

# Safety in Erection of Escalators

Athisiyaraj Immanuel and Dr.E. Palanisamy

**Abstract---** Many metropolises, including railway station, are increasingly constructed with high-rise buildings in which the lifts and escalators are essential facilities for numerous end users. In a late different year, unfortunately, a spate of shocking lift incidents occurred in many sectors, which triggered the government to put forward for consultation a range of amendments to the Lifts and Escalators (Safety) Ordinance for enhancing lifts and escalators safety. Supports to separate provisions of maintenance and examination services for lifts and escalators and appointment of a third party for assuring service quality, nevertheless, were only fair. Further to analyzing the factors affecting such responses and the costs and benefits of the amendments, the judgments for two relevant precedents were reviewed, which revealed the importance of observing not only the statutory requirements but also the common law safety and principles which are intricate yet influential to deciding liability for improper maintenance or use of lifts and escalators.

**Keywords---** Maintenance-Remote Condition Monitoring, Organizational Change-enterprise transformation, decision Support-energy consumption.

## I. INTRODUCTION

The word 'Lift' seems to get from the word, for example, 'Lift', whereas elevator derives from the to lift up. This signifies 'a mechanical assembly to raise or bringing down people or things from one story or level to other. Lifts are introduced in structures to fulfill the vertical transportation needs of their inhabitants and guests. Their need in multi-stored buildings has been so very much perceived that no

multi-stored buildings are planned without proper provision of lifts. Lift Acts, Rules and Codes govern the installation of elevators and their operation and maintenance. Lift is essential when building height exceeds meters. To ensure the elevator operates safely, support is required. To provide an elevator is performed correctly and safely, the operator must read through this "Instruction Manual" carefully before the operation. After finished perusing this manual, please put it inside the reach of the administrator. At the point when the proprietor or the administrator changes please ensure that this manual is hand over to the following Operator. If you find, any question or incomprehensible descriptions, please direct all inquiry. Accidents at the Platform Train Interface, on escalators and stairs, account for 80 percent of accidents on the London Underground network. The most severe injuries also occur in these areas. Approximately percent of customer accidents on the Underground occur on escalators. This sets out the background to the LU Escalator Passenger Safety Strategy, the results of a trial of twelve escalator safety improvements and next steps. c, and callback and safety code inspection support services. The Contractor might give all supervision, work, authoritative help, materials, devices, parts, supplies, gear, and transportation necessary to successfully and productively satisfy every one of the necessities of this Statement of Work at the Airport. The elevators, escalators, and moving walks included in this contract vary by manufacturer, model and execution attributes and are subject to serious use in operating times and traveler loads which most properties and equipment do not experience. Thus, the lifts, elevators, moving strolls, and related frameworks and gear incorporated into this SOW require a substantially higher level of deterrent support, benefit, repair, assessment, and testing than run of the mill business establishments. The term of this prerequisite is expected to

---

*Athisiyaraj Immanuel, PG Scholar, Dept of Mechanical Engineering, Excel College of Engineering and Technology, Salem Main Road, Pallakapalayam, Tamilnadu. E-mail:athired@gmail.com*

*Dr.E. Palanisamy, Principal, Excel College of Engineering and Technology, Salem Main Road, Pallakapalayam, Tamilnadu.*

comprise of a one base period with four one option periods. Three million lifts are being used today in Europe. In numerous nations, the greater part of existing lifts. Maybe a couple of them have been modernized to meet current security and performance requirements. Nevertheless, aging lifts can be made more effective, safer, more reliable and more comfortable through regular maintenance and improvement.

## II. LITERATURE REVIEW

Escalators are a conventional method of transportation for people in commercial and residential buildings, for this reason, its energy efficiency is usually a matter of concern. Typically, the design of energy-saving systems to be used in them involves the control of their speed. In this situation, to estimate the achievable energy savings it is necessary to evaluate the escalator's behavior regarding traffic. In this, a method to analyze this behavior using only electrical measurements is proposed. As a result of the proposed approach, the energy saving obtained using the common two-speed control is also investigated using data from real escalators. In addition to lifts, escalators have become the primary method of transport for people inside buildings, commercial facilities or even outdoor areas. In fact, there were more than a thousand escalators and moving walks around the world. According to the project, the annual energy consumed by escalators as shown in and the potential energy savings are around. To achieve the savings mentioned above, it is necessary to use high-efficiency motors, drives, transmissions, bearing, etc. Maintenance and lubrication should likewise be considered to keep the productivity at its greatest level. Aside from outline perspectives, the control techniques of the electric motor being utilized as the prime mover significantly affect the energy consumption.

The proposed methodology has a result a detailed characterization of the traffic in an escalator. This allows deriving the following information: walking factor, passengers per hour, distribution of periods of time when

the escalator is loaded or unloaded, etc. Furthermore, information regarding the energy consumed by escalators and its relation to traffic can be obtained. The power consumed during unloaded and loaded periods and the energy associated with traffic can be estimated, which is very useful for evaluating the impact of energy saving strategies. The proposed approach has been connected to information estimated in the three lifts of a dress store. Accordingly, the activity in every moment can be gotten, and pertinent information of movement can be calculated, the traffic in the busiest escalator the walking factor ranges between the mean unloaded time in the most working escalator and approx.

