK BASED INSPECTION MODEL

¹⁰ To be elaborated in ensuing paragraphs.

¹¹ Guidelines for Responsible Persons for Lifts on Coping with Adverse Weather Conditions:

[https://www.emsd.gov.hk/filemanager/en/content_826/Guidelines%20of%20Lift%20Preparedness%20for%20Typhoon%20\(Final\).pdf](https://www.emsd.gov.hk/filemanager/en/content_826/Guidelines%20of%20Lift%20Preparedness%20for%20Typhoon%20(Final).pdf)

The EMSD has stepped up the regulatory control since the North Point lift incident¹². In order to oversee around 61 000 lifts and 8 600 escalators by a team of 23 inspectorate staff effectively at that time, a risk-based strategy to conduct audit inspections has since been adopted. The objective is to identify specifically those potential risk factors that would affect the safe operation of lifts/escalators and carry out target-oriented inspections. Those non-compliance or malpractice cases identified during inspections were handled in accordance with the provisions of the legislation, with appropriate means of regulatory actions against registered persons¹³ and RPs. There have been regular reviews and refinements of the inspection model. The risk-based inspection model with the following categories of risk factors has been established over the years:

Inspection categorization for risk-based inspection model

Sampling Inspection	Event Driven Inspection
◇ Sub-contracting works	◇ New installation works
◇ Change of maintenance contractors	◇ Major alteration works
◇ Periodic examination works	◇ Complaints
◇ Reportable incidents (<i>other than due to equipment failure, e.g. passenger behaviour or external factors</i>)	◇ Reportable incidents (<i>due to equipment failure or public/ media concern</i>)
◇ Routine maintenance works	◇ Long escalators
◇ Lift locations with low maintenance price	
◇ Other factors	

In the entire risk-based inspection model, new installation works, major alteration works, reportable incidents due to equipment failure and frequent complaints of lifts/escalators are accorded with a comparatively higher risk level. Although the lifts/escalators have been tested and examined thoroughly by REs following completion of installation and major alteration works for new installation and major alteration cases, it is considered that further verification by EMSD inspectors could effectively banish non-compliance with the statutory requirements and existence of issues associated with builder's works rendering unsuitability for putting the lifts/escalators into service. These are currently taken as event driven inspections and can help ensure all those lifts/escalators following installation and major alteration works are in compliance with the requirements and be placed in the existing lift/escalator stock for use and operation and subject to the normal risk-based inspection.

On the other hand, reportable incidents due to equipment failure and frequent complaints are in some circumstances reflecting maintenance quality and workmanship of the registered persons for the lifts/escalators. The EMSD would carefully review the seriousness of each case to determine whether criminal investigation leading possibly to prosecution and disciplinary actions should be initiated or warning/advisory letters together with points deduction under the Contractor Performance Rating mechanism¹⁴ and responsively allocating more audit inspections to closely monitor the performance of the registered persons as appropriate. Recently, the EMSD has

¹² The incident happened on 2 March 2013 in that the lift car carrying seven passengers dropped to the bottom of the lift shaft when the lift car ascended and reached the first floor, causing injuries to all seven passengers inside. It was found that all the four suspension ropes were broken, and the safety gears were not activated to stop the lift car from falling.

