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ED 16200-2013: ELEVATORS, DUMBWAITERS, AND ESCALATORS

Guidelines for Building Owners, Design Professionals, and Maintenance Personnel

August 2013

Mechanical and Electrical Engineering

Advisory and Practices (Professional Services) Directorate
Professional and Technical Service Management
Real Property Branch
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Public Information

Public Works and Government Services Canada is pleased to present the guidelines document *ED 16200-2013: Elevators, Dumbwaiters, and Escalators.*

The objective of this document is to serve as a guide to those involved in the design of new buildings, and the renovation, modernization or maintenance of existing buildings for federal government use. This document does not apply to leased buildings.

The document was developed by Mechanical and Electrical Engineering, Advisory and Practices (Professional Services) (APPS) Directorate, Professional and Technical Service Management (PTSM), Real Property Branch (RPB), Public Works and Government Services Canada (PWGSC), in consultation with specialists and engineering professionals in the regions.

Clients, building owners, property managers, design professionals, engineers and maintenance personnel should become familiar with this document and apply these guidelines in a consistent manner for federal projects throughout Canada.

This document is available in electronic format from the PWGSC RPB Publication's website at: **www.tpsgc-pwgsc.gc.ca/biens-property/publications-eng.html**.

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Le ministère des Travaux publics et des Services gouvernementaux Canada a le plaisir de vous présenter les Lignes directrices *IE 16200-2013 : Ascenseurs, petits monte-charges et escaliers mécaniques.*

L'objectif du présent document est de servir de guide aux personnes qui participent à la conception de nouveaux immeubles, et à la rénovation, la modernisation ou l'entretien d'immeubles existants à l'usage du gouvernement fédéral. Le présent document ne s'applique pas aux immeubles loués.

Le présent document a été élaboré par le groupe du Génie mécanique et électrique, Direction des conseils et pratiques (Services professionnels) (CPSP), Gestion des services professionnels et techniques (GSPT), Direction générale des biens immobiliers (DGBI), Travaux publics et Services gouvernementaux Canada (TPSGC), en consultation avec des spécialistes et des professionnels de l'ingénierie dans les régions.

Les clients, les gestionnaires immobiliers, les ingénieurs et le personnel d'entretien devraient se familiariser avec le contenu du présent document. Cela leur permettra d'appliquer les lignes directrices d'une façon uniforme dans les projets fédéraux partout au Canada.

Le présent document est disponible sur le site de publications de la DGBI de TPSGC a l'adresse : **www.tpsgc-pwgsc.gc.ca/biens-property/publications-fra.html**.

Pour obtenir de plus amples renseignements sur le présent document, veuillez communiquer avec :

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PREFACE

General

This document has been developed by the Mechanical and Electrical Engineering (M&E) group within Advisory and Practices (Professional Services) (APPS), Professional and Technical Service Management (PTSM), Real Property Branch (RPB), Public Works and Government Services Canada (PWGSC), in consultation with engineers and technical specialists from the regions.

Intended Audience

Clients, building owners, property managers, design professionals, engineers, and maintenance personnel should become familiar with this document and apply these guidelines in a consistent manner for federal projects throughout Canada.

Feedback

Comments, additional information, and suggestions for changes, corrections or recommendations that will improve this document are invited. For this purpose the attached form titled "Request for Changes" may be used and sent by e-mail, regular mail, or by fax to the address shown.

Conflicts

Any conflict between this document and the terms of reference, project brief, request for proposal (RFP), or other project documents shall be brought to the attention of the project manager for clarification as soon as it is noted.

Background

This document, ED 16200-2013, replaces the previous design standard titled "Elevators, Dumbwaiters, Escalators, and Moving Walks" that was published by Public Works Canada (now PWGSC) in March 1993.

With this current document, the title has changed to "Elevators, Dumbwaiters, and Escalators." This document was revised to serve as a guide to those involved in the design of new buildings, and the renovation, modernization or maintenance of existing buildings for federal government use.

Acknowledgments

We acknowledge the valuable inputs from technical professionals from the National Headquarters and from the Regions of the Real Property Branch, who took time to review and comment on this document.

ED 16200-2013: Elevators, Dumbwaiters, and Escalators

REQUEST FOR CHANGES

Type of change suggested

☐ Correction of information ☐ Deletion of information ☐ Addition of Information

Location of suggested changes

If necessary, photocopy relevant page(s) of this manual and attach to this sheet.

Page(s): _____ Chapter(s): _____ Paragraph No(s): _____

Details of suggested changes

Name: _____ Organisation: _____

Telephone No.: _____ Date: _____

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(Use additional sheets if necessary)

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TABLE OF CONTENTS

List of Tables

List of Figures

CHAPTER 1

INTRODUCTION

1.1 Purpose

1. This document outlines the design and maintenance guidelines for major vertical transportation systems in PWGSC buildings in Canada. It covers different types of vertical transportation, including passenger elevators, service elevators, freight elevators, dumbwaiters and escalators.

2. This document is intended to serve as a guide (good engineering practices) to those involved in the design of new buildings, and the renovation, modernization or maintenance of existing buildings for federal government use. It does not apply to leased buildings.

1.2 Definitions

The following terms, for the purposes of this document, are defined as shown below. Terms not listed below are used as defined in either the CSA B44 Code or the National Building Code of Canada, latest edition.

Barrier-free access: The access requirements of a site, building, and its facilities that can be approached, entered, and used by people, including those with physical, sensory, or cognitive disabilities.

Contract documents: The agreement between the Owner and the Elevator Contractor and any other related documents, such as specifications, drawings, etc.

Contractor or elevator contractor: Any person, firm, or corporation employed by the Owner to supply and/or install elevator, escalator, or dumbwaiter equipment.

Departmental representative: The PWGSC employee assigned the responsibility to administer, monitor, and/or review the quality of work and the progress of the vertical transportation equipment installation.

Density or population density: The number of persons for a given area. It is normally defined as the number of square meters of usable area per person. Thus, office buildings will have densities ranging from 14 to 28 m^2 per person with a typical figure of 18 being common.

Double-deck elevators: An elevator with two platforms, one on top of the other, each platform having its own cab, cab doors and door operator, car stations, position indicators, and other similar items.

Hall call registered time: The elapsed time between the hall call registration at an elevator lobby and the cancellation of the call by the arrival of an elevator.

The hall call registered time does not bear a direct relationship to waiting time. At the main floor of a busy office building, the hall call may never be registered because of the continual arrival of elevators and constant flow of passengers.

At a typical floor when the first person comes to the elevators, he will push the button and register the hall call; if other persons come to the elevators prior to the arrival of an elevator they will have shorter waiting times, but the call registered time will not change.

Handling capacity: The number of persons using the elevator system in a five minute period as a percentage of the building population on those floors serviced by the elevator system.[1]

The handling capacity is normally determined for the busiest five minutes of the morning peak, the busiest five minutes of the noon peak, and less frequently, the busiest five minutes of the evening down peak. A well designed system must properly serve each of the three.

Interval: The time between elevators arriving at the main floor.[2]

Load factor or car load factor: The ratio, expressed as a percentage, of the greatest number of passengers in the car during one round trip to the code-maximum number that the car can hold. The average load factor is the average for all cars and trips.

The load factor is normally determined for the busiest five minutes of the morning peak, the busiest five minutes of the noon peak, and less frequently, the busiest five minutes of the evening down peak.

The parameter is, in practice, derived from computer simulations.

Major component: Refers to traction machines, hydraulic machines, escalator machines, door operators, hydraulic jacks, traction cables, compensating cables, sheaves, safeties, governors, buffers, travelling cables, guide rails, slings, platforms, sills, entrances, escalator hand rails, escalator tracks, and escalator chains.

[1] Prior to the extensive use of computer simulations, handling capacity was sometimes defined as the theoretical capacity of the elevator system if one assumed a certain number of people travelling in each elevator and a given round-trip time. A calculation could then be made as to the number of people transported in five minutes; this was called the handling capacity. Using this definition, the handling capacity, expressed as a percentage = (300 × [Number of persons per elevator] × [Number of elevators] × 100 {Round trip time in seconds} × {Population serviced by the elevators}).

[2] Prior to the extensive use of computer simulations, interval was a frequently used measure of the quality of an elevator system. The interval is related to the round trip time in that the round trip time for an individual elevator of a group divided by the number of elevators in the group gives the interval. Interval is rarely used today and has been supplanted by the average waiting time as a measure of system performance. Apart from the errors, inherent in the use of the interval, that result from a purely arbitrary and artificial relationship between one elevator and the group of elevators, there is the additional complication that elevators do not always return to the main floor on each trip—as was the practice up until 1955. During the noon peak period, an elevator will frequently respond to a series of calls such that up and down direction reversals would take place without the elevator going to the main floor. The definition of a round trip is thus somewhat changed with the more modern dispatching systems.

Round trip time:	The time taken for a round trip; that is the elapsed time from the time an elevator starts in the up direction, reverses to the down direction, and next starts in the up direction.[3]
Service elevator:	An elevator rated as a passenger elevator but designed to carry both passenger and freight with its primary function being to carry freight.
Single-deck elevator:	The standard elevator configuration having one platform as opposed to the double-deck elevator.
Solid state motor drive:	An assembly of solid state devices such as silicon-controlled rectifiers or transistors designed to vary the voltage, current, or frequency of the power supplied to the elevator motor so as to control the speed and direction of the elevator.
Traction elevator:	An electric elevator employing a traction machine.
Shuttle elevator:	A passenger elevator arranged to serve floors other than the typical building floors, for example, the parking levels below the main floor, or the floors above the typical top floor.
Total performance of the work:	The time when the entire work, except for the warranty period, has been performed to the requirements of the contract documents as certified by the departmental representative.
Total trip time:	The time taken from the start of a passenger trip to the end. This figure is the sum of the waiting time and the travel time.
Travel time:	The elapsed time starting from the arrival of an elevator to service a waiting passenger until the passenger exits the elevator at his/her destination. This parameter is, in practice, derived from computer simulations.
Usable space or Usable area:	The space in an office building that can be used by people in the course of their normal duties. It excludes core areas, corridors, perimeter heating and cooling devices, walls, etc.[4]
Vertical transportation system and vertical transportation equipment:	The total assemblage of escalators, elevators, and dumbwaiters as used on a given project.

[3] Prior to the extensive use of computer simulations, round-trip time was assumed to be the time between two consecutive up starts at the main floor for a given elevator. This is somewhat meaningless today since elevators do not always return to the main floor each time.