## III. PROPOSED SYSTEM

The community of the traveling public appreciates the mobility and access that lifts, escalators and moving walks provide to all groups in the society. They also expect that their journeys are as safe as possible. There is a need for new technical and social solutions to facilitate everyday life and to create an inclusive society. These solutions will have an impact on all residents of urban communities and people in their environments, be they young or old, healthy or with restricted mobility. Vertical lift equipment and related services are an integral part of the accessibility chain of buildings and society as a whole. There is a growing trend in our population: people live longer. The disabled require access and both groups, senior citizens and people with disabilities want safety without the need for supervision. People do not want to leave their homes where they have been living for many years due to age and mobility problems. The lift should be audited against a checklist. The distinguishing proof of the dangerous situation can be completed over the span of any periodical study or extraordinary examination on a given establishment, but just in fact equipped and adequately prepared people ought to be permitted to do these examinations. This can be subjected to public controls. Once the powerless purposes of the establishment have been recognized through this

professional dynamic evaluation or safety review, upgrades can be made by a stepwise upgrading which can naturally be combined with any modernization being carried out. Also, preventive maintenance and repairs are a necessary ongoing process.

### ***Introduction and Summary of Work***

The Metropolitan area Authority (the Authority) is responsible for the operation, maintenance and repair of). The Authority's objective for the Elevator, Escalator, Moving Walk Systems ("EEMWS") is to give protected, high caliber and stable administrations to all Airport clients and to accomplish amazing consumer satisfaction.

The Authority's Objectives to achieve this objective are as per the following:

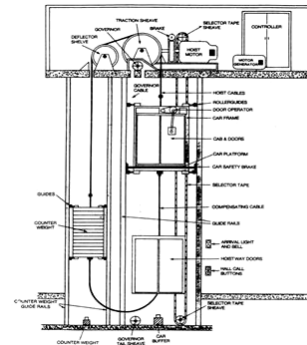
- To achieve EEMWS activity and on location support and repair works through a single administration temporary worker.
- To keep up EEMWS in safe and stable condition consistently.
- To react to benefit calls and play out the necessary repair or activity successfully and productively.
- To set up and execute a compelling quality control program that outcomes in a continuous change in system execution.
- To know the operational status and practical execution of the EEMWS consistently.
- To keep up precise gear upkeep and repair movement documentation and records.

Terminal B/C lifts, elevators, and moving ended up operational. The Terminal a Pedestrian Tunnel elevator, escalators and moving walks became operational. Two lifts located in were installed. Units located in the outbuildings were installed.

### ***Full Maintenance and Repair Services***

The Contractor should be in charge of performing out all upkeep and repair work required to keep up with the condition prescribed by the original equipment

manufacturers recommended guidelines to include all items, fixtures, lights, receptacles, switches, finishes, components, systems and subsystems erected hoistway construction and machinery rooms/enclosures of elevators, escalators and moving walks. The Contractor shall maintain all equipment covered by this contract in compliance with the requirements and all other applicable codes, laws, and regulations.



### ***Full Maintenance and Repair Services***

The following work items/repairs shall be included as part of Base Services and shall be performed at no additional cost.

- Re-set activated safeties
- Re-set activated fireman's recall
- Respond to equipment running on arrival
- Respond to entrapments
- Requests for unit shutdowns or restarts
- Requests for access to equipment from MWAA maintenance sections
- Removal of foreign objects(i.e. keys, identification badges etc.) from equipment pits

Requests for administration will be dispatched by the Authority to the Contractor. In any case, the Contractor might likewise be in charge of starting and finishing expected repairs to redress all inadequacies that they find while

### ***Preventive Maintenance Services***

As a significant aspect of Base Services, the Contractor might perform and keep up a point by point cyclic

preventive upkeep program for the assignments indicated in Appendix F of the SOW. The preventive upkeep program should comprise of the following three sections:

- Schedule
- Task and Frequencies
- Corrective Action

The Contractor might take after the Authority's CMMS created preventive maintenance schedule. The Authority will give the Contractor standing work orders for the planned preventive. Support administrations toward the start of every month. The Contractor might play out these preventive upkeep work arranges inside give or take from the last cyclical date the maintenance was performed. Should the Contractor have recommended changes or additions to the preventive maintenance schedule, the contractor shall notify the writing and provide complete information and justification for the changes.

#### ***Inspection Support***

As part of Base Services the Contractor shall provide security code review support services during the agreement time frame to help the Authority in achieving planned and unscheduled post occurrence, fire device, standard, intermittent, and safety code inspections on all equipment covered by this contract. The Contractor might give all supervision, work, authoritative help, materials, instruments, parts, supplies, hardware, and transportation essential to accomplish this requirement.

The scheduled routine and periodic safety code inspections support shall not be performed by the onsite personnel assigned to perform the Services portion of this contract. Inspections shall be carried out in addition to Base Service tasks and responsibilities, and there shall be no delay or another impact on the performance of Base Service tasks and duties because of the safety code inspections support.

The Contractor shall notify them in writing when the repairs are completed and request a re-inspection. The Contractor shall document all violations discovered during

the safety code inspections using the Barcode System, create a work order for all violations/deficiencies and notify them before the end of the shift on the day they were discovered.

#### ***Contract Services Call Order***

All Supplemental Services shall be requested and approved in advance by the COTR using the "Contract Services Call Order" form shown in Appendix. The Call Order will contain a point by point depiction of the administrations that are required from the Contractor.