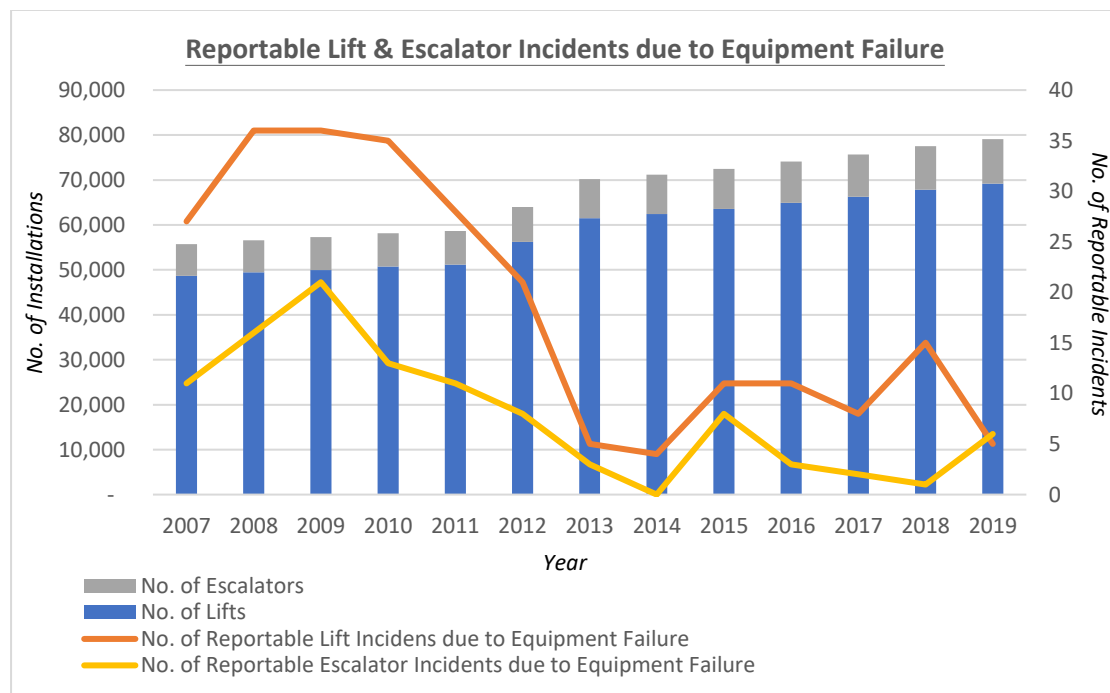
¹³ "Registered Person" means a registered escalator contractor, a registered escalator engineer, a registered escalator worker, a registered lift contractor, a registered lift engineer or a registered lift worker.

¹⁴ To assist lift/escalator owners or their property management agents to choose appropriate RCs for provision of lift/escalator maintenance and repair services, the EMSD introduced the Contractors' Performance Rating System ("CPR") in June 2009. The CPR is based on a scheme of performance monitoring points to provide a fair and transparent mechanism for reflecting the performance of RCs in safety and service quality aspects. The CPR is not a requirement under the LEO. It is an administrative measure adopted by the EMSD to support enforcement of the LEO. The EMSD reviews and improves the CPR from time to time. More information about the CPR can be observed from –

https://www.emsd.gov.hk/en/lifts_and_escalators_safety/publications/contractors_performance_rating/index.html

formed a taskforce to review the classification indices of the risk-based inspection model, aiming to adopting the new indices for tailored inspection programmes in 2020.

The effectiveness of regulatory control over lift/escalator safety could be reflected from different aspects. One of the key indicators is the number of reportable incidents due to equipment failure. The numbers have dropped by more than 70% from an annual average of 31 cases for lifts and 13 cases for escalators during 2007 to 2012 (before enactment of the LEO) to eight cases for lifts and three cases for escalators during 2013 to 2019 (post enactment period). Moreover, the EMSD conducted direct investigation for about 270 cases every year from 2013 to 2019, in which the registered persons and RPs involved in more than 30 cases were prosecuted, disciplined and fined accordingly. The enforcement actions have led to the termination of registration of four registered persons who were involved in the cases. In one case, the RC was fined \$320k in total for its failure to carry out escalator works properly. Under the stringent regulatory control and heavy sanctions, the compliance rates have since the enactment of the LEO maintained at a very high level.



To further stepped up surveillance, the annual inspection number on lifts/escalators has been greatly increased from around 11 000 in earlier years (resembling to an inspection ratio of about 1 out of 7 installations) to an anticipated figure of 28 900 (about 1 out of 3 installations). Greater emphasis has now been put on the maintenance works, in particular for aged lifts, i.e. those which have not been equipped with double brake, ascending car overspeed protection means, or uncontrolled car movement protection means. The number of aged lifts amounts to about 80% of the lift stock in the territory.