[4] In cases where the building design is in the preliminary states and floor plans are not available, it is sometimes the practice to use a figure for usable area of 75% of the gross floor area. Care should be taken to re-evaluate the design based on the actual drawings—particularly in a high-rise building—since the percentage of usable area will vary considerably from the bottom to the top of the building. Thus in a sixty floor building, the low-rise may have under 70% usable area and the high-rise over 80%. This will strongly affect the number of elevators, their speed, and the number of floors served by each group.

Waiting time: The elapsed time between the arrival of a person at an elevator lobby and the arrival of an elevator capable of serving that person.

The average of the waiting times for all passengers at all floors (average waiting time) is the most significant factor in the design of an elevator system, since it is the parameter most noticeable to passengers. This parameter is, in practice, derived from computer simulations.

The average waiting time is normally determined for the busiest five minutes of the morning peak, the busiest five minutes of the noon peak, and less frequently, the busiest five minutes of the evening down peak.

The average waiting time will vary in a general way (it is not a linear relationship) in proportion to the number of people using the system and it has to be considered in conjunction with the handling capacity.

Work: The total construction and related services required by the contract documents.

1.3 Acronyms and Abbreviations

AC	Alternating Current
ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
APPS	Advisory and Practices (Professional Services)
ASME	American Society of Mechanical Engineers
CADD	Computer-Aided Design and Drafting
CCTV	Closed Circuit Television
CSA	Canadian Standards Association
dBA	Decibel
EMT	Electrical Metallic Tubing
FEO	Firefighters Emergency Operation
Kg	Kilogram
LCD	Liquid Crystal Display
LED	Light-Emitting Diodes
LULA	Limited Use Limited Application
m	metre
mm	millimetre
MRL	Machine Room Less
m/s	metre per second
NBC	National Building Code
NMS	National Master Specification
PWGSC	Public Works and Government Services Canada
ULC	Underwriters Laboratories of Canada

CHAPTER 2

GENERAL

2.1 Use

1. Provide elevators, dumbwaiters and escalators only where they can be justified as a functional requirement, including barrier-free design.
2. Arrange the vertical transportation/conveying system in accordance with "good elevator practice" and as herein described.
3. Support the choice of equipment by a computer simulation that models the expected elevator system demand and the call response efficiency of various configurations of equipment. Base the selection of equipment primarily on comparison of the average waiting time determined for each configuration.
4. Provide spare hoistways where future expansion or increased use may create a need for additional elevator equipment.
5. In office buildings over four stories high and where continuous service is important, provide redundant service to each floor.
6. To make buildings accessible to and usable by people with physical, sensory, or cognitive disabilities, provide buildings having two or more stories with passenger elevator service, in accordance with CSA B44, Appendix E and CAN/CSA B651.
7. Provide escalators, which are relatively expensive, only when warranted or supported by traffic study.
8. Provide escalators only for applications in which a high traffic volume must be transported within a low-rise structure or where desirable for aesthetic value, and only when their use is financially justified.
9. Provide dumbwaiters to complement and reduce traffic demand on the elevators in buildings where there is a large amount of small freight, such as books, records, food, or medical supplies, to be transported from floor to floor on a regular basis.

2.2 Codes and Standards

As a minimum, comply with the latest editions requirements of the following standards and regulations:

1. Canadian Standards Association (CSA)
    a. ASME A17.1/CSA B44 Safety Code for Elevators and Escalators
    b. CAN/CSA B651 Accessible Design for the Built Environment
    c. CSA B44.1/ASME A17.5 Elevator and Escalator Electrical Equipment
    d. CSA C22.1 Canadian Electrical Code
    e. CSA Z320 Building Commissioning Standard
2. National Building Code of Canada (NBC)
3. Provincial and/or local codes or regulations that govern the requirements of the installation
4. Health-and-safety-regulations with respect to all physical and electrical hazards to persons.
5. NEII (National Elevator Industry Inc.) Building Transportation Standards and Guidelines

2.3 Types

1. Classify the components of the vertical transportation and people moving system as passenger elevators, service elevators, freight elevators, escalators, LULAs, or dumbwaiters.
2. Classify elevators according to the drive type as gearless traction, geared traction, or hydraulic.
3. Classify traction elevators according to machine location as overhead, side-mounted, basement-mounted, or hoistway-mounted (MRL).
4. Passenger elevators may be further classified as observation elevators.
5. Passenger elevators may be further classified as shuttle elevators.
6. Passenger elevators may be further classified as single or double deck elevators.
7. Passenger elevators may be further classified as service elevators used to carry both passengers and freight.
8. Refer to **Appendix B** for more details on LULAs and MRL technologies.

2.4 Maintenance

1. Provide regular systematic examinations and adjustments, including repairs and replacements due to defects in materials or workmanship, and normal wear and tear, for a period of 12 months following the date of total performance of the work.

2. Keep the equipment in substantially good condition and maintain its performance as originally designed. Carry out maintenance inspections and tests in accordance with provincial regulations, CAN/CSA codes and the PWGSC Elevating Devices Maintenance Specification, as a minimum.

3. Ensure that the equipment constantly and consistently meets the standards specified for the original installation.

4. Provide weekly examinations where the equipment is used intensively, such as major office building passenger elevators and escalators. Provide semi-monthly examinations where equipment is used non-intensively, such as passenger elevators in small office buildings, passenger elevators in residential buildings or service elevators in office buildings. Provide monthly examinations where the equipment is used infrequently.

5. As a general guide, provide a minimum maintenance time per month, exclusive of time spent on repairs and service calls, of four man hours per traction elevator, two man hours per hydraulic elevator, and three man hours per escalator.

6. Provide call back service as required.

7. Provide and maintain a maintenance log book on the premises indicating specific tasks carried out, or utilize book supplied by PWGSC, if applicable.

8. Show, as a separate figure on the bid form, the maintenance cost in accordance with the vertical transportation Equipment Maintenance Contract.

2.5 Warranty

Warrant the equipment supplied and installed to be free from defects in materials and workmanship for a period of twelve (12) months from the date of total performance of the work.

2.6 Standard Equipment

1. Use standard equipment wherever possible, except where use of such equipment is not feasible or where standard equipment of the required configuration does not exist.

2. In any one project, use identical or similar layouts, designs, and components wherever possible.

2.7 Drawings and Specifications

1. Design to accommodate the equipment of manufacturers expected to bid on the work.
2. Do not include trade names in specifications.
3. Do not show registered industrial designs of equipment identified with a particular elevator contractor.
4. Do not specify patented equipment, or equipment unique to a particular manufacturer or elevator contractor.
5. Use Government of Canada National Master Specification (NMS), Division 14, as a guide for the specification of vertical transportation and people mover systems.
6. Provide the following information on elevator drawings:
    a. Plan view of each floor;
    b. Plan view of machine room, pit, and secondary levels showing space allowance and access;
    c. Plan view of hoistway showing size, construction, dividing beams and rail bracket support, entrance design, arrangement of counterweight, and any special hoistway conditions;
    d. Vertical sections of hoistway, entrances, pit, secondary levels, machine room, run by, and access doors;
    e. Details of structural support;
    f. Sill design, trap doors, trolley beams, and hoist beams;
    g. Fixtures and locations of fixtures, including hall buttons, car stations, position indicators, hall lanterns, central control consoles, car lighting, emergency car lighting, car telephone, and intercom;
    h. Hall entrances and car cab enclosures; and
    i. Other special details.
7. Provide the following information on escalator drawings:
    a. Balustrades;
    b. Truss covering (including truss loading weight);
    c. Access doors;
    d. Location of emergency stop and operating controls;
    e. Design details, such as balustrade panels (i.e., type of material, fixing and finish);
    f. Step design (i.e., demarcation, cleating);
    g. Plan and elevation views (i.e., sufficient description in architectural drawings to determine traffic pattern and volume); and
    h. Railing design (to protect floor opening).

8. Provide the following information on dumbwaiter drawings:
    a. Plan and vertical sections to indicate cab and hoistway design;
    b. Access doors;
    c. Machine location;
    d. Signal fixture location; and
    e. Entrance details.
9. Coordinate electrical, mechanical, structural, architectural drawings and associated specification documents to be compatible and consistent with Division 14 specifications.
10. Provide engineered general arrangement equipment layout concept design drawings and specification documents, bearing the signature and seal of a professional engineer registered to practice in the province where the work will be executed.

2.8 Wiring Diagrams and Layout Drawings

1. Specify three complete sets of prints and one complete CADD version of schematic wiring diagrams and layout drawings covering equipment as supplied and installed, including changes made at the job site.
2. Specify, as part of the schematic diagrams, a reference index ("road map") giving the location of electrical components and wiring interconnections for relay coils, relay contacts, field equipment, integrated circuits, etc., so that the position on the schematics of any of these devices can be readily determined.
3. Before final acceptance of the elevators, provide:
    a. Three (3) sets of as-built wiring diagrams;
    b. Three (3) sets of all final issue shop drawings;
    c. All drawings laminated or enclosed in plastic protectors and marked "as-built";
    d. Layouts stamped by a Professional Engineer registered in the province where the work is executed.
4. Provide one soft copy of the above information in AutoCAD format.
5. Mark up all field changes or additions to original wiring diagrams in red.

2.9 Loading Classes

1. Where heavy freight is to be regularly transported, provide class C2 loading or other C class loading as is appropriate.
2. Provide power-operated vertical sliding hoistway doors and power-operated vertical sliding car gates.

2.10 Machine Rooms and Hoistways

1. Paint machine room floors a light grey colour.
2. Finish machine room walls and ceilings with a dust-inhibiting surface.
3. Do not locate traction elevator machines in basement machine rooms or in machine rooms adjacent to the hoistway except where building conditions prevent the use of overhead traction machines.
4. Locate hydraulic elevator machines adjacent to the hoistway unless building conditions dictate the use of a remote machine room.
5. Provide means for the removal of major equipment components for repair, through either a trap door in the machine room floor connecting to the top floor served, or through access to the roof and then via a crane to the ground.

2.11 Operating Environment

1. Ventilate, air condition (where necessary) and heat machine rooms to maintain a temperature range between 10 °C and 29 °C.
2. Specify equipment to operate normally when the ambient temperature is between 3.5 °C and 36.0 °C.
3. When required, provide for traction elevator machine rooms, dust precipitators, and particle air filters having an efficiency of 95% for 0.3 micron diameter particles.
4. Provide, for hydraulic elevator machine rooms, filters designed to remove dust and oil from the air prior to exhausting it outside the machine room or returning it to the machine room.
5. Provide an electrical supply for the equipment having a voltage variation of not more than ±7% of the nominal voltage.
6. Specify equipment to operate normally with variations of up to ±10% in the electrical power supply voltage.
7. Provide means to absorb the regenerative power to prevent the elevator from attaining governor tripping speed, or a speed in excess of 125% of rated speed, whichever is less.
8. Provide means to minimize machine room noise and noise transmission so as to limit the increase in noise level with the machines running, with adjacent office space, to 10% above ambient, given a minimum ambient noise level of 48 dBA.
9. Specify the machine room equipment so that the increase in noise level with the elevator running, as measured by a meter positioned in the machine room, does not exceed 25 dBA. Measure this noise level using an ANSI type 2 sound level meter on the “A” scale with an “S” response.