The Contractor should give the point by point cost gauge including an organized breakdown for all work, parts and materials and dispatching and in addition a calendar with basic turning points for finishing the work to be recorded on the Call Order. Work rates included in the agreement value plan for the agreement will be utilized as a part of setting up these assessments. Both the cost breakdown and schedule should be made part of the Call Order. The Contractor might not continue with any work portrayed in such Call Orders until approved ahead of advance and writing.

#### ***All Hoisting and Lowering Equipment***

No elevator, dumbwaiter, escalator, gravity elevator, hoist or man lift should be built and introduced without an allow from the Department. The designer, temporary worker, proprietor or maker in charge of such establishments should record with the Department designs in triplicate, each demonstrating the area of the machinery and equipment together with an application for an allow in copy, on forms gave by the Department.

Speed governor and safeties, overhead and pit clearance, type of buffers, machine, and overhead grating, the weight of the machine if over mounted, the material, quality and spans of overhead supporting members, and the construction of shaft waygates or doors, and car gates or doors, where required.

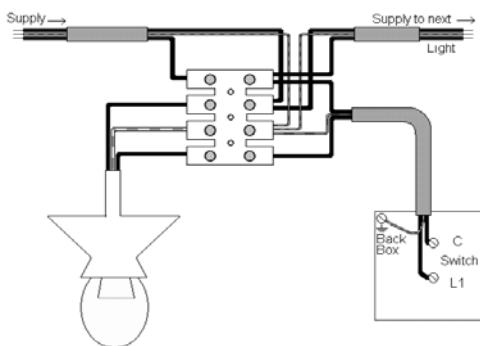
### ***(i) Operation of Elevators under Fire or Other Emergency Conditions***

Automatic lifts serving three or more landings in line and having the travel of feet or more above the lowest grade elevation shall conform A three position on, off and bypass keyed switch might be given at the primary floor to every single elevator or each group of elevators. At the point when the switch is in the "on" position, lifts controlled by this switch which is on programmed benefit might return constant to the first or approved floor, and the doors shall open and remain open.

A lift stopped at a landing might have its "Emergency Stop" switch rendered out of commission when the doors are shut, and it heads toward the first or endorsed floor. A moving lift, setting out to or far from the first or endorsed floor, should have its "Emergency Stop" switch rendered out of inoperative quickly.

### ***(ii) Lighting and Electric Wiring***

The cars and landing floors or platforms of elevators, dumbwaiters, escalators, gravity elevators, hoists and man lifts should be continuously enlightened of the task. The base force of light on the auto and landing floors should be five foot-candles. In another establishment, sufficient lighting should be given in all machinery space to which get to is required for support or investigation, for example, machine rooms, penthouses, pits, optional levels and sheave rooms.



Lighting and Electric Wiring

There shall be an approved, enclosed fused mainline or circuit breaker switch in the machine room located adjacent to the entrance door. The substitution of wire or other current-carrying devices in place of the proper fuses or circuit breakers is prohibited.

### ***(iii) Combination Elevators***

Lifts proposed for both cargo and traveler benefit should be developed, introduced and worked in congruity with the requirements for traveler lifts, aside from that balanced and vertical two-speed sorts of landing entryways and vertical-rising auto doors might be utilized as given in subsection when not of the semiautomatic kind and when equipped with locking devices, as required.

The requirements for new passenger elevators, except that counterbalanced biparting and vertical two-speed types of landing doors and vertical-rising car gates may be used as provided for in subsection when not of the semiautomatic kind and when equipped with locking devices as required Biparting or vertical-working entryways and vertical-rising auto doors are precluded at the shaftway openings of blend cargo and traveler lifts through which general society is enabled access to the elevator car.

### ***General Requirements***

#### ***(i) Shaft Way Construction***

The shaftways of new traveler lift in buildings more than two stories in stature might be encased by consistent dividers of fire-resistive development, aside from when overhead loads are carried on steel or point press tower or by the essential parts of the working, in which case fire-resistive drapery dividers might be given in lieu thereof. There might be no openings other than those for flame resistive entryways, windows, or skylights.

The open spaces in such grille or latticework should be with the end goal that a ball two creeps in distance across won't pass, and the wire or material utilized might not be not exactly standard steel wire gauge. While verging on stabilizer runways, or while moving parts are inside four

crawls of such walled in areas, the open spaces might be with the end goal that a ball 3/8 inch in the distance across won't pass. Machine room entryways might be continuously bolted, aside from when repairs are being made or when the apparatus is being assessed or adjusted. Oil-electric pump units introduced in storm cellar territories don't require a machine room if the controller is encased in a fire-resistive bureau outfitted with a bolt and the pumping unit is appropriately guarded.

#### ***(ii) Shaft Ways Shorter than Buildings***

Traveler lift shaftways which are required to be of flame resistive development and which don't reach out to the full stature of the building should be secured with a fire-resistive, unpaired covering.

No elevator Shaft ways shall be used as a thoroughfare when the elevator is above or below the landing or when the lift is at the landing, except upon special permission of the Department. Existing shaftways used as thoroughfares may be required to be removed or reelected in new locations or their use as thoroughfares abandoned.

#### ***(iii) Overhead Protecting Platforms***

A substantial iron working platform capable of sustaining a live load of not less to the square foot shall be securely fastened underneath the overhead machinery of all passenger elevators, except when a reinforced concrete roof or ceiling is located beneath such mechanism. The most significant measurements of the open spaces in such a stage might not be in excess of one inch, aside from the fundamental open spaces for cables. Stages might cover the whole zone of the shaftways, except when such area exceeds, in which case the platforms may be provided under that portion of the shaftway occupied by machinery, including vibrating, deflecting, and secondary sheaves.