The log-book is an essential tool for the RPs to monitor the RCs to conduct lift/escalator works. To facilitate surveillance and monitoring of maintenance activities, the format of log-book was updated in August 2018 requiring RCs to check boxes to more specifically describe the works undertaken in each visit. Furthermore, RCs have been required to furnish their maintenance schedules to facilitate the EMSD to decide, as appropriate, inspections to be conducted either at the spot during or ex post the maintenance event to enhance effectiveness as well as deterrence of the inspections.

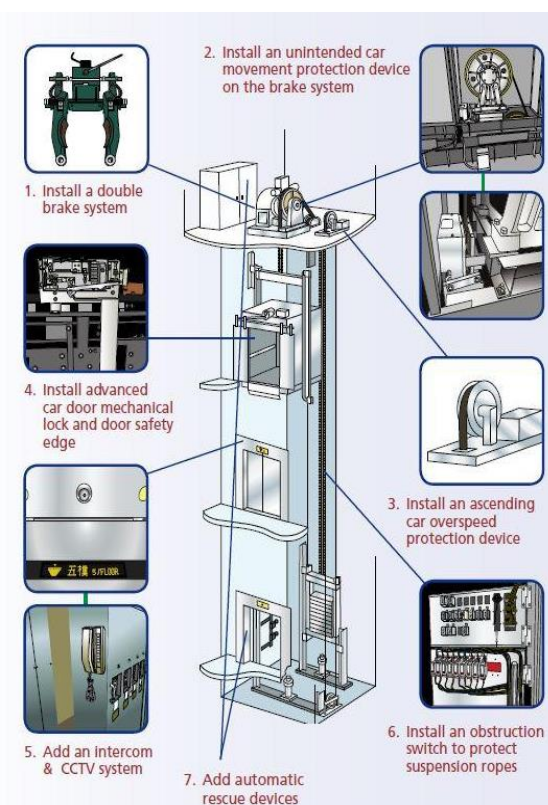
MODERNISATION OF AGED LIFTS

The EMSD always attach importance on lift/escalator safety. All lifts/escalators in Hong Kong have adopted the level of technology appropriate at the time of their installation. Following decades of operation of the regime¹⁵, lifts which have been in service for more than 20 years have exceeded 50% of the lift stock.

Technological advancement in recent years has made lifts/escalators of the prevailing design at a higher safety, reliability and traveling comfort level. In view of this, the EMSD rolled out the guidelines on modernisation of lifts in 2011 aiming to encourage RPs to modernise their aged lifts to bring the safety, reliability and traveling comfort levels to those of prevailing standard.

Acting as a “Facilitator” and “Promotor”, in addition to establishing the informative RP Corner that public education and promotion videos as well as useful materials such as lift maintenance price figures, sample contracts, contact information of independent registered lift/escalator engineers, could be easily available, the EMSD has further set up a Lift Modernisation Resource Corner¹⁶ at the official website in 2017 to provide one-stop information regarding lift modernisation to RPs. To further arouse the attention of RPs, reminder letters were issued to all RPs encouraging them to expedite implementation of modernisation solutions applicable to their lifts such as the addition of unintended car movement protective device in mid-2017.

Although there was a general receptiveness of RPs of the idea of lift modernisation, the growth of lift modernisation has been hampered by tight workforce, lack of technical and financial support to the RPs and difficulty of RPs in reaching consensus for implementing such works.



STEP-UP MEASURES TO ENHANCE THE SAFETY OF AGED LIFTS

RPs are primarily responsible for proper keeping of their lifts. In general, as long as proper periodic examination as well as routine maintenance and repair are in place, safe use of the lifts can be assured. A couple of serious accidents¹⁷ occurred around mid 2018 were found to be attributable to human factors and the lifts involved were lack of safety protection devices. The

¹⁵ The Lifts and Escalators (Safety) Ordinance (Cap. 327) was enacted in 1959.

¹⁶ “Lift Modernisation Resource Corner”: https://www.emsd.gov.hk/en/lifts_and_escalators_safety/responsible_persons_corner/lift_modernisation_resource_corner/index.html

¹⁷ On 8 April 2018, the lift car of the incident lift carrying two passengers moved from 7/F and continued to ascend, while without opening its car doors upon reaching the destination floor of 15/F, until it collided with the ceiling of the lift shaft. The two passengers were seriously injured. It was found that the solenoid plunger of the brake system was jammed by metal debris from a damaged spacer ring, thereby obstructing the movement of the plunger and the application of the brake to stop the lift at the time of the incident.