2.12 Traction Machines

1. Provide geared machines for rated speeds up to and including 2 m/s. Provide AC gearless machines for rated speeds of over 2 m/s. Geared or AC gearless machines may be provided at 2 m/s.
2. Locate machinery, where possible, above the hoistway.
3. Contractor to submit the horsepower and torque ratings of the elevator motor with the bid.

2.13 Motor Drives

1. Provide regenerative solid state motor drives for traction elevators.
2. Specify electronic feedback circuits to limit the current through the motor and the solid state power devices. Arrange these circuits so that under low-voltage conditions the current limits are not exceeded.
3. Specify speed variation with rated load at not more than ±3%.
4. Specify safety circuits to prevent runaway in the event of closed-loop feedback circuit failure arranged so that:
   a. With a partial or complete loss of the feedback signal, the elevator will come to a stop before the governor jaws are tripped; and
   b. If the elevator is in the levelling zone with the door interlock circuit open, the elevator will come to a stop prior to leaving the levelling zone.

   Test circuits by opening the feedback circuit while the elevator is running at contract speed no load up and while the elevator is levelling into the floor no load up.
5. Specify means for dissipating the heat generated by the solid state power devices and means to shut down the unit in the event of overheating.
6. Specify protection against surge currents.
7. Specify the equipment design and installation so that any vibration generated is not transmitted directly to the building structure.
8. Specify the equipment to operate normally with variations of the normal power supply voltage so that power loss or power fade (brownout) does not cause fuses to blow or damage to the equipment.
9. Specify chokes and/or filters as required.

2.14 Rail Bracket Fastenings

1. Weld or bolt guide rail brackets to the steel frame structure.
2. Use inserts cast in place with the concrete in concrete structures or use self-drilling concrete anchors when fastening into solid concrete.
3. Provide concrete surrounds where masonry walls are used.
4. Provide structural steel column supports for rail bracket fastenings when elevators must accommodate industrial truck loading.

2.15 Hoist Ropes

1. Provide hoist ropes of sufficient number, size, and characteristics, supplied by qualified rope manufacturers. Use wedge terminations.
2. Where ropes are used in parallel to share a load, ensure that the ropes are from one manufacturing run.
3. Where Lang Lay rope is used, provide means during and after installation to prevent the ropes from turning. Do not use swivel connections.
4. Provide sufficient removable counterweight buffer blocking to allow adjustment for rope stretch without requiring cable shortening.

2.16 Safeties

1. Use safeties for car and counterweight as required, which release automatically when the car or counterweight, respectively, is moved in the up direction.
2. Arrange the safeties so that the car stops at both no load and full load on a safety test without excessive acceleration and without damage to the equipment.
3. Test the operation of the safeties on an annual basis by tripping the governor jaws with the elevator travelling at rated speed.

2.17 Auxiliary Braking Device

1. Use an auxiliary braking device to prevent uncontrolled ascent of the elevator.
2. Specify a device separate from and independent of the other elevator stopping devices (e.g., machine brake, car safeties).
3. Specify a device that applies to the machine traction sheave grooves or to the elevator lift cables and without damage or scoring.

4. Specify that the auxiliary braking device applies if:
   a. The elevator over speeds in the up direction;
   b. The elevator moves away from the floor in either direction with the doors open.
5. Specify the deceleration, effected by the auxiliary braking device, to between 25% and 100% of gravity.
6. Specify the device so that it is actuated at a sufficient distance from the buffer—relative to the speed of the elevator—so as to prevent the counterweight striking the buffer at a velocity in excess of the rated velocity of the buffer.
7. Specify a manually reset electrical switch arranged to disconnect power to the elevator motor and brake when the auxiliary braking device is actuated.
8. Specify a device capable of being applied for test purposes without damage to the device or to the other elevator equipment.
9. Specify that the device can be reset and the elevator put back into service only from the elevator machine room.

2.18 Compensation

1. Provide compensating devices where required, and always when travel exceeds 30 m, to limit total variation of motor current to 5% full load up to full load down.
2. At speeds up to and including 1.75 m/s, provide chain-type compensation, attached to the undersides of the car and the counterweight, to counterbalance the weight of the hoist cables and the unbalanced portion of the travelling cables.
   a. Provide chain of suitable length to allow an adequate loop in the pit.
   b. Supply encapsulated chain to minimize noise.

   At speeds greater than 1.75 m/s, counterbalance the weight of the hoist cables and the unbalanced portion of the travelling cables by steel cables, attached to the undersides of the car and counterweight, passing under a weighted sheave in the pit.

2.19 Controllers

1. Provide microprocessor-based control equipment for passenger and service elevators.
2. Provide microprocessor-based or relay-based control equipment for freight elevators.
3. Provide for group supervisory systems, microprocessor-based dispatching controls.
4. Where relays are used, provide those having a designed electrical life and mechanical life "equivalent" to thirty years' operation in the given application, with their contacts designed for maximum conductivity and wiping action.

5. Provide electronic time-delay devices that employ stable capacitors or crystals as the time base.
6. Specify that wiring on the controller, whether control or field wiring, should be installed in a neat workmanlike manner, and make connections to studs and terminals by means of solder or solderless lugs, or similar connecting devices.
7. Mark relays, contactors, fuses, and printed circuit board components, etc., clearly and permanently with designations as shown on the schematics.
8. Mount the designations for plug-in components on the controller adjacent to the component. Do not mount the designation on the plug-in component.
9. Locate electrical control equipment within ventilated metal controller cabinets with swing doors for easy access.
10. Provide direct current operated control and operating circuits.
11. Provide fully non-proprietary versions of all control equipment including:
    a. All required diagnostics are "on board".
    b. All programming and diagrams required for long-term maintenance are provided with the controller.
    c. The controller will not shut down or alter its functionality in any way after a pre-determined increment of time or use.
    d. Any elevator contractor should be allowed to purchase parts, supplies, diagrams, support, or training directly from the factory at the same cost level as the original installer. A published price list shall be supplied with the controller.
    e. Parts including circuit boards should be available for direct purchase from the factory in numbers and not on an one-for-one "exchange only" basis.

2.20 Conduit and Fittings

1. Provide insulated cables having a flame-retarding and moisture-resisting outer cover.
2. Where shielded cable is specified, provide conductors of not less than 22 gauge having individually shielded pairs with 100% shielding.
3. Provide colour or number-coded conductors in multi-conductor cables.
4. Provide waterproof terminal labels.
5. Provide stranded field conductors except for the individual conductors in multi-conductor cables, which may be either stranded or solid.

6. Provide flexible travelling cable to connect car operating panels and other car operating devices to the controller in the machine room.
    a. Supply cables with flame-retarding and moisture-resisting outer covers and stranded conductors.
    b. Supply cables approved for elevator use.
    c. Provide 10% additional spare conductors, as a minimum in each cable.
    d. Provide at least six pair, minimum 22 gauge, shield cable and one spare coax for audio, video or other electronic equipment.
    e. Terminate cables on terminal blocks having identifying numbers to facilitate replacement and service.
    f. Suitably suspend the travelling cables to relieve strain in the individual conductors (using a steel supporting strand if the suspended weight exceeds 35 kg).
7. Provide 10% spare conductors throughout the elevator wiring signal runs.
8. Provide, minimum 22 gauge, shielded cables for audio, video, or other electronic equipment, running from the top of the elevator cab to the car junction box, from the hoistway junction box to the machine room controller, and, if a central control console is provided, from the machine room controller to the central control console.
9. Provide a separate junction box with terminals for the connection of "non-elevator" devices, such as telephones, and connect from the elevator controller to this junction box as required.
    a. Mount this junction box on the side of one controller in the machine room, or at some designated point in the hoistway conveniently located for the external connections to be made.
10. Connect spares and shielded wires continuously from the point of origin to the destination using car, hoistway, controller, or other terminal blocks as necessary.
    a. Make no splices.
    b. For the shielded wires, use compatible connectors or terminal blocks designated to minimize signal deterioration.
11. Mark individual wires by numbered adhesive waterproof markers.
    a. Label groups of cables and multi-conductor cables with waterproof markers.
    b. Mark terminals with waterproof labels.
    c. Mark connections on intermediate terminal blocks with corresponding numbers.
    d. Attach waterproof, neat, legible lists, showing cable runs, colour codes, and number codes, to the controller.
12. Use threaded rigid conduit, electrical metallic tubing or other galvanized steel raceway.
    a. Provide a separate insulated grounding conductor in EMT.
    b. Use steel compression type fittings where electrical metallic tubing is used.
    c. Do not use flexible metallic conduit as a grounding conductor.

2.21 Emergency Power

1. Provide elevator emergency power, where required, to comply with code and/or functional operational needs.
2. Provide sufficient power to operate at least one elevator in each group of elevators at its contract speed and capacity.
3. Provide means to automatically return elevators to the main lobby, in sequence, to discharge passengers when the normal power fails.
4. Provide emergency power on the same lines and the same disconnect as the normal power.
5. Provide interconnection between the elevator controller and the emergency power supply controller to indicate to the elevator controller whether it is being supplied by normal power or emergency power.
6. After all cars are at the main floor with their doors open, select one elevator by a manual switch to run normally answering hall and car calls with its main floor hail lantern illuminated.
7. Normal safety devices including door open buttons, safety edges, and door-protective devices will remain operational.
8. Arrange that the elevator rotating equipment, motor drive, and control equipment are not damaged on changeover to and from emergency power because of phase difference.
9. Provide surge protection for all related equipment.

2.22 Levelling

1. Cause the car to stop automatically at floor level, without overshoot, regardless of load or direction of travel so that the car sill is within 5 mm level with respect to the hoistway sill.
2. Correct for over travel, under travel, rope stretch or oil loss by returning the car imperceptibly to the floor.

2.23 Temporary Use and Operation

1. Allow for, where necessary, temporary use of the equipment prior to total completion of the work.
2. Restore the equipment to new condition upon completion of temporary operation.
3. Protect the cab doors and interior finishes.
4. Provide necessary protective temporary hoistway partitions between the temporary car and other elevators and remove them upon project completion.