If doors are placed in platforms, they shall be accessible from the top of the car and hinged, so they open upwards and self-close automatically. Underslung elevators constructed so that no elevator overhead sheaves, hitches, governors or other elevator equipment occurs directly over

the car may be erected without an above working stage, gave the senator is made effortlessly available from some point other than through the shaftway.

#### ***(iv) Landing Doors and Locking Devices***

The shaftways of passenger elevators shall be equipped with landing doors. The first or most minimal landing door of all lifts aside from programmed control, double control, or double-button control lifts might be given a removable administration scratch by which the door might be opened when the auto is at that arrival.

On the off chance that a lift is introduced in a single shaftway, the crisis key might open all shaftway entryways. This run additionally applies to existing establishments when new landing entryways are introduced. A notice might be put on or over the walled in area for the key, such that the key isn't to be utilized aside from in the event of an emergency.

#### ***Definition of Safety Signs***

Understand the following safety signs and their meaning. These signs are vital to alert the operators and users about the hazardous actions or locations.

Seriously injured means blindness, injury, burn (high-temperature and moderate-temperature), electric shock, fractures, poisoning, etc. with long-lasting effects or that require hospitalization and long-term hospital visits for treatments.

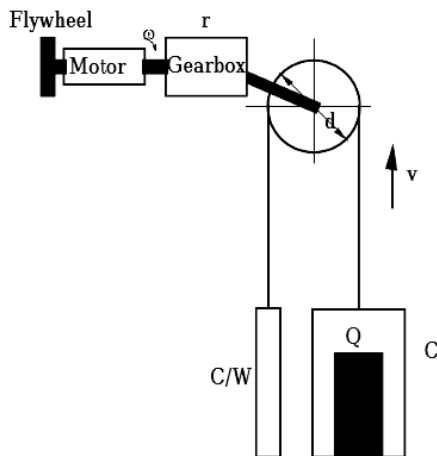
- Failure to follow or apply the operating or handling instructions contained herein
- Inappropriate maintenance, inspections, and repairs
- Unauthorized alterations to the elevator
- Use of parts other than those provided or specified by Toshiba

#### ***Loading Requirements of Lifts and Escalators***

Most of the lifts and escalators are typically introduced in a building or frame some portion of a building. Particular thought should be paid to the loading of an elevator or an

elevator which may have on the building for works concerning the installation, modification or demolition of the lift or the escalator.

The RP ought to be told of any adjustment in loading prerequisites emerging from any repair or change work which surpasses the resistance of the first establishment detail of a lift or an elevator and there is the need to draw in an AP or RSE as per the necessity of the Buildings Ordinance, to review the impact of the change in loading on the building structure.



Loading Requirements of Lifts and Escalators

**(i) Lift, Escalator, and the Associated Equipment or Machinery**

The definitions of "lift" and "escalator" under of the Ordinance give the non specific nature of the offices. When it alludes to exercises including the lift or the elevator all in all, subordinate gadgets under the name of the "related equipment or machinery" of the lift or the escalator should also be taken into consideration.

Therefore when a thorough examination of a lift or an escalator, and the associated equipment or machinery of the elevator or the elevator is required to be made, the detailed examination should cover all the equipment and components of the lift system or escalator system as a whole.

**(ii) Work to be Carried Out by Two or More Lift Workers**

RCs must ensure that the following lift works (other than for stair lifts and vertical lifting platforms) are carried out by two or more lift workers as required

- Releasing passengers trapped in a lift car which stopped outside the unlocking zone;
- Manually releasing the brake of the traction machine of an electric lift, or operating the manual emergency lowering or ascending device of a hydraulic lift
- Works in the lift pit
- Maintenance of the counterweight assembly
- Carrying out maintenance works, while the elevator is in motion, which cannot be performed by the worker who is controlling the movement of the lift.
  - Safety gear, pawl and clamping devices;
  - anti-creep device and hand pump;
  - rupture valve, one-way restrictor, manual lowering valve; and
  - hose/ pipework.

**(iii) Relationship of Lift Works or Elevator Works with Building**

"Lift works" is characterized in of the Ordinance to incorporate any work concerning the establishment, charging, examination, support, repair, alteration or demolition of a lift or any related hardware or apparatus of a lift. Though "lift works" is characterized to incorporate any work concerning the installation, commissioning, examination, maintenance, repair, alteration or demolition of an escalator or any associated equipment or machinery of an elevator.

The avoidance of doubt, preparation and backfilling of structural openings, provision of concrete plinths, arrangement of fire-resistant lift shafts, machine room doors, machine room ventilating system, power sockets, lift waterproof pit works, lifting I-beams at the machine room, etc.

#### ***(iv) Safety Training to Hot Work Supervisors and Workers***

Hot work supervisors and workers should have received training on fire safety. Hot work supervisors should have attended fire safety training course organized by recognized institutions, e.g., the Occupational Safety and Health Council.

Welding workers who are to carry out welding work concerning lift works or escalator works should have attended safety training courses covering fire safety aspects.

#### ***(v) Suspension of Lifts or Escalators from Service***

RCs should remind its QPs to take necessary safety precautions in carrying out work, in particular when any safety circuit of an elevator or an escalator is bypassed or interfered. If that is the case, the lift or the escalator should be taken out of service to prevent people from using the facility. The QP should display a warning sign to warn others not to use a lift or an escalator when the elevator or the escalator is removed from service. A lift or an elevator is to be come back to ordinary activity following completion of work and just in the event that it has been found out that there is no individual, instrument, get to equipment, and so on., in the lift shaft including lift transporter and best of the bearer, or apparatus space of the lift.