On 11 May 2018, the lift car of the incident lift moved upwards unintentionally from 7/F while its doors were opened, leading to the falling to the lift shaft of a passenger. It was found that the brake plungers were not lubricated for a long time and could not be operated smoothly, thereby overheating the brake linings and significantly reducing the braking force.

need to conduct “special maintenance¹⁸” for aged lifts twice a year with effect from 1 February 2019 was promulgated in the Works Code in August 2018. The objective of special maintenance is to strengthen the maintenance of critical components of the aged lifts, i.e. brakes, traction machines and door locks, so as to enhance their functionality and effectiveness for greater safety assurance and minimizing the risk of uncontrolled lift car movement. RCs responsible for maintenance of aged lifts are required to submit to the EMSD the scheduled date, time and inspection results of special maintenance works via an online platform. RCs should dispatch specifically trained RWs to carry out special maintenance, involving brake overhaul, testing and examination of traction machines and door locks. The EMSD will conduct sample checks to ensure that the works have been properly performed.

Special maintenance is an important measure to ensure the effective operation of critical safety components to protect public safety. In the long run, the EMSD recommends that RPs should modernise or replace their aged lifts to make the lifts safer and more comfortable, and users can rest assured of the safe operation of the lifts. Whilst the feasibility of mandatory lift modernisation by conducting comparison study and experience sharing with various overseas jurisdictions and trade practitioners has been underway since 2018, a holistic review taking into consideration of different aspects such as the technical constraints of buildings, property ownerships issues, trade ecology, financial and social impacts, etc., will be made.

There will be a long way to go prior to implementation of mandatory lift modernisation. Apart from the stop-gap measures of specifying “special maintenance” for aged lifts, the Government has engaged the Urban Renewal Authority to launch a HK\$2.5 billion Lift Modernisation Subsidy Scheme¹⁹ (“LIMSS”) in March 2019. The scheme aims to promoting lift modernisation in the community through provision of financial incentive with appropriate professional support to building owners of private residential or composite (commercial and residential) in need to modernise about 5 000 aged lifts in six years commencing from 2019-20, thereby enhancing lift safety. With the overwhelming response to the 1st round application for the LIMSS, the Government has now decided to expand the LIMSS to gradually modernise about 3 000 additional aged lifts by 2025-26. The Government will sought endorsement of the LegCo for allocating extra \$2.0 billion for the expansion of the scheme.



MODERNISATION OF AGED ESCALATORS

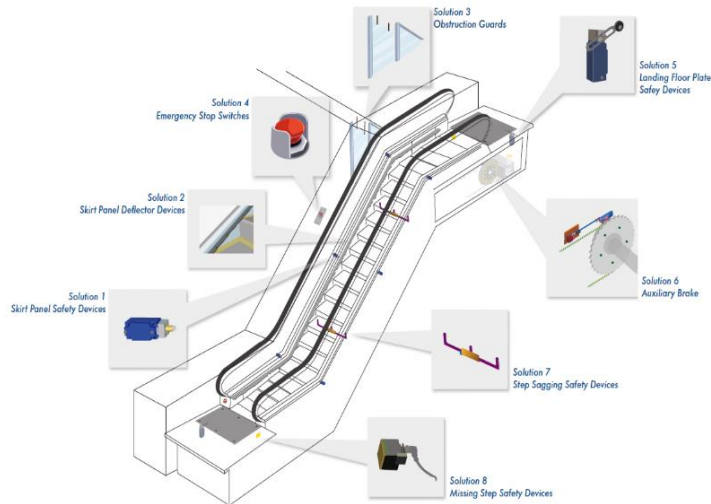
¹⁸ In addition to the items listed in the maintenance schedule/instructions provided by the lift manufacturer, the RC responsible for maintaining the lift must also carry out the following maintenance items for not less than twice a year if the lift concerned has not equipped with unintended car movement protection device, ascending car overspeed protection device or double braking system: (a) Disassembly maintenance of the braking mechanism for the lift machine brake; (b) Measure the braking distance by performing no-load brake test to ensure compliance with the lift manufacturer's requirements; (c) Measure grooves of traction sheave in the lift traction machine and replace the traction sheave in accordance with the manufacturer's requirements. Perform no-load traction test for the lift and measure the leveling accuracy to ensure the traction and leveling accuracy are in compliance with the lift manufacturer's requirements & (d) Check the mechanical locks and electrical contacts of all lift landing doors to ensure they are in safe working order.