2.24 Hydraulic Elevators

1. Provide hydraulic elevators where overhead space is limited or where aesthetic considerations preclude the use of traction elevators, or for speeds of less than 0.76 m/s and for travels of less than 20 m.

2. Consider application of holeless hydraulic elevators or direct plunger hydraulic elevators for up to 10 m of travel. Do not use telescoping cylinders or piston-follower guides.

3. Provide microprocessor-based starters to limit the starting current to not more than 2½ times the full load running current.

4. Protect the hydraulic cylinder and associated buried piping against deterioration caused by chemical, electrolytic, galvanic, or other action, which may exist or develop in the soil, by means of:

    a. Cathodic protection of buried equipment by means of impressed current designed by and installed under the supervision of a professional corrosion control engineer. The related control panel should be located in the machine room;

    b. A plastic external container or a plastic liner for the cylinder; and

    c. A casing to the full depth of the excavation, of minimum 5 mm wall thickness, and of minimum diameter 100 mm greater than the hydraulic cylinder diameter for depths to 10 m or less, 150 mm greater for depths of 10–15 m and 200 mm greater for depths in excess of 15 m.

5. Set piping in sand in a covered floor trough and provide access to piping in all concealed spaces.

6. Do not use pipe couplings or fittings that are dependent upon friction.

7. Where fire or smoke production hazard is high, use fire-resistant hydraulic fluids in place of hydraulic oil.

8. Provide an automatic oil-recovery (scavenger) system.

9. Include the excavation for the cylinder in the elevator specification and allow no extra fees, should water, rock, boulders, quicksand, etc., be encountered.

10. Include replacement of the cylinder and buried piping in the subsequent maintenance contract entered into after the expiry of the 12-month maintenance period.

2.25 Motors and Protection

1. Provide an electric motor:

    a. Which will deliver its rated output continuously with a temperature rise not to exceed 50 °C;

    b. Which has, as a minimum, Class B insulation; and

    c. With manually reset integral overheating protection.

2.26 Firefighters Emergency Operation (FEO)

1. Provide FEO in all automatic elevators in accordance with CSA B44 and National Building Code of Canada, latest edition. In high rise buildings, as defined in the National Building Code of Canada, latest edition, provide FEO in all passenger and service elevators.

2. Arrange that FEO is initiated through a three-position firefighter's keyed switch, either automatically, by actuation of smoke detectors connected through the switch, or manually.

3. Emergency recall operation, either to the designated floor or to an alternate floor, should be in accordance with CSA B44, latest edition.

4. At typical floors, protect elevator lobbies against fire and hot gasses by means of fire-resistant doors, which would:
   a. Protect the elevators from the ravages of the fire to ensure continued elevator operation;
   b. Provide an area of refuge for staff;
   c. Provide a staging area for firefighting operations;
   d. Assist in equalizing pressure across the elevator doors; and
   e. Provide security of floor areas.

2.27 Two-Way Communication

1. Provide a hands-free, two-way communication device with an automatic dialler in each elevator, in accordance with CSA B44 latest edition. Connect the communication devices to the central control console, if permanently manned.[5]

2. If a permanently manned central control console is not available, connect the telephone to a central, permanently manned switchboard or station.

3. Make provision for a two-way communication device at each of the following locations:
   a. Car
   b. Machine room
   c. Central control room

4. Provide for the two-way communication device, complete with assistance button, as an integral part of the main car operating panel.

5. Provide hoistway wiring, travelling cables, car wiring, etc., for the device.
   a. Provide wiring of the twin conductor shielded type and ground all shields appropriately.
   b. Provide equipment and wiring compatible with and acceptable to the telephone company providing service to the project.

6. Arrange the device to operate for at least four hours if the normal building power supply fails.

[5] Usually this installation of telephone system is arranged by Departmental Representatives with a local telephone company for a leased line.

7. Provide an international telephone symbol to identify the assistance button with engraved bilingual signage "AIDE/HELP"
8. Provide an LED visual indicator on the car operating faceplate to illuminate when the call has been connected.
9. Provide hands-free emergency communications device containing an internal speaker and microphone to enable two-way communication with elevator passengers.

2.28 Emergency Lighting in Elevators

1. Provide battery-operated emergency lighting in car to CSA C22.2 N^{O}. 141.
2. Provide a lighting level of at least 11 lx of illumination at the car operating panels and telephone cabinets for a minimum period of four hours, using at least two lamps of equal wattage rating.
3. Cause the lamps to be immediately energized in the event of a power failure or electrical fault de-energizing the normal elevator lighting circuit.
4. Provide for the automatic disconnection of the lamps and the automatic recharging of the lighting unit when normal power is restored to the elevator lighting circuit.
5. Provide a rechargeable battery of the hermetically sealed type, or of a type that provides a reserve of electrolyte, capable of operating unattended and requiring no addition of water or electrolyte for a period of not less than three years, with provision for visual checking of the electrolyte level without opening the battery or removing caps or fittings.
6. Arrange the battery charging means to operate automatically upon restoration of normal power to the unit, to remain in operation until the battery is fully recharged and to maintain the battery at full rated capacity at all times when the unit is not in operation.
7. Provide a pilot lamp on each unit to indicate that the normal power supply, the unit, and the battery charging means are in operation.
8. Provide an emergency lighting test switch in the car service for the testing of the unit.
9. Install the unit as part of the car so that it is not readily removed.
10. Do not provide portable equipment.
11. Install the lamps out of view above the ceiling.
12. Connect car lighting circuits to the building emergency power system, where provided.

2.29 Elevator Alarm Bell

Connect the elevator alarm bell to the emergency lighting circuit.

2.30 Guides

1. Equip cars and counterweights with roller or slipper guides mounted at both the top and the bottom of the car or counterweight frame.
2. Spring load or flexibly mount the roller guides.
3. When car roller guides are used, statically balance the car so that, at the centre of the travel, with the top roller guides removed, the empty car hangs in the centre of the rails.
4. When counterweight roller guides are used, statically balance the counterweight so that, at the centre of the travel, with the top roller guides removed, the counterweight hangs in the centre of the rails.
5. When the equipment is in the position described in **clause 2.30.4** and the roller guides have been properly adjusted, arrange the equipment so that there is no pressure upon the rollers.
6. Adjust roller guides for even pressure upon any roller on the car at any point in the travel and not to exceed 12 kg.

2.31 Markings, Graphics, and Symbols for Bilingualism and Visual Impaired

1. Provide bilingual markings graphics or symbols in accordance with the National Signage Program and CSA B44. Refer to **Appendix A** for more details.
2. Provide markings, graphics, or symbols to meet the needs of the visual impaired in accordance with the National Signage Program and CAN/CSA B651.
3. Show all operational markings or symbols on drawings issued for tendering purposes.

2.32 Signal Illumination

1. Provide signal fixture lights having a minimum contrast ratio of 8:1.
2. Determine the contrast ratio by subtracting the brightness of the indicator background from the brightness of the marking (LED, LCD, or Lamp) and then dividing the result by the brightness of the background.
3. Arrange that the variation in intensity and contrast ratio between adjacent (i.e., Visible by the passenger at the same time) signal indicators does not exceed 5%.
4. Arrange that the variation in intensity and contrast ratio between car call registered lights within the car does not exceed 5%.
5. Make the measurements in normal ambient light.

2.33 Vandal-Resistant Design

1. Provide elevators resistant to abuse where installed in public non-supervised buildings, where public mischief is expected to result in malicious damage to equipment, or when elevators are designed to be used as service elevators.
2. Equip car interiors with removable panels, which can be readily removed and refinished. Alternatively, fabricate the car enclosure with rigidized stainless steel.
3. Provide hall and car pushbuttons of the metal mushroom-type or flush-mounted with minimum stroke.
4. Provide concealed fasteners, designed to discourage tampering. Where exposed fastenings must be used, provide specially designed spanner head or similar type screws.
5. Provide specially designed vandal-resistant telephones.
6. Locate key switches and key-operated devices in a locked service cabinet. Provide a cylindrical-key type lock for the service cabinet.
7. Do not use signal fixtures with separate indicating lights, rotating disk, or indicators.
8. Design publicly accessible elevator equipment as simply as possible with a minimum number of operating devices and accessories.

2.34 Stack Effect

1. On elevators with travels in excess of 30 m, provide means, as outlined below to minimize or eliminate problems caused by the stack effect.
2. Arrange the elevator entrances to minimize noise caused by the passage of air through spaces around the hoistway doors.
3. Provide means to either recycle the door operation or to increase the door closing force (within the limits of the code) in the event that the doors stall in closing due to air movement through the opening.
4. Provide seals around the machine room floor openings by means of closely fitting sleeves mounted around the traction cables, the governor cables, and the selector tape.
5. Seal all other machine room floor holes completely.
6. Provide sealed machine room walls and ceilings.
7. Provide closely sealed machine room doors.
8. Provide revolving doors or double sets of doors and similar devices to limit the flow of air into the building at the main floors.
9. Seal the curtain wall so as to limit the flow of air out of the building at the upper floors.
10. Provide closed loop-door operation.

2.35 Earthquake Design

1. Design the equipment and structure to withstand seismic acceleration per requirements of the National Building Code of Canada, latest edition.

2. Comply with the seismic design requirements of CSA B44.

2.36 Tourist Attraction

1. Analyze the potential of imposing structures as tourist attractions. Consider this possibility in the analysis, design and specification of the vertical transportation system.

2. Conduct this study concurrently with the elevator system computer simulation. Consider both system performance requirements and aesthetic value in the analysis.

2.37 Future Addition

1. Where all elevators of a single bank or group are not installed in a single construction phase or contract, select elevators for subsequent phases or contracts from the same manufacturer of the existing equipment and connect them to function as a single group.

2. Arrange in the initial contract for upset maximum prices, with escalation if necessary, for the future addition.

2.38 Elevators Modernization

1. Modernization is the process of upgrading the critical parts of the elevator in order to improve safety, operate efficiently, and give the aesthetics an up-to-date appeal for tenant satisfactions.

2. Different factors would lead to elevator modernization such as obsolescence, elevator is near or beyond expected life, performance of the unit is unacceptable, or newer technologies and code changes are being introduced that would affect the safety and operation efficiency of the equipment.

3. Modernization would affect mainly the controller equipments, the hoist machine and motors, electrical wiring, position indicators, as well as cab interior and buttons.

4. New equipment and/or materials used in modernization should be in accordance with the overall requirements of this guideline.

CHAPTER 3

OFFICE BUILDINGS—PASSENGER ELEVATORS

3.1 Arrangement

1. Locate elevators such that the maximum horizontal walking distance from the centre of the elevator core to a building entrance is 55 m.