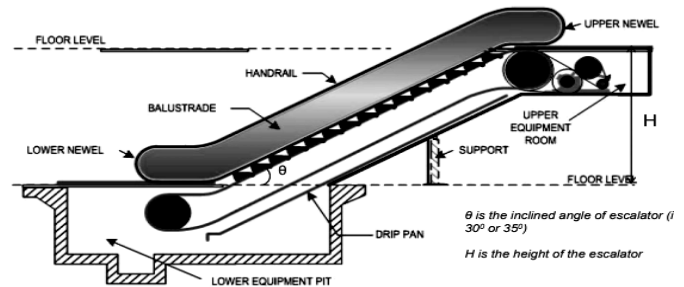
#### ***(vi) Matters Relating to Installation of Lifts or Escalators***

Installation of an elevator or an escalator is required to be undertaken by an RC who may in turn subcontract the works to a person who is not an RC. The RC can subcontract the work, but cannot subcontract its liabilities to the subcontractor. Disregarding whether the installation works are carried out by an RC or not, the actions are required to be under the quick supervision of a QP at the place at which the works are carried out.

#### ***Testing and Commissioning of Lifts or Escalators***

Upon completion of installation, the RC undertaking the actions is required to test and commission the lift system or the escalator system to confirm that the installation works are completed following the design specifications. The test

and commissioning include checking the electrical connections, power supply system, control and monitoring system, the functioning of individual components and smooth operation of the lift or the escalator and the associated equipment or machinery as a whole in accordance with design specifications and parameters drawn up by the manufacturer of the elevator or the escalator.



#### **Testing and Commissioning**

Test results should be recorded appropriately and incorporated into the operation and maintenance manual for the lift or the escalator. Test records should be made available for reference of the RE-appointed for undertaking the thorough examination of the elevator or the elevator.

#### ***Maintenance of Lifts and Escalators***

The definition of "maintenance works" is provided of the Ordinance to mean works that are for keeping a lift or an escalator, and the associated equipment or machinery of the elevator or the elevator, in safe working order, including any inspection, cleaning, oiling, adjusting, repair, replacement, and alteration of the lift or the elevator, and any of the associated equipment or machinery of the elevator or the escalator for those purposes. The RP is required under of the Ordinance to ensure that an RC undertakes maintenance of a lift or an escalator.

#### ***Safety Components for a Lift or an Escalator***

Copies of type-examination certificates relating to an elevator, an elevator or safety components for the lift or the escalator of a particular brand and model should be available, at the latest, before the commissioning of the lift,



the escalator or safety components. These test certificates should relate to type-examinations carried out by an independent body. A set of type-examination certificates issued by an independent testing institute (same as an independent body) as approved by the Director on the lift, the escalator, or safety components used by the elevator or the escalator should be provided.

(a) For safety components of lifts as provided for in Schedule 2 to the Ordinance

- Safety gear
- Over speed governor
- Door locking device
- Buffer
- Ascending car over speed protection means
- Unintended car movement protection means and
- Safety circuit containing electronic components.

(b) For safety components of escalators as provided for in Schedule 2 to the Ordinance

- Step or pallet

***(i) Lift Works or Elevator Works Involving Significant Alteration***

To facilitate monitoring of fire safety in existing buildings, in addition to the Director, the Commissioner for Lab our should also be notified before the commencement of any lift works concerning significant alteration to or replacement of an elevator in an existing building.

The standard notice should also be forwarded to the Fire Services Department and the Buildings Department if the compartmentation of the lift well will be breached, or there will be replacement or removal of lift landing doors or erection of scarf fording in the elevator well.

Over the span of huge adjustment or substitution works including the arrival entryways of a lift, the fire safety requirements for ensuring the honesty of lift shafts keeping in mind the end goal to repress the spread of flame between floor compartments through the lift shafts and openings as given in the Practice Note for Authorized Persons and

Registered Structural Engineers issued by the Buildings Department would be watched.

***Computerized Maintenance Management System***

The Contractor should use for the term of this agreement the Authority provided Computerized Maintenance Management System (CMMS) which will schedule and generate work orders for all maintenance and repair activities performed for each bit of hardware secured under this Contract. The Authority will retain a management role over the system.

The CMMS will create preventive upkeep work arranges every month. The Contractor should be in charge of finishing off work organizes by contributing all applicable data information in the CMMS that identifies with work performed by the Contractor. If access to the CMMS program isn't accessible from the Authority, the temporary worker should meet this necessity by giving the required data on paper duplicates of the work orders, which will be given by the Authority.

***(i) Electric Passenger Elevators and Lift***

Electric passenger elevators and lift operated by polyphase alternating current motors shall be provided with relays of the possible type or other approved devices which keep the beginning of the motor if the stage turn is in the wrong course, or if there is a disappointment in any stage. No potential difference more than shall be used in connection with the car switch or automatic control circuits of electric passenger elevators and lift. At the point when coordinate current is the main accessible wellspring of energy supply, and it is impracticable to keep inside this requirement, the application may be made to the Department for special permission to use a higher voltage. The full information shall be given with every request for a special permit. When step down transformers are utilized as a part of association with substituting current auto switch and programmed control circuits, they might be of the two-winding type.

