

# Life Cycle of the World's Longest Escalator Link

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## Abstract

*The Central to Mid-Levels Escalator Link is the longest outdoor covered escalator system in the world. It provides a unique transport mode, which links up the residential areas in the mid-levels with the central business district near the waterfront by an escalator link, and has a daily patronage of over 85,000. Commencing operation in 1993, the escalator link comprises 18 escalators and 3 travelators. This 800m long escalator link bisects 13 streets, with a vertical rise of 135m. It is a highly challenging engineering system from design to its operation and maintenance.*

*As the link passes through commercial and residential buildings as well as restaurants and bars areas, lots of issues were encountered in the management, operation and maintenance of this escalator link. This paper shares the experience of management, operation and maintenance of this escalator link, which has been operating for over 20 years. It also covers a planned replacement project for the system, which is scheduled for commencement in 2016.*

## Keywords

*Escalator Link, Life Cycle Management*

## 1. INTRODUCTION

In the 1970s and 1980s, vehicular traffic had grown rapidly in Hong Kong, particularly in Central which, as its name implies, is the central business district of Hong Kong. In view of the effectiveness of linked bridges connecting commercial buildings at Central in relieving vehicular traffic burden, the government decided to build the Central and Mid-levels Escalator Link as a pilot scheme to assess the cost-effectiveness of mechanized walkway system. The main purpose of providing such a link was to encourage walking and to provide a convenient alternative transport means between Central and the Mid-levels, which is a mixed residential/commercial area a few hundred metres uphill from Central. Such link would reduce the vehicular traffic and hence traffic congestion in both Central and the Mid-levels.

The escalator link was built between the late 1980s and early 1990s at a cost of \$240M, and commenced operation in October 1993. It comprises 18 escalators and 3 travelators, linking up the residential areas in the mid-levels with the central business district near the waterfront. This 800m long escalator link bisects 13

streets, with a vertical rise of 135m. According to the Guinness World Records, it is the longest outdoor escalator in the world.

After more than 20 years of use, the escalator link is approaching the end of its lifecycle. A major refurbishment work will be launched in the coming years to replace most of electrical and mechanical parts.



Fig. 1 The night view of the escalator link

## 2. CONSTRUCTION, OPERATION AND MAINTENANCE

### 2.1 Design and Construction

The design of the escalator link was based on the concept of aligning the escalator and walkway with the natural inclination of the hill slope, and retaining the local characteristics of the neighborhood as far as possible. Therefore, the standard inclination of 30° or 35° of escalators cannot be used in some sections. Of the 18 escalators, 11 are with 30° inclination and 7 are with 17.5° inclination, while the 3 travelators have inclinations of 8.1°, 11.9° and 11.7° respectively.

Because of its non-standard design, the escalator manufacturer had to set up a dedicated production line solely for this project. The escalator steel framework (truss) was cut into small sections to facilitate transportation. Upon arrival at the site, the escalators were put into the pit before the construction of the canopy above. Huge mobile cranes were deployed on site to deliver and hoist the escalator section by section into the pit.

Apart from the escalators and travelators, there are also other electrical and mechanical installations within the escalator link. These include :

- a CCTV system with 75 CCTV cameras for 7x24 monitoring of the whole system;
- a public address (PA) system with 200 speakers for broadcasting important information;
- 450 sets fluorescent lights;
- 4 LED display boards to display messages about the operation of the system;
- 61 soffit lightings installed at elevated locations of the system; and

A control room is located mid-way through the link. Inside the control room is a console where the operator can control the travelling direction as well as start and stop of individual escalator. A mimic control panel is installed with a large TV wall for displaying CCTV images. There is also a PA system through which pre-recorded messages can be broadcast or instant announcement be made to users of the escalator link.

### 2.2 Operation Characteristics

Owing to the geographical constraints and space limitation, it was not possible to build twin escalators to serve both uphill and downhill pedestrians at the same time. Therefore, the escalator link is operated to provide one-way service, for 18 hours every day, basically following the prevailing direction of pedestrian flow during the day, running downhill between 6 and 10 am, and switching to uphill direction from 10 am onwards until mid-night.