2. Locate the hoistway such that the elevator core is approximately equidistant from public entrances. See **Figure 3.1**.

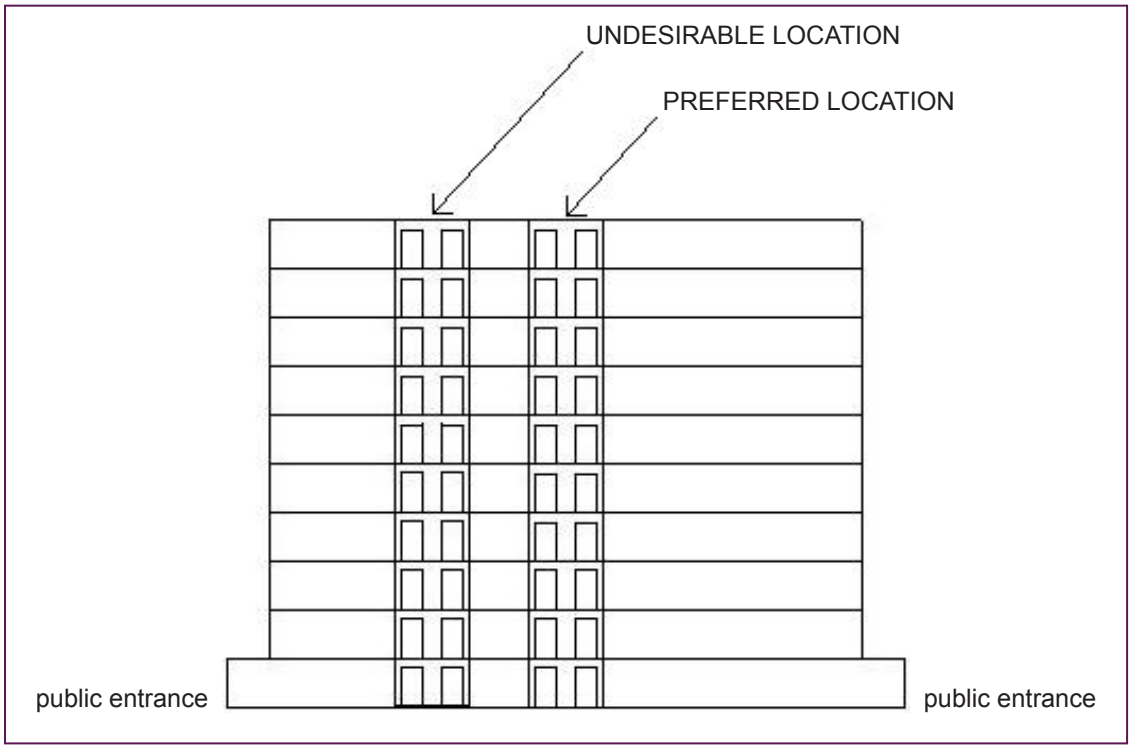

Figure 3.1: Preferred Elevator Core Location

3. Design elevator lobbies to be symmetrical by locating elevators of the same group either adjacent to each other, or directly facing each other on opposite sides of a lobby. See **Figure 3.2**.

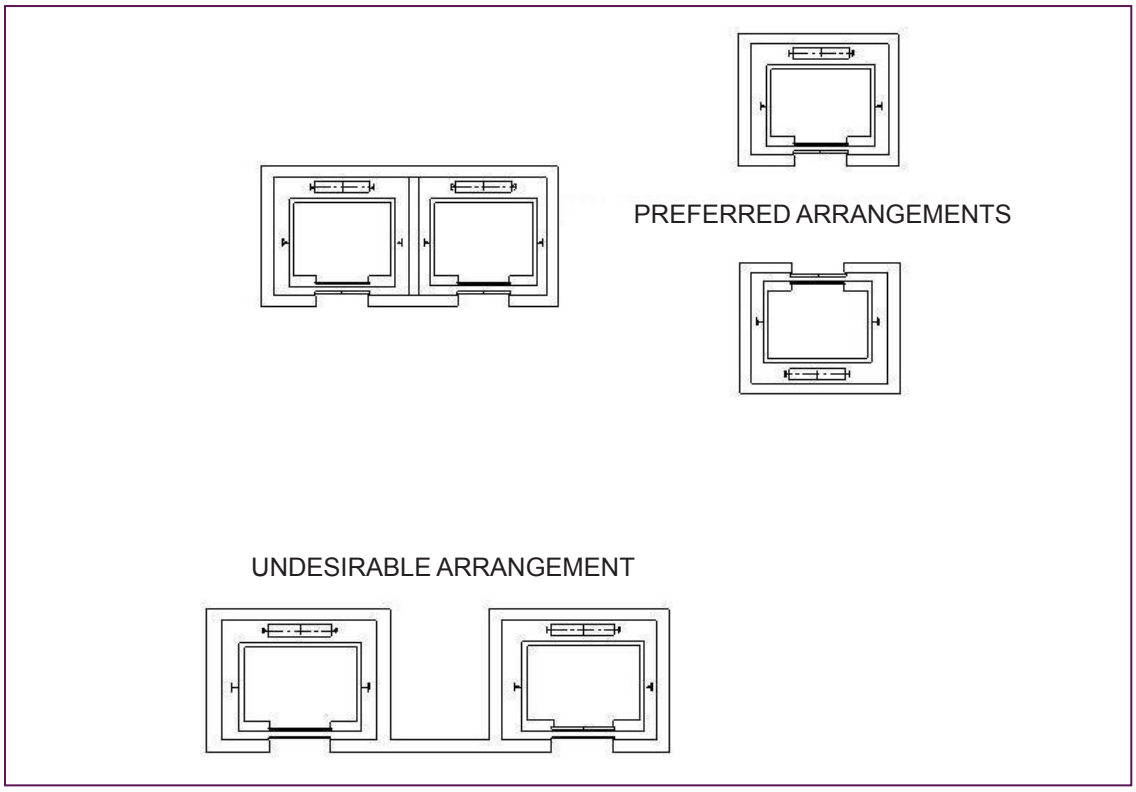

Figure 3.2: Symmetrical Lobby Arrangement

4. Arrange the hall lanterns and gongs to provide advance notice of arrival of an elevator in accordance with the following:
   a. For two cars in line, provide a minimum of three seconds advance notice.
   b. For three cars in line, provide a minimum of four seconds advance notice.
   c. For four cars in line, provide a minimum of five seconds advance notice.
   d. Do not stop for a hall call or allow a car call to be registered unless it is possible to provide the minimum advance notice.
   e. Avoid arrangements of a group of more than four elevators in line, or more than eight elevators in a single group.[6]

[6] Under these circumstances, unless special dispatching methods are employed, the elevator doors should be held open an extra length of time to allow sufficient time to walk the length of the lobby. The delay at each floor, multiplied by the number of stops, becomes significant and poor service results.

5. When multiple banks of elevators are involved, separate the lobbies, and where architecturally feasible or acceptable, use the closed alcove elevator lobby arrangement as shown in **Figure 3.3**.

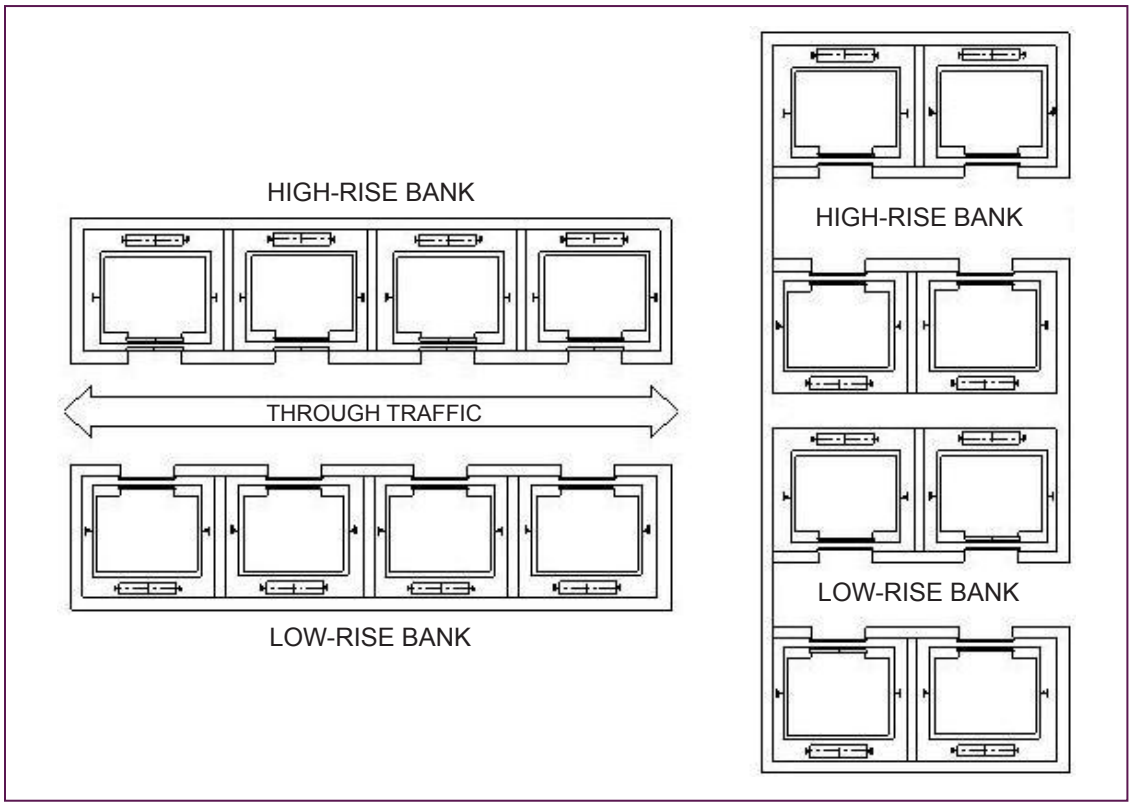

Figure 3.3: Open and Closed Lobby Arrangements

Table 3-1: Open and Closed Lobby Arrangements

Open	Closed
Through traffic interferes with waiting passengers.	No through traffic possible
Passengers have choice of direction and will interfere with one another, especially during peak periods.	Traffic moves in one direction, eliminating interference.
High-rise bank and low-rise bank are confusing.	High-rise bank and low-rise bank are separated and clearly defined.

6. Provide lobby widths as shown in **Figure 3.4** to **Figure 3.9**, depending upon the car size and number of cars.

7. It is preferable to arrange main floor lobbies so that through traffic will not occur or will be closed off to prohibit such traffic.

