

## 透過改善電源質素提升扶手電梯的穩定性 Enhancement of Escalator Stability by Improving Quality of the Energy Power

### 團隊背景 Background of the Team



小組名稱 Team name	穩電圈 PS Circle
成立日期 Date of formation	2012年2月1日 1 February 2012
所屬部門 Composition	跨部門/跨公司團隊 Cross-departmental / Company Team (15 members)
促進員 Team facilitator	陳新國 CHAN Sun Kwok Anson
隊長 Team leader	何偉光 HO Wai Kwong Dennis
小組成員 Team members	蕭愛珊、謝頌偉、鄭子暘、郭景賢、金慶基、梁東偉、 傅雄章、高健超、陳庭勳； 中電：潘建仁、李嘉欣、蔡啟文、林文俊 SHIU Oi Shan Chloe, TSE Chung Wai Tonio, CHENG Tsz Yeung Tony, KWOK King Yin, KAM Hing Kee, LEUNG Tung Wai Eric, FOO Hung Cheong Alex, KOO Kin Chiu, CHANTing Fun CLP: POON Kin Yan Ben, LEE Ka Yan Olivia, CHOI Kai Man, LAM Man Chun

### 背景 Background

根據統計數字，羅湖站、上水站及落馬洲站的扶手電梯受電壓驟降影響而停止運作的次數有上升趨勢。運作中的扶手電梯突然停止運作，對安全及車站客流管理造成負面影響，急需提出改善方案。

### Background

With reference to research data, escalator trips in Lo Wu, Sheung Shui and Lok Ma Chau Stations due to voltage dips have been increasing since 2008. As sudden stoppages of escalators have not only affected the passenger flow but also caused impact on escalator safety, an imminent solution was necessary.

### 問題原因 / 主要分析及驗證

透過“思維衝擊法”和“因果圖”找出問題多種不同原因。再利用“因果矩陣圖”和“柏拉圖分析”確定和驗證問題的主因。最後，確認以下為問題主因：

- 三個車站的供電網絡皆有架空電線相連，網絡容易受到干擾，遇到電壓驟降的次數較多和持續時間較長。
- 現時扶手電梯所安裝的電壓驟降過渡裝置只能應付短時間和較輕微的電壓驟降，遇上較嚴重的電壓驟降，扶手電梯會停止運作。

### Causes / Root Causes Analysis and Validation

All causes were figured out with Brainstorming and Cause & Effect Diagram while the root causes were screened out and validated by use of Cause & Effect Matrix Diagram and Pareto Analysis. Finally, the following factors were confirmed as the root causes of the problem:

- The power supplies of these 3 stations were associated with the overhead line network which is relatively vulnerable to external interference, resulting in high chance of frequent and severe voltage dips in these 3 stations.
- Escalators have a ride-through device installed now to overcome the short and mild voltage dips. If a prolonged and more severe voltage dip occurs, escalators would be tripped to stop.



### 解決方案 Solutions

針對問題的成因，配合三個車站獨有的環境因素，組員運用品質工具找出最佳的解決方案：

- 羅湖站：由於短期至中期內無法移除與架空電線相連的網絡，小組提議於3條下行扶手電梯及1條自動人行道，安裝比傳統電壓驟降過渡裝置更強力的大型電容式電壓驟降補償器，以處理電壓驟降的問題。
- 上水站：由於上水站的電掣房十分狹小，無法安裝大型的電壓驟降補償器，故小組提議將影響上水站的架空電線盡量移走。
- 落馬洲站：與中電的通力合作，落馬洲站全部扶手電梯的供電源改由供電網沒有與架空電線相連的變電站供電。

### Solutions

In analysing the root cause, and in careful consideration with the particular situations of the 3 stations, the Team came up with improvement options as follows:

- Lo Wu Station: Because the OHL associated circuits could not be removed from the supply ring to Lo Wu in the short-to-medium term, it was suggested that a local high power ride-through device shall be installed for 3 escalators and 1 traveller.
- Sheung Shui Station: It was suggested that most of the OHL circuits from the supply rings of Sheung Shui shall be relocated because there was no room to install a local high power ride-through device.
- Lok Ma Chau Station: To co-operate with CLP, the reconfiguration of the power supply network to the power source which was not associated with OHL.

### 成果及效益 Achievements & Benefits

三個車站的扶手電梯受電壓驟降影響而停止運作的次數大幅減少，由2011年合共約100宗減至2013年合共12宗。供電網絡得到改善，現有的電壓驟降過渡裝置可更有效地發揮保護扶手電梯的功能。

The numbers of escalator tripping at these 3 stations due to voltage dips have been dropped significantly from about 100 cases in 2011 to 12 cases in 2013. After the enhancement of the power network, the existing ride-through devices can protect the escalators in a more effective way.

#### 有形得益 Tangible benefits

- 扶手電梯穩定性提高，安全系數提升，公司處理索償及保險所需費用下降。與中電的互相配合，落馬洲站及上水站不用安裝大型的電容式電壓驟降補償器，為公司省回約港幣420萬元成本。

#### Tangible benefits

- With a more reliable and safer operation of escalators, the insurance premium and the cost of handling claims resulting from passengers' injuries are expected to decrease. With the co-operation with CLP, the total costs of HK\$4.2 million for purchasing high power ride-through devices for SHS and LMC have been saved.

#### 無形得益 Intangible Benefits

- 加強乘客安全。
- 投放具規模的資源改善服務，鞏固港鐵優質服務的形象。
- 增進部門和商業合作夥伴之間的合作和溝通。
- 提升組員解難能力和專業知識，增加工作熱誠。
- 電容式電壓驟降補償器具有高能源效率及減少棄置電池，可多次「儲電」及「放電」，循環使用，切合環保原則。

#### Intangible Benefits

- Passenger safety has been enhanced.
- A substantial investment has been made to improve the customer services, which can strengthen the Corporate image of providing Quality Services and build a good example for the society.
- The cooperation among the departments and the working partner can be improved.
- The competence and knowledge of the Team members have been enhanced in addition to building up a good team spirit.
- The high power ride-through device is an environmental friendly device as it has a high energy efficiency and can avoid battery waste.



大型電容式電壓驟降補償器  
High power ride-through device



扶手電梯突然停止運作會對乘客安全及車站客流管理造成負面影響。  
The tripping of escalators has adverse effect on the passenger safety and station traffic control.