Appendix XIV, Clause XIV.1.3, Code of Practice for Lift Works and Escalator Works (2018 Edition), [https://www.emsd.gov.hk/filemanager/en/content_805/CoP%20on%20Lift%20Works%20and%20Escalator%20Works%202018%20Edition%20\(Eng\).pdf](https://www.emsd.gov.hk/filemanager/en/content_805/CoP%20on%20Lift%20Works%20and%20Escalator%20Works%202018%20Edition%20(Eng).pdf)

¹⁹ Lift Modernisation Subsidy Scheme: <https://www.brplatform.org.hk/en/subsidy-and-assistance/limss>

Escalators were first brought to commercial buildings and then to metro-stations and residential buildings. Some of the escalators have been in operation for decades. Similar to the case of aged lifts, there is room for improvement to make the escalators safer, more reliable and comfortable. It must however be emphasised that, with proper maintenance and periodic examination, escalators are safe for use.

The EMSD issued guidelines²⁰ for modernising aged escalators in 2016. Eight solutions have been identified with the greatest potential benefit for enhancement of the safety of aged escalators. RPs should consider factors such as space availability, technical feasibility and cost implications before deciding on whether to replace major components of their aged escalators or install new safety equipment. The applicable solutions for enhancing the safety requirements of aged escalators are elaborated as follows:



1. Install an auxiliary brake to prevent passenger from losing balance due to sudden acceleration or reversal movement of the escalator.
2. Install step sagging safety devices to reduce the risk of trapping due to step sagging.
3. Install missing step safety devices to prevent missing step which could be a serious trapping hazard to passengers.
4. Install skirt panel safety devices to prevent serious injury due to trapping between skirting and steps.
5. Install landing floor plate safety devices to reduce the risk of injury if a passenger falls into the machinery space under the landing floor plate due to dislocation of the floor plate.
6. Install emergency stop switches to stop the escalator in case of emergency.
7. Install skirt panel deflector devices to reduce the risk of trapping between skirting and steps.
8. Install obstruction guards to reduce the risk of trapping passenger's head or upper limb at floor intersections and criss-cross area.

APPLICATION OF NEW AND INNOVATION TECHNOLOGIES

Innovative technology can bring in improvement in efficiency and effectiveness in industry's mode of operation. The lift/escalator trade also needs to embrace innovative technologies. To act in line with the directive of the 2017 Policy Address on development of Innovation and Technology ("I&T") in Hong Kong and encourage a widespread application of new technologies in the Electrical & Mechanical (E&M) trade, the EMSD has launched the "E&M InnoPortal²¹" in 2018. The E&M InnoPortal is a platform for a public list of technologies needed by various government departments, public bodies and the E&M trade, and it invites the I&T collaboration from innovators in the private sector to solve the problems. Universities, start-ups, etc., are also welcomed to put on the platform their E&M related

²⁰ Guidelines for Modernising Existing Escalators: [https://www.emsd.gov.hk/filemanager/en/content_803/Guidelines%20for%20Modernising%20Existing%20Escalators%20\(E\).pdf](https://www.emsd.gov.hk/filemanager/en/content_803/Guidelines%20for%20Modernising%20Existing%20Escalators%20(E).pdf)