A crisis switch might be introduced in each electric lift auto aside from programmed control. Such crisis change might work to openit wiring.

### ***(ii) Automatic Control Passenger Elevators and Lift***

Programmed control traveler lifts and lift should not be developed and introduced unless an extraordinary allow is first acquired from the Department. Their utilization is constantly subject to any exceptional directions connected to them by the Department for the assurance of the general population and utilizes. The arrival entryways of programmed control traveler lifts might be equipped with endorsed interlocking switches so arranged that the elevator car is held unflinching while any arrival door is opened or opened, thus that such entryway or doors are not opened after the elevator car has left the arrival.

The cars of automatic control passenger elevators and lift shall not have openings on more than two sides. Sliding or rolling doors or collapsible gates are required at all car openings, and such entrances might be furnished with changes so associated with the auto control circuit as to hold the auto relentless while the entryways are open.

### ***(iii) Subcontracting of Lift Works or Escalator Works***

An RC who has undertaken any lift works or escalator works is required under of the General Regulation to notify in the specified form the Director of subcontracting of lift works or escalator works before any of the tasks outsourced is to commence. The RC who outsources any works concerning the maintenance of a lift or an escalator is required under the General Regulation to notify the Director in the specified form not later than before the date on which maintenance works subcontracted to commence for the first occasion.

The Director to review the work arrangement and, where necessary, to acquire additional information from the RC to ascertain that sufficient workforce, adequate equipment, and tools, appropriate safety measures, etc., are in place for the works.

The notification requirement applies to subcontracting of lift works or escalator works to an RC or a person who is not an RC. To enable the RP to have access to subcontractor information, an RC who has subcontracted lift works or escalator works to another person should enter into the log-book the name and contact details of the subcontractor and the scope of tasks being outsourced.

### ***Performance Incentives/Penalties***

In case of non-execution of work by the Contractor, the Authority's Contracting Officer will have the privilege to practice one of the accompanying alternatives inside ten calendars after the event of nonperformance.

- The Contractor shall correct such non-performance upon notification by the Contracting Officer, and the Authority shall make no deductions for non-performance.
- The Contractor shall reduce the monthly invoice when notified by the Contracting Officer of penalty action. When applicable, deductions shall be made following the following paragraphs:
  - EEMWS unit found not to comply with during Annual Safety Code Inspection per reinsertion.
  - EEMWS unit found not to comply with about safety devices per device.
  - Failure to respond to trouble calls and callback requests following the response time limits stated in General Requirements Response Times per occurrence.

Failure to document and provide unit hour meter readings following the contract requirements as stated Documentation and Reporting, Unit Availability.

### ***Shift Specific Unit Status Notification***

Toward the start of each move, the Contractor should inform the Work Order Desk and the COTR through email of all units the Contractor plans to expel from service during the change and identify all units that remain out of service. Toward the finish of the move, the Contractor

should inform the Work Order Desk and the COTR through e-mail of work which has been finished and identifies all units that remain out of service.

#### ***(i) Safety and Accessibility of Existing Lifts***

The community of the traveling public appreciates the mobility and access that lifts, escalators and moving walks provide to all groups in the society. They also expect that their journeys are as safe as possible. There is a need for new technical and social solutions to facilitate everyday life and to create an inclusive society.

Vertical lift equipment and related services are an integral part of the accessibility chain of buildings and society as a whole. Finally, lift attendants and caretakers are less, and therefore it is necessary to provide relevant safety features for the rescue of trapped persons.

The distinguishing proof of the risky circumstance can be completed over the span of any periodical overview or uncommon examination on a given establishment, yet just, in fact, skillful and adequately prepared people ought to be permitted to do these examinations. This can be subjected to public controls.

#### ***A Family of Lift and Escalator Expertise***

Regardless of whether it's a lift at the station, a dumbwaiter at the bistro, a traveler lift at the workplace, a stage lift at the library, an elevator in the shopping center, a moving walkway at the store, a supermarket lift at the bar or a stair lift at home. We are there discreetly helping life happen. We configuration, make, supply and introduce lifts to enable growth to stream. We do this with the most extreme look after our clients, our travelers, and our staff. Our items are quality designed, protected and stable and provided with the knowledge that we can maintain them and other manufacturers' products efficiently and locally via our service branches right across. By persistently putting resources into new innovations, new items, and our exceedingly prepared national workforce we convey esteem for-cash perfection. We are pleased to be an autonomous family organization whose pro item and administration

divisions give our clients master support appropriate over our portfolio.

#### ***Services for Lifts and Escalators***

We support operators and manufacturers at different stages of the equipment lifecycle, from design to operation.

#### ***(i) Advisory Services***

Our experts provide qualified technical statements based on Adie system. We offer advisory services in developing risk assessment reports, support with tenders, asset depreciation reports, project management and monitoring, expert witness services, incident investigations, expert reports, traffic studies, progress payment verification, and assistance with problematic installations.

Electric lifts, with regenerative variable speed drives, consume electrical energy when ascending full or descending empty. When they go up empty, or they slide full, the engine goes about as a break, and the mechanical vitality is changed into electrical dynamism and after that conveyed back to the system. The BMS (Building Management System) has to know the vitality utilization of the lift, how it impacts on the total use of the building and how much energy is returned to the network. The measures energy in both directions, it is easy to install and directly measures, covering most applications. The both imported and exported energy for CT measuring applications. Furthermore, the Mod bus RTU connection allows data transmission to the BMS.