8. If, for architectural reasons, it is necessary to have the lobby for a group of elevators open at both ends thus allowing through traffic to mix with elevator traffic, allow only one group of elevators to use the lobby and arrange the lobby so as to discourage through traffic.

9. For an elevator group of six or more elevators, when through traffic cannot be avoided, provide lobby widths of twice the car inside depth as shown in **Figure 3.9**.

10. Do not exceed 60 m horizontal walking distance from the elevator lobby to the furthest office served by a group of elevators.

11. Unless double-deck elevators are being specified, do not provide more than one main lobby floor.

12. When two main lobby floors are unavoidable due to building design, arrange the elevators to serve only one of the two main lobbies—preferably the upper level—and provide escalators between the two main levels.

13. Avoid two or more main lobby floors because:
    a. Passenger loading and unloading is done more efficiently at one level as compared to two levels.
    b. The elevators will have, on almost every trip, one additional forced stop as a consequence of the dual lobby.
    c. Loaded cars may bypass the second stop.
    d. Group supervisory systems operate best with one main lobby.
    e. A partially loaded car may only be able to accommodate some of the waiting passengers at the second stop thus leading to user complaints and system delays as passengers attempt to board the loaded elevator.
    f. Passengers soon learn to board a down bound car in order to go up which causes additional delay due to the additional stop.

14. Locate cafeterias, restaurants, and similar heavy traffic generators at the main floor or at a floor served by escalators from the main floor, and this floor should not be served by the main elevator group or groups.