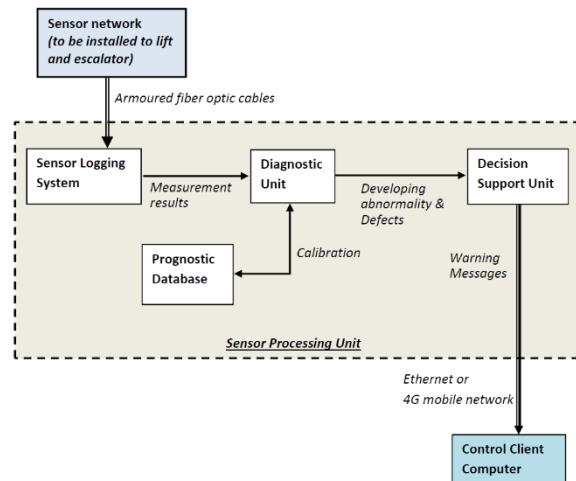
²¹ Website of "E&M InnoPortal": <https://www.emsd.gov.hk/minisites/inno/index.html>

innovations and new technologies, including those related to lifts/escalators (e.g. new products developed for enhancing efficiency and safety of lifts/escalators), to match the market needs.

The EMSD will provide venues for trial of suitable projects, conduct prototype testing and pilot projects in a collaborative way, and upload validated performance reports of trial cases to the platform for sharing with the public with a view to jointly promoting and driving the research and development and application of E&M related innovation and technology in the territory. There have been over 50 cases of successful matched I&T trial projects involving a total estimated project sum of HK\$ 35 million, in which three projects relate to lifts/escalators. Technologies such as video analytics, artificial intelligence, internet of things are being adopted.

Besides, the EMSD has been thinking out of the box to have a pilot trial of Optical Fiber Bragg Grating sensing technology for early detection of abnormal operation of lifts/escalators prior to the failure of equipment by artificial intelligence analysis of their noise signatures. By on-site fault simulation and data validation, the detection of foreign objects such as screw taxis towards the escalator comb plates, degraded step rollers and handrails are obvious and precise to be distinguishable by the RPs and maintenance contractors for necessary preventive measures. The proof-of-

concept has been successful while the validation of those noise signature database by artificial intelligence for different brands and models of machines at different locations would start soon. The EMSD welcome all interested stakeholders to participate and co-create a higher level of lift/escalator safety and efficiency by making use of innovative idea and new technology.



CONCLUSION

Amid the sweeping tide of the fourth industrial revolution as well as the aging challenge of both population and equipment, the mission of the EMSD to, among others, ensure the safety of lifts/escalators and safeguard the life and property of members of public would never end. Acting expeditiously on important and emerging issues in the best interests of the public, the EMSD will continue to smartly deploy resources to focus attention where the potential risks are comparatively higher.

Lift/escalator safety requires the concerted efforts of all stakeholders, i.e. the Government, RPs, trade practitioners, training institutions, and the passengers. Amendment of legislation and mandatory modernisation of aged lifts/escalators is normally taken as a last resort. With the buy-in of shared responsibilities, the community should strive together for higher performance standards than just for compliance with the minimum statutory requirements. Of course, the RPs always have the right to choose their most appropriate service providers while sacrificing the reliability and travel comfort as long as they have ensured that the lifts/escalators and all its associated equipment and machinery are kept in a proper state of repair and in safe working order. The EMSD as a “Regulator”, “Facilitator” and “Promoter”, has great determination to pursue better outcomes by giving pre-emptive warnings and facilitation to stakeholders against degradation in performance and monitoring the trade ecology to take appropriate actions to eliminate malpractice and emerging abnormalities in keeping with the spirit of our regulatory objectives.

BIOGRAPHICAL DETAIL

Ir William T.W. AU is the Senior Electrical and Mechanical Engineer of the EMSD, Government of the HKSAR. He is currently responsible for enforcement of the Lifts and Escalators Ordinance (Cap. 618) as well as the Aerial Ropeways (Safety) Ordinance (Cap. 211) in Hong Kong. Ir AU graduated with 1st Class Honor in Bachelor of Mechanical Engineering and passed his Master of Science in Building Services Engineering with Distinction from the University of Hong Kong in 2002 and 2005 respectively. He further obtained his Master of Business Administration from the University of Hong Kong in 2016. He is a Corporate Member of the Hong Kong Institution of Engineers and possesses diversified engineering experience in different electrical and mechanical systems, innovation technologies, project management, regulatory control and incident investigation.