#### ***Harmonic Distortion***

The lift/escalator/passenger conveyor installation shall not, by injection of undesirable waveforms into the electricity supply distribution system, adversely affect the power company's system or the electricity supply to other users or consumers. The Total Harmonic Distortion (THD) produced by the lift/escalator/passenger conveyor motor drive system measured at the isolator connecting the lift/escalator/passenger conveyor equipment to the feeder circuit of the building is limited to the maximum allowable

values specified in Table I. For lift installation, the THD shall be measured at the moment the lift car is moving up with rated load at its rated speed, For escalator/passenger conveyor installation, the THD shall be measured when the escalator/passenger conveyor is operating with no-load at its graded speed.

#### ***Internal Construction of Passenger Lift & Escalator Car***

Unless otherwise specified in the Particular Specification or on the Drawings, passenger lift car enclosure shall be of steel with a studded rubber floor to color and pattern as approved by the Supervising Officer or his/her Representative. The entire of the interior face of the car shall be of thick hairline stainless steel sheet with the etched pattern as approved by the Supervising Officer or his/her Representative.

The layout of the false ceiling and lighting fittings shall be subject to the approval by the Supervising Officer or his/her Representative. The fan shall be of a quiet running type having a noise level not higher than when measured at a distance of from the fan, and it shall be capable of handling at least air changes per hour of lift car volume, with car doors closed.

#### ***Emergency Lighting***

Every lift car shall be provided with emergency lighting operated by a rechargeable battery supply. The light shall be automatically switched on in the event of failure of regular power supply to the lift. One of the fluorescent luminaries, as specified in Clause, shall be the self-maintained emergency type with rechargeable batteries having a capacity sufficient to maintain the lighting for two hours upon failure of the standard lighting supply.

#### ***(i) Evacuation***

Cable car lodges might be outfitted with a trap door and either a rope stepping stool or boatswain's seat equipped for achieving the ground from the most highest point. Thought ought to be given to the arrangement of assistant crisis autos for the clearing of surprisingly tentative or invalid or

physically disabled passengers, or in cases of extreme heights. An auxiliary hauling rope or emergency care system shall be provided in cases of absolute height or hazardous terrain.

#### ***Examination of a Lift at Periodic Intervals***

At least the following examination activities should be carried out by an RE undertaking periodic thorough testing for a lift to determine whether the lift is in safe working order.

- Motor and its overload protection;
- Brakes and the braking components such as the hubs, spindles, and linkages to ensure there is no wear, corrosion or dirt accumulation affecting their satisfactory operation.
- Control equipment and safety devices;
- Interlocking devices, both mechanical and electrical, provided for the landing doors and car door;
- Over speed governor, safety gear, and other devices connected therewith

#### ***Examination of an Escalator at Periodic Intervals***

The escalator and its associated equipment or machinery in safe working request, at any rate the accompanying pertinent things are to be checked for proper condition, and took care of if essential, as per a schedule suggested by an escalator manufacturer.

- clearances between consecutive steps/pallets and between the steps/pallets and the skirt panels
- drums, pulleys and moving parts
- machine room cleanliness
- any irregularities in running the escalator/passenger conveyor
- safety devices, such as skirt panel switches, handrail inlet switches, emergency stop switches, broken drive/step chain devices, step sagging devices, comb plate switches, etc.
- main drive system

- step/pallet rollers

### ***Certificates Relating to a Lift, an Escalator***

Copies of type-examination certificates relating to a lift, an escalator or safety components for the lift or the escalator of a particular brand and model should be available, at the latest, prior to the commissioning of the lift, the escalator or safety components. These test certificates should relate to type-examinations carried out by an independent body. A set of type-examination certificates issued by an independent testing institute (same as independent body) as approved by the Director on the lift, the escalator, or safety components used by the lift or the escalator should be provided.

Safety components of lifts as provided for in the Ordinance:

- Safety gear
  - Over speed governor
  - Door locking device
  - Buffer
  - Ascending car over speed protection means
  - Unintended car movement protection means
- Safety circuit containing electronic components.

### ***Elevator and Lift Safety Tips***

#### ***(i) When Waiting for Elevators***

- Know your destination.
- Push the elevator or lift call button once for the direction you want to go in.
- Look and listen in for the signal reporting your car's entry.
- Know about health conditions that could add to falls or accidents.
- Stand clear of the lift entryways and stand aside to exiting travelers.
- In the event that the arriving auto is full, wait for the next car.
- Try not to endeavor to move in or quit closing door, wait for the next car.

- In case of a fire or other circumstance that could prompt an interruption in electrical administrations, take the stairs.

#### ***(ii) When Boarding Elevators***

- Watch your progression – the lift car may not be superbly level with the floor.
- Stand clear of the doors – keep garments and portable items from the opening.
- Hold youngsters and pets solidly.
- Travelers closest to the doors should move first when the car arrives.
- Push and hold the DOOR OPEN catch if entryways should be kept open, or approach somebody to push the catch for you.
- Never endeavor to stop an end door, wait for the next car.

Once on board, rapidly press the catch for your floor and move to the back of the auto to prepare for different travelers.

#### ***(iii) Before Entering the Lift***

- Know your FLOOR destination.
- Push the lift outside call catch once for the heading you WISH to go.
- Look or tune in for the flag declaring your car's entry.
- Stand aside to permit space for leaving travelers. Sit tight for the following car if the arriving lift is full.
- Try not to attempt to quit closing doors with anything, including hands, feet, sticks, and so on. Sit tight for the following Lift trip.
- Take the stairs if there is a fire or other circumstance that could prompt an interruption in electrical administration.