15. Arrange that all elevators of a group serve the same floors for normal passenger service.

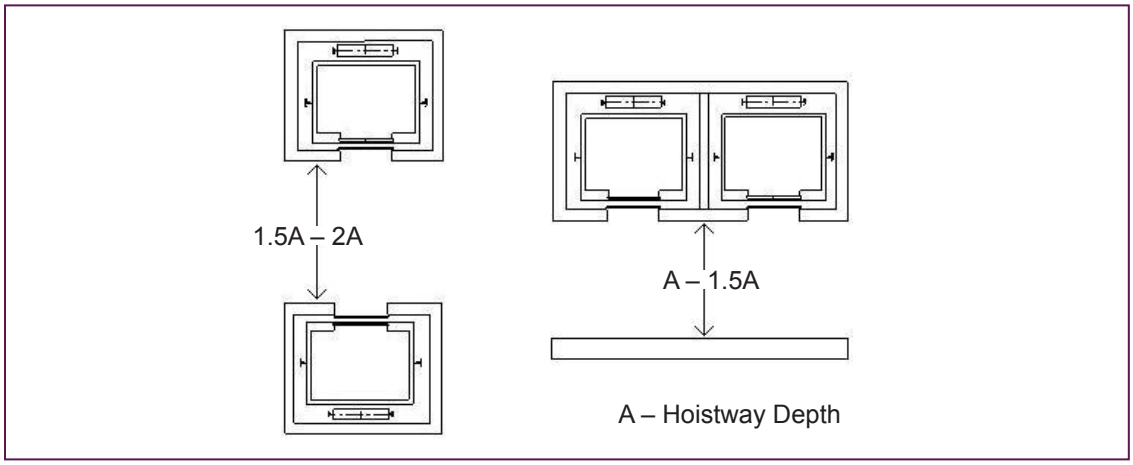

Figure 3.4: Two-Car Lobby Arrangements

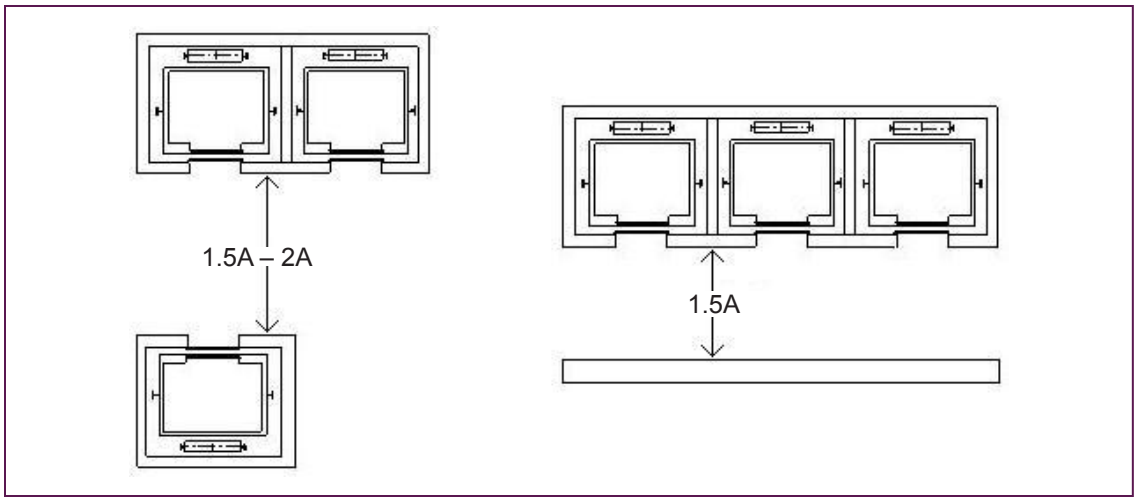

Figure 3.5: Three-Car Lobby Arrangements

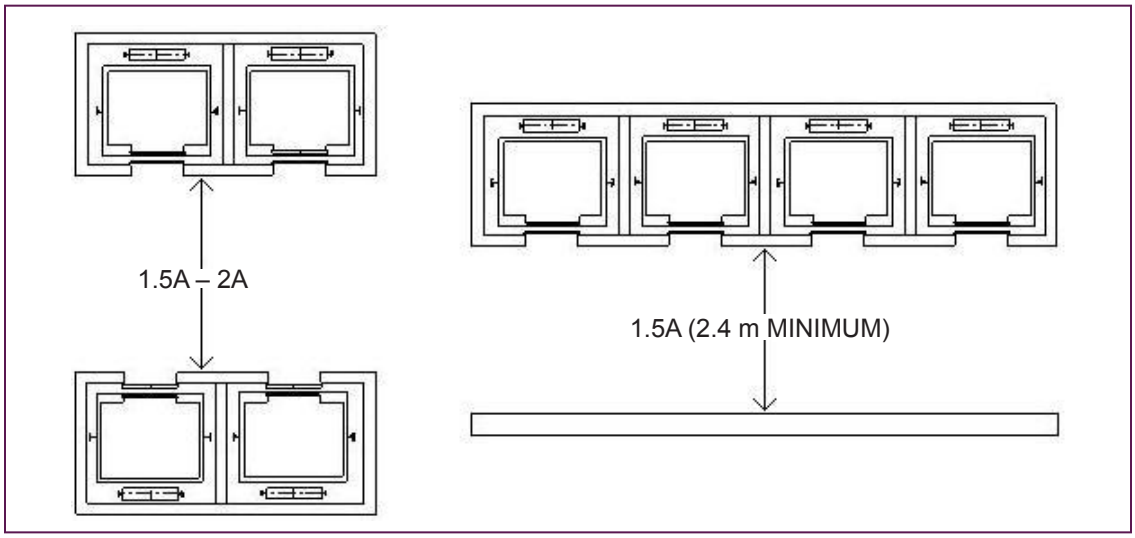

Figure 3.6: Four-Car Lobby Arrangements

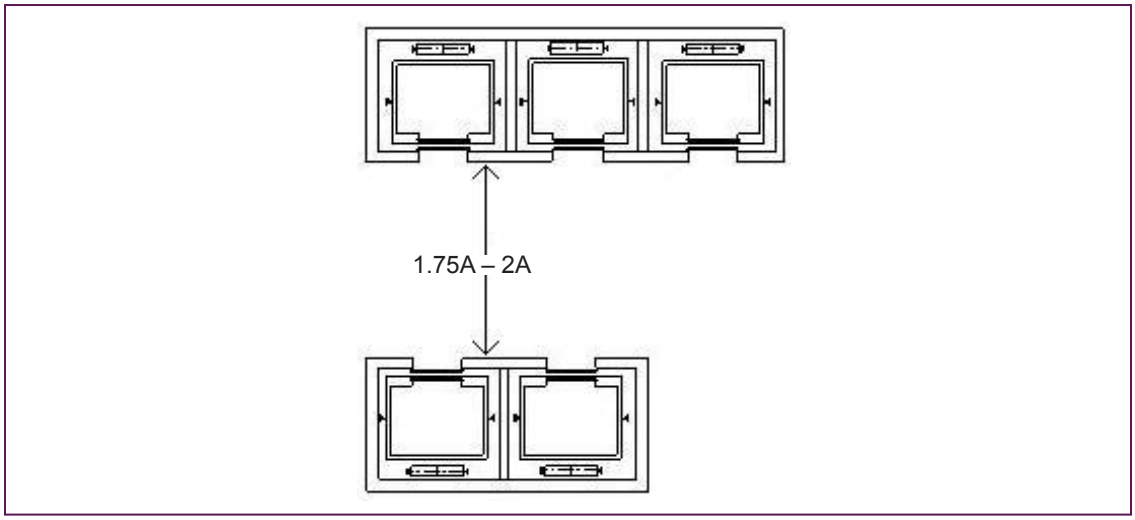

Figure 3.7: Five-Car Lobby Arrangement

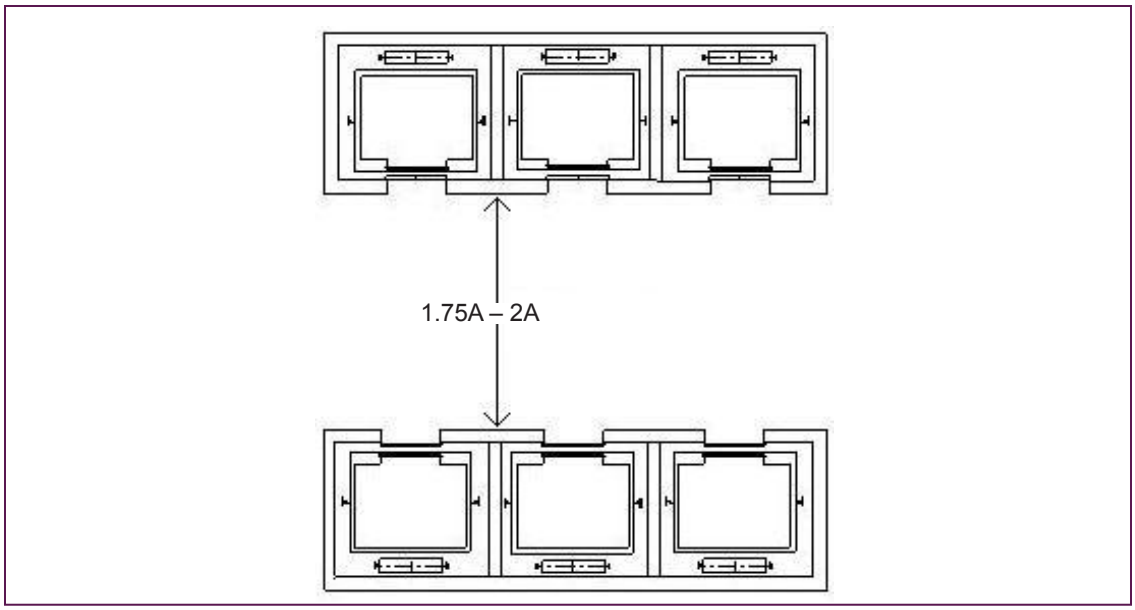

Figure 3.8: Six-Car Lobby Arrangement

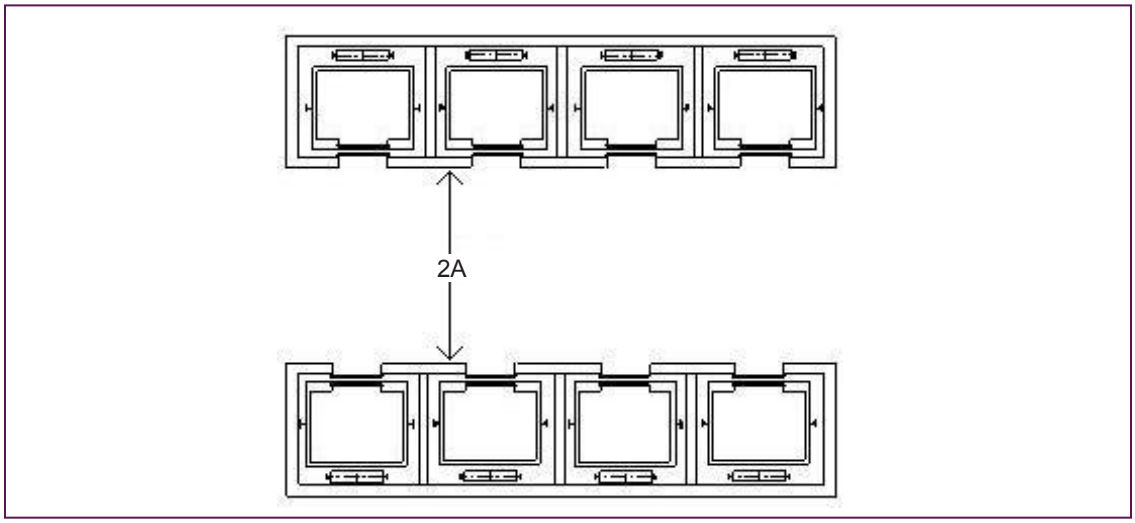

Figure 3.9: Eight-Car Lobby Arrangement

16. Provide, if desired, extra stops on any one or more elevators of a group to serve special floors (e.g., mechanical levels) when the elevator is on independent service, or by means of a spring-loaded return to off key switch.

17. Although it is desirable to arrange the traffic flow so as to avoid it, for groups of three or fewer elevators where a floor below the main floor has a significant amount of traffic (i.e., greater than 1/3 of the total traffic), it is possible to serve this lower floor with the elevator group provided that:

    a. the elevators are dispatched from the lower floor;

    b. an elevator travelling up does not stop at the main floor unless in response to a registered car call or up hall call; and

    c. an elevator travelling down does not stop at the main floor unless in response to a car call or a down hall call at the main floor.

18. In buildings having over 25,000 m² of usable space above the main floor, provide elevators serving from the main floor down and elevators serving from the main floor up, but not elevators serving both above and below the main floor, except where shuttle elevators are used to interconnect the main floor and levels below the main floor with special levels above the main floor (e.g., mezzanines).

19. Locate public entrances to the building so that they lead directly to the vertical transportation system.

20. When providing multiple banks of elevators serving different floor levels, provide elevator service to each floor above the main floor by only one group of elevators.
    a. Avoid the use of crossover floors.[7]
    b. Minimize traffic between banks of elevators by locating office sections that must interact frequently on adjacent floors served by the same group of elevators.
    c. Locate the two lower terminal floors in such a way as to clearly emphasize the existence of the two levels.
    d. Provide equal access to and egress from the elevator system.
    e. Post conspicuous signs to indicate the use of the two-level system.
    f. Arrange both upper and lower decks of double-deck elevators to serve top office floors.

3.2 Size and Rated Load

1. Typical size and rated load are shown in **Table 3-2**.

2. Provide elevators with rated load more than 1,100 kg to allow for handicapped access.

3. Provide shallow, wide cars for passenger elevator service.

4. Provide narrow, deep cars for use as service elevators.

Table 3-2: Recommended Platform and Hoistway Sizes—Overhead Traction Passenger Elevators

Equipment Type	Rated Capacity		Platform Dimensions (mm)		Hoistway Dimensions (mm)		Net Inside Area (m²)
	kg	Persons	Width	Depth	Width	Depth	
Geared	1,125	16	2,135	1,525	2,540	2,165	2.60
Gearless					2,540	2,135	
Geared	1,350	20	2,135	1,675	2,540	2,315	2.95
Gearless					2,540	2,285	
Geared	1,575	23	2,135	1,880	2,540	2,515	3.35
Gearless					2,540	2,485	
Geared	1,800	26	2,440	1,880	2,845	2,485	3.85
Gearless							

[7] It is always more efficient to move between elevator groups by going to the main floor to transfer. However, since this involves going down and then up again, it is psychologically repellent to some people. For that reason—although bad for system efficiency and trip time—many buildings have crossover floors.

3.3 Car Speeds

1. Provide equipment designed and adjusted to operate at speeds that will be adequate for the travel indicated, as set out in **Table 3-3**.

Table 3-3: Suggested Car Speeds

Total Travel (metres)	Typical Number of Floors Served	Recommended Speed (m/s)
≤8	2 to 3	0.5 to 0.75
8 to 15	4 to 5	1.0 to 1.50
15 to 35	5 to 11	1.50 to 1.75
35 to 60	11 to 20	1.75 to 2.5
60 to 80	20 to 30	2.5 to 3.5
80 to 120	30 to 40	3.5 to 4.0
>120	>40	4.0 to 7.0

2. Use the figures given in **Table 3-3** as an approximate guideline only.

3. Confirm the actual speed requirement by performing a computer simulation, taking into account relevant building conditions.

3.4 Design Criteria

Provide a vertical transportation system to the criteria shown below in **Table 3-4** and **Table 3-5**.

Table 3-4: Morning Peak Design Criteria

Parameter	Excellent	Good	Fair	Marginal
Average waiting time (sec)	≤23	24 to 27	28 to 29	≥30
Total trip time (sec)	≤70	71 to 90	91 to 129	≥130

It is desirable that the morning peak car load factor be in the range of 40–50%. The total trip time for elevators having an express zone, is the trip time in the local zone, excluding the express zone travel time.

Table 3-5: Noon Peak Design Criteria

Parameter	Excellent	Good	Fair	Marginal
Average waiting time (sec)	≤30	31 to 35	36 to 37	≥38
Total trip time (sec)	≤70	71 to 90	91 to 129	≥130

It is desirable that the noon peak car load factor be in the range of 40–50%. The total trip time for elevators having an express zone, is the trip time in the local zone, excluding the express zone travel time.

3.5 System Analysis

1. Perform computer simulations for the vertical transportation system as outlined below.
2. Confirm the building population with the project manager based on the following criteria:
   a. Use a population density as determined by the building occupation if known;
   b. If the actual building occupation is not known, use a figure of 18 m^2 of usable area per person.
3. Morning up peak simulation:
   a. Use a handling capacity as determined by the building occupation if known.
   b. If the actual building occupation is not known, use a handling capacity of 11.5%.
   c. Use a traffic pattern as determined by the building occupation if known.
   d. If the actual building occupation is not known, use a traffic pattern split as follows:
      i. 85% of hall calls will be up hall calls registered at the main floor;
      ii. 5% of hall calls will be up hall calls registered at an intermediate floor;
      iii. 8% of hall calls will be down hall calls registered by passengers travelling to the main floor; and
      iv. 2% of hall calls will be down hall calls registered by passengers travelling to an intermediate floor.
4. Noon peak simulation:
   a. Use a handling capacity as determined by the building occupation if known.
   b. If the actual building occupation is not known, use a handling capacity of 11%.
   c. Use a traffic pattern as determined by the building occupation if known.
   d. If the actual building occupation is not known, use a traffic pattern split as follows:
      i. 55% of hall calls will be up hall calls registered at the main floor;
      ii. 5% of hall calls will be hall calls registered at an intermediate floor;
      iii. 30% of hall calls will be down hall calls registered by passengers travelling to main floor; and
      iv. 10% of hall calls will be down hall calls registered by passengers travelling to an intermediate floor.
5. Provide a computer simulation printout showing the following data for both morning up peak and noon peak:
   a. Average waiting times for the group;
   b. Average waiting time for each floor for up hall calls;
   c. Average waiting time for each floor for down hall calls;
   d. Load factors; and
   e. Total trip times.

3.6 Performance—Traffic Balance

1. Arrange the control system to integrate the movement of cars so that between the hours of 8:00 to 18:00 on a normal working day:
   a. 55% of the hall calls are answered within 20 seconds;
   b. 75% of the hall calls are answered within 30 seconds;
   c. 90% of the hall calls are answered within 50 seconds;
   d. 99% of the hall calls are answered within 90 seconds; and
   e. 100% of the hall calls are answered within 180 seconds.
2. The times given above assume a handling capacity based upon a population density of 18 m^2 per person of usable space (excluding core and perimeter) and handling capacities of 11.5% during the morning up peak, 11% during the noon peak, 11% during the late afternoon down peak, and 7% during the remainder of the working day.
3. At a time determined by the Departmental Representative, when the building is fully occupied and within the 12-month guarantee period, conduct a test to verify performance and furnish the Departmental Representative with a graphic recording of hall call waiting times.
4. Include the engineer's design data from the computer simulation into specifications to enable the elevator contractor to verify the capability of the control system to meet the requirement.