The step width of all escalators and travelators is 1 000mm and the travelling speed is 0.65 m/sec. Such speed can carry approximately 11 700 persons per hour. The speed is in between escalators in shopping centres (mostly 0.5 m/sec) and escalators in railway station or airport (mostly 0.75 m/sec for higher passenger to increase the handling capacity). The total journey time between the two ends of the escalator is around 20 minutes. The system serves about 85,000 users daily, among them residents, students, commercial operators as well as tourists.



Fig. 2 The Central to Mid-levels Escalator Link

Apart from benefiting the pedestrians in negotiating the hilly terrain of the mid-levels, the system is also a popular spot for advertisement of non-profit making events, and for film-shooting. The Hollywood movie, “Batman – The Dark Knight” was shot here in 2007 and “Transformer 4” in 2013.

### 2.3 Maintenance of the Escalator Link

Electrical and Mechanical Services Department (EMSD) is a department in the Government of the Hong Kong Special Administrative Region responsible for providing electrical and mechanical (E&M) engineering services for other Government Departments and autonomous bodies. Between 1993 and 2005, EMSD provided maintenance service for the escalators and travelators in the system, while the Client Department let out the management, security, cleansing services for the facility under a service contract.

Upon the request of the Client Department, EMSD further assumed the management role of the system in 2005, by posting staff at the control room round-the-clock to provide the operation and management of the escalator system during its daily 18 hours of operation, and overseeing the escalator maintenance, security and cleansing services which were provided by contractors.

In 2014, EMSD decided to integrate various services through a management-operation-maintenance (MOM) contract let by EMSD. The MOM contractor is a facility management company which assumes the role of the management, operation and security of the escalator link while engaging subcontractors to perform cleansing and E&M maintenance works.

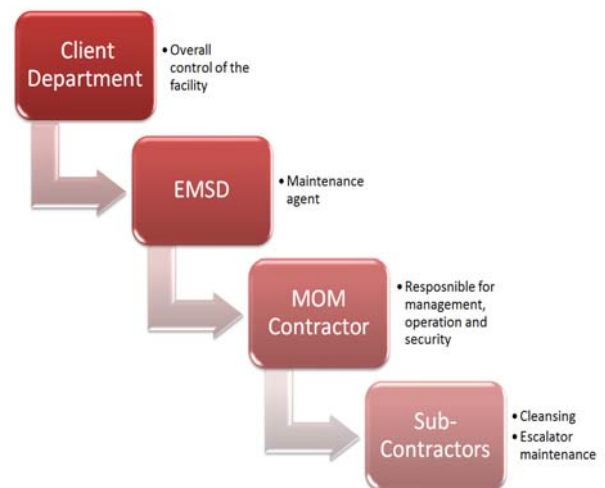


Fig. 3 Relationship between EMSD, the MOM Contractor and Sub-contractors

Under the new MOM arrangement, positive changes have been observed with enhanced maintenance, inspection and cleansing, better emergency

preparedness and responsiveness in emergency situation, and better communication with users and the public.

As the escalator link has now become an essential transportation means for local people, its availability and reliability are crucial. In the past, preventive maintenance was conducted on weekly basis during day time. This caused inconvenience to the public. Starting from 2014, some of the preventive maintenance work was re-scheduled to bi-weekly basis. Moreover, preventive maintenance work at the lower end of the link, which is in the business district, is now performed in the late evening as nuisance to residents is not a major issue while such arrangement can reduce the impact to day-time users of the escalator link.

### 3. LIFE CYCLE MANAGEMENT

Albeit proper service and maintenance, it is inevitable that any equipment will reach its end of useful life sooner or later. Normally, the lifecycle of a civil structure may exceed 50 years. However, for an E&M system, it can usually last half that time or even less. The life time may also varied by the environmental condition. As the Central to Mid-level Escalator Link is partly exposed to outdoor condition, the original manufacturer expected its serviceable life to be around 15-20 years.