When entering and leaving lifts, take after these rules:

- Enter and exit precisely. Travelers closest the doors should move first.

- Once on board, rapidly press the catch for your floor, and move to the back of the car to make room.
- for different travelers.
- Hold children and pets immovably.
- Stand clear of the doors, keeping garments and portable items from the opening.
- Push and hold the DOOR OPEN catch if doors should be kept open, or approach somebody to push the catch for you.

*(iv) When riding on lifts, take after these rules*

- Remain once again from the door.
- Hold the handrail, if accessible.
- Focus on the floor markers and be set up to exit at your goal.
- In the event that the doors don't open when the lift stops, push the DOOR OPEN catch. In the event that the doors still don't open, ring the ALARM catch or use the telephone or intercom. Wait until qualified people can assist you.

#### IV. CONCLUSION

A new parameter has been introduced that measures the efficiency of the passenger transfer time denoted Elevators and Lifts. It represents how efficient the transfer of passenger is when alighting at the destination floors. The can be used in the calculation of the round trip time whereby it provides an accurate measure of the passenger transfer time. In general, the round trip time equation contains a passenger transfer element that accounts for the time taken up by a passenger in boarding and alighting. In this case, the can be used to amend the time required by a passenger to alight at their destinations by taking into consideration the time saving that results from simultaneous passenger alighting from both decks. A numerical example is given for some buildings to show the effect of the number of passengers per pack and the number of floors above the pair of main entrances on the value of the coefficient. It is

shown that the value of the factor increases with the increase in N and decreases with the growth.

#### REFERENCES

- [1] C. Carrillo, E. Díaz-Dorado, J. Cidrás and M.Silva-Ucha, "A Methodology For Energy Analysis Of Escalators", Energy And Buildings, Vol. 61, Pp. 21-30, 2013.
- [2] A.D. Almeida, S. Hirzel, C. Patrão, J. Fong and E. Dütschke, "Energy-efficient Elevators And Escalators In Europe: An Analysis Of Energy Efficiency Potentials And Policy Measures", Energy And Buildings, Vol.47, Pp.151-158, 2012.
- [3] L. Al-Sharif, "Modelling Of Escalator Energy Consumption", Energy And Buildings, Vol. 43, No. 6, Pp. 1382-1391, 2011.
- [4] J.M. Kuusinen, J. Sorsa, M.L. Siikonen and H. Ehtamo, "A Study on The Arrival Process Of Lift Passengers In A Multi-Storey Office Building", Building Services Engineering Research And Technology, Vol. 4, No.33, Pp. 437-449, 2012.
- [5] C. Patrão, A.D. Almeida, J. Fong and F. Ferreira, "Elevators And Escalators Energy Performance Analysis", ACEEE Summer Study On Energy Efficiency In Buildings, 2010.
- [6] L. Al-Sharif, "Experimental Investigation Into The Effect Of Mechanical Design Of An Escalator And Passenger Loading On Its Energy Consumption", World Congress On Engineering, London, 2008.
- [7] L. Ciocoiu, E.M. Hubbard and C. Siemieniuch, "Implementation Of Remote Conditioning Monitoring System For Predictive Maintenance: An Organizational Challenge", Contemporary Ergonomics And Human Factors (Ed.), Taylor And Francis. Conference Proceedings, 2015.
- [8] J. Koochaki and M. Bouwhuis, "The Role Of Knowledge Sharing And Transitive Memory System On Condition Based Maintenance Policy", IEEE International Conference On Industrial Engineering And Engineering Management, Singapore, 2008.
- [9] T. Eguchi, K. Hirasawa, J. Hu and S. Markon, "Elevator group supervisory control systems using genetic network programming", IEEE, 19th to 23rd Congress on Evolutionary Computation, Pp 1661-1667, 2004.
- [10] P. Cortes, J. Larraneta and L. Onieva, "Genetic algorithm for controllers in elevator groups: Analysis and simulation during lunch-peak traffic", Applied Soft Computing, Vol.4, No.2, Pp. 159-174, 2004.
- [11] G. Kavounas, "Elevating Analysis with Double Deck Elevators", Elevator World, Vol.37, No.11, Pp. 65-72, 1989.
- [12] R.D. Peters, "Lift traffic analysis: General formulae for double deck lifts", Building Services

- Engineering Research and Technology, Vol.17, No.4, Pp.209-213, 1996.
- [13] R.D. Peters, "General Analysis Double Decker Lift Calculations", Elevator Technology, Proceedings of the 6 International Conference on Elevator Technologies, Elevcon '95, Hong Kong March 1995.
- [14] L. Al-Sharif, "Calculating the Elevator Round Trip Time for the Most Basic of Cases (METE II)", Lift Report, Vol.40, No.5, Pp.18-30, 2014.
- [15] L. Al-Sharif, A.M. Abu Alqumsan and R. Khaleel, "Derivation of a Universal Elevator Round Trip Time Formula under Incoming Traffic with Stepwise Verification", Building Services Engineering Research and Technology, Vol.35, No.2, Pp.198-213, 2014.
- [16] L. Al-Sharif and A.M. Abu Alqumsan, "Stepwise derivation and verification of a universal elevator round trip time formula for general traffic conditions", Building Services Engineering Research and Technology, Vol.36, No.3, Pp.311-330, 2015.