Over the years, EMSD has been monitoring the maintenance performance of the escalator link, and since 2014, the link has also been included under an asset management system. It is noticed that, after over twenty years of use, the downtime and the maintenance cost has increased substantially over the last few years. In view of this, the government has set aside \$63M for major refurbishment work including the replacement of all the escalators and travelators of the link.

It is always challenging to execute major E&M replacement project under an operating environment. Interest from different stakeholders, impact to the users, including prolonged downtime, increased traffic congestion, and nuisance to residents and commercial operators, etc. all have to be studied and addressed carefully. Public consultations and meetings with District Council are under way. At the same time, detailed design, work programme and tender specifications are also being formulated. Out of 21 escalators and travelators in the link, only half of them are of standard design, while the other half needs to be tailor made to suit the gradient and other geographic constraints. A major constraint is the need to avoid altering the main civil structure or the irregular slopes along the path to minimize local disturbance and shutting down of the escalators. Therefore the site work is highly challenging in terms of material

handling, logistic arrangement and possible exposure to adverse weather condition during the work.

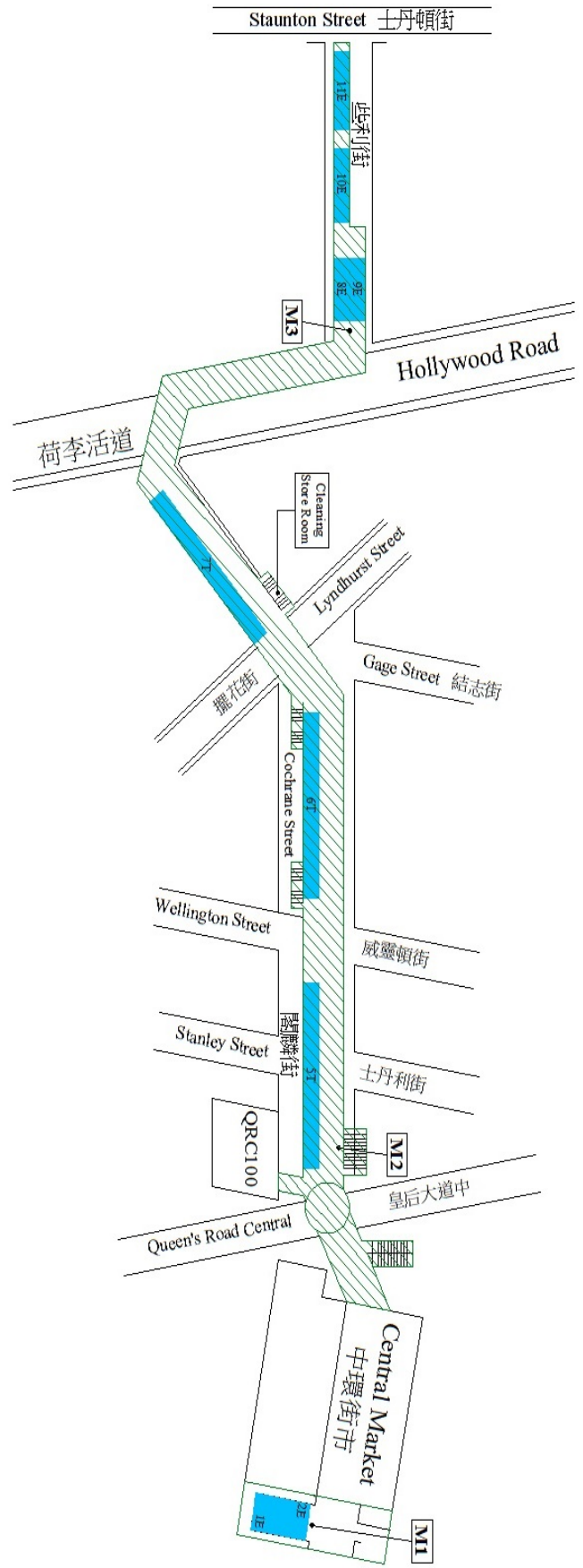
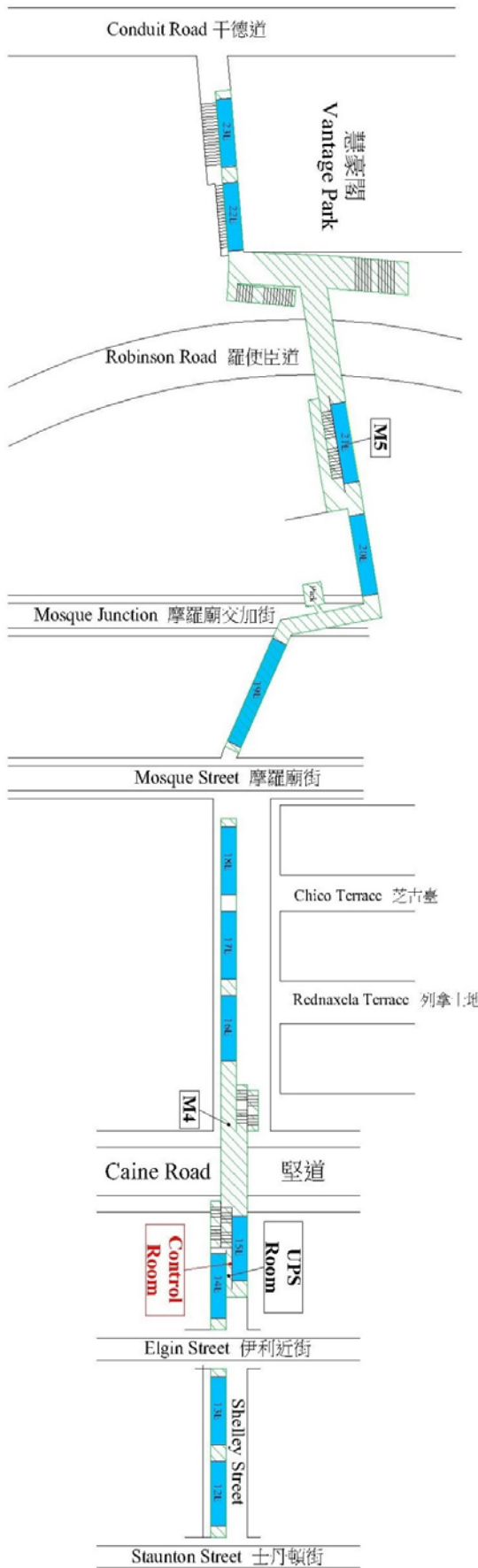
According to the present programme, the refurbishment work will be performed in phases between 2017 and 2023. It is anticipated that upon completion of the refurbishment, the life of the escalators and travelators can be extended for another 15 years.

### 4. CONCLUSION

The Central to Mid-levels Escalator Link was originally built more than 20 years ago to relieve vehicular traffic between the central business district and the mid-levels residential district. Over the years, this longest outdoor escalator link in the world has helped the interconnected areas to grow in popularity in serving not only as a residential, but also a commercial, and a tourist spot. As years pass by, the escalator link has now become an aged facility, and a replacement project is on hand to refurbish and revitalise the link. The refurbishment project is turning out to be a highly challenging engineering project with substantial civil and geographic constraints, and great need for optimal material handling, logistic arrangement and managing adverse weather scenario while keeping the disruption to the existing operation to a minimum.

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Escalators: 1E, 2E, 3E, 9E, 10E, 11E, 12E, 13E, 14E, 15E, 16E, 17E, 18E, 19E, 20E, 21E, 22E, 23E  
 Travelators: 5T, 6T, 7T  
 M1 to M5: Electrical room

Fig. 4 Map of Central to Mid-levels Escalator Link