3.7 Operating Time

1. Adjust the equipment of elevators having speeds of 2.5 m/s and greater so that the elapsed time to travel one typical floor does not exceed 7.5 seconds.
2. Measure this time under the following conditions:
   a. A typical floor not exceeding 4,000 mm;
   b. Floor level is ±5 mm;
   c. The time starts when the fully opened doors begin to close and continues until the car is stopped level with the next floor and the car and hall doors are open to three-quarters of their fully open position;
   d. The time is measured with full load in the car and in both directions of travel; and
   e. The power door operation for the hall and car doors conforms to the elevator code requirements.
3. This time assumes centre opening doors with not more than 1,065 mm clear entrance width. For side opening entrances increase the time by two seconds. For wider openings increase the time in proportion to the size of the entrance.
4. Adjust the equipment so that the operating time as set out above is compatible with dependable, consistent operation without undue wear or excessive maintenance and so that this operating time can be readily maintained over the life of the elevator installation.
5. Adjust the equipment so that, with the control functioning so as to give the required time, the elevator operates under smooth acceleration and retardation and provides a comfortable and agreeable ride.

3.8 Control and Operation

1. Arrange all passenger elevators for automatic operation without the use of an attendant and with automatic two-way levelling devices.

2. Arrange single elevators for selective collective automatic operation.

3. Provide a microprocessor-based group supervisory system for a group of two or more elevators.

4. Control the elevators automatically by buttons in the car, marked to correspond with the respective landings served and by the car buttons at the landing stations. Register a call by momentary pressure of a button. Provide integral visual indication of the registration of a car or hall call.

5. Store hall and car calls in the control memory until answered.
   a. Cancel a call when it is answered by a car.
   b. Cause a car selected by the control system to respond to a registered call.
   c. Prevent more than one car starting to answer any hall call.

6. Stop a running car at the first landing for which a car call is registered.

7. Stop a running car for a hall call registered for the same direction in which the car is travelling, subject to higher priority assignments and to load in the car.

8. On elevators with more than six stops, arrange the control circuits to cancel all car calls when an unreasonable number of car calls has been registered relative to the number of passengers in the car. Prevent nuisance car calls by:
   a. Not allowing car calls to be registered below the current position of an up travelling car;
   b. Not allowing car calls to be registered above the current position of a down travelling car; or
   c. Cancelling car calls when the car reverses direction.

9. Cause the car to proceed to the calls until it has come to the limit of calls placed in the direction in which it is travelling and having done this, subject to the assignment of the dispatch system, reverse direction. Do not stop the car for hall calls in the opposite direction to the direction of the car.

10. For group control, if a hall call exists that cannot be answered by a car in its normal line of travel (e.g., a hall call above a down travelling car), either cause another car to be assigned to answer the call, or redistribute the remaining cars as required to service other traffic needs.

11. Cause a car without registered car calls, arriving at a floor where both up and down hall calls are registered, to initially respond to the hall call in the direction in which the car was travelling.
    a. If, subsequent to the stop at this landing, there is no car or hall calls registered such as to require immediate travel in the same direction as before stopping at that landing, cause the car to close its doors, immediately reopen them, and respond to the hall call in the opposite direction.

12. For group control, if a hall call remains registered for longer than 60 seconds and within that period the cars are not running, dispatch all cars and run without dispatch delay or assignment until registered hall calls are cancelled.

13. For group control, automatically disassociate a car from group service in the event that the car is delayed for more than a given period of time.
    a. Restore the car automatically to group service when the delay is corrected;
    b. Arrange that the given period of time is approximately one minute but is adjustable from 30 seconds to 2 minutes.
14. For group control, if there is a failure in the group supervisory control dispatching system, arrange the elevators to automatically follow a prearranged dispatching program until the fault has been corrected.
15. For group control, if an elevator is removed from group automatic operation for any reason, adjust the dispatching system automatically to the new conditions of operation and continue to control the movement of the other cars in substantially the same way as with the full group.

3.9 Car Enclosures

1. Select a cab from the manufacturer's standard range of products except when building prestige or aesthetic considerations warrant provision of cabs designed to suit.
2. Provide equipment necessary for a complete installation, including cab components such as door panels, ceiling, handrails, pad hooks, flooring, mounting strips, stay plates, base, sill, wainscot, soffit and frieze, certificate frame, sound deadening material, etc.
3. Do not use coloured anodic or oxidizing surfaces on areas that may need refinishing and that cannot be conveniently refinished on site.
4. Use materials that minimize flame spread, smoke production, and fuel contribution (i.e., metal platforms and enclosures).
5. For elevators used as designed fireman's cars, use materials in the cab enclosure that conform to the ratings given in the National Building Code of Canada, latest edition.
6. Provide, for each elevator group, one set of protective pads. Provide pads made of non-flammable or fire-resistant materials or chemically treated materials.
7. Provide car lighting of the fluorescent type generally used throughout the building. Consider using LED light sources based on the initial cost, the operating cost of the fixtures, and life-cycle analysis.
    a. Use rapid start type with high-power factor ballasts sound rated A.
    b. Design for illumination of approximately 215 lx measured 762 mm above the floor in order not to overpower the illumination of car position indicators and car pushbuttons.
    c. Locate the light switch within the locked service cabinet, or, if exposed, provide a key-operated light switch in the car operating panel.

8. In addition to natural ventilation, provide forced ventilation. In air-conditioned buildings, provide blowers or fans of the exhaust type. Do not exceed 55 decibels on the A scale of the sound level meter from a reading approximately 3 feet (0.75 m) above the floor with doors closed and fan on high speed. Provide 2-speed operation, approximately 700/300 cfm (330/165 dm^3/s).

9. When separate service or freight elevators are not provided, arrange one passenger car to provide a clear height of 10′-0″ (3.05 m) under the car top for handling long goods. Include removable suspended ceiling for normal use.

10. Supply car enclosures by the elevator contractor in order to minimize divided responsibility.

3.10 Central Control Console

1. Provide, in buildings having 30,000 m^2 or more gross area and five or more floors, a control panel, integrated into the building central control console.

2. Locate the control panel such that the operator can have a full view of the elevator lobby, either directly or through a CCTV system.

3. Provide, in this panel, as applicable, the following equipment:
   a. Emergency power indicator light
   b. Telephone or intercommunication equipment
   c. Emergency service operation pilot light
   d. In-car emergency service operation pilot light
   e. Distress light and buzzer
   f. Acknowledge button (to cancel distress signal)
   g. Independent service pilot light
   h. Digital car position indicator
   i. Independent service switch
   j. In-service pilot light.
   k. Return to lobby (parking) switch
   l. Three position (OFF-AUTO-ON) fireman's switch with an illuminated warning sign arranged to flash on and off when the fireman's switch is in the "OFF" position.

4. Where a central control room has not been designated:
   a. For groups of four or more elevators, provide combined group control and indicator panel in the lobby;
   b. For groups of three or fewer elevators, provide group control panel in the lobby.

3.11 Hoistway Entrances

1. Provide single-speed centre-opening entrances with a clear width of not less than 1,067 mm.
2. For elevators with a rated capacity of 1,800 kg, entrances should have a minimum clear entrance width of 1,220 mm.
3. Provide a clear entrance height of not less than 2,135 mm.
4. Provide entrances consisting of frames, jambs, sills, sill support angles and brackets, struts, headers, fascias, toe guards, sight guards, and doors of approved design and size complete with guides and bumpers and other items necessary to provide a completed installation.
5. Construct the doors of sheet steel a minimum of 1.3 mm thick.
6. Supply hoistway door hardware consisting of door hangers and tracks, interlocks, door closers, relating mechanism, operating linkages, gibs, and other hardware necessary for the installation and operation of the hoistway doors.
7. Design door hardware for a minimum of noise.
8. Provide numerals at least 50 mm high on the leading edge of each hoistway door panel or sight guard corresponding to the respective floor level.
9. Furnish entrances supplied by the elevator contractor to minimize divided responsibility.
10. Protect entrances throughout the construction period.
11. Provide entrances bearing a 1.5-hour fire rating approved by the authorities having jurisdiction.
12. Provide a closure, including an interlock mechanism and associated wiring, capable of operating for a period of at least one hour when the assembly is subjected to the standard fire exposure tests.
13. Include fascias to reduce the running clearance to 30 mm.
14. Finish typical floor entrances in baked enamel, to a colour as selected by the Owner or Architect.
15. Main floor entrances may be finished in natural metal brought to a satin lustre finish, but do not use anodized or oxidizing metals.
16. Do not use raised or depressed panels or ornamentation on doors except under very unusual circumstances. They are expensive and difficult to maintain.
17. Provide stainless steel kick plates where hall entrances are subject to abuse due to cleaning.
18. Provide transom panels only when desired for aesthetic value.
    a. When providing transom panels, provide only those types and sizes for which the elevator contractor has previously obtained a 1.5-hour ULC label.

3.12 Power Door Operators

1. Provide power door operation.
2. Provide a door operator to open and close the car and hoistway doors simultaneously, capable of moving the door panels from the closed position to within 70 mm of the fully open position, at an average speed of not less than 700 mm per second.
3. Provide closed-loop speed and torque control for the door operator.
4. Check the movement of the doors at both limits of travel.
5. Design the door operator and associated components for a minimum of noise.

3.13 Door Protective Devices

1. Provide multiple infra-red beam door detector devices.
2. Design and locate the devices so that the active area of the door opening (i.e., the full width and from within 25 mm of the floor to a height of 1,800 mm) is protected such that a person or object passing through the car entrance causes the doors to re-open.
3. Position the equipment at least 25 mm back from the leading edge of the door.
4. Arrange the circuits so that activation of the door protective device during the door-closing cycle causes the doors to re-open fully before the re-closing operation is established.
5. Arrange that if the system fails to provide protection over the active area of the door opening, the elevator will park at the current floor with its doors open and the lights off, or the system will switch to nudging operation.
6. If a door protective device is operated continuously for more than 20 seconds after the elapse of the normal door open time, cause the doors to close slowly under reduced power and operate a buzzer in the car panel as a warning to the person obstructing the door.
    a. Cause the 20 seconds to be reduced to 6 seconds until a normal door cycle is performed.
7. Provide a signal on the unit or in the machine room to indicate that a failure has occurred.
8. Supply a device, reliable and consistent in operation, not affected by dust or temperature changes, and having inherent long-term reliability with minimum maintenance.

3.14 Signals

1. For an elevator with centre opening doors, provide two car operating panels, one main and one auxiliary.
2. For an elevator with side opening doors, provide one car operating panel.
3. Provide in each panel the devices required for normal automatic operation, which should include the following:
    a. Floor push buttons;
    b. Door open button;
    c. Door close button; and
    d. Alarm button.
4. Number the car call buttons to correspond to the floor served.
5. Provide in conjunction with the car buttons a call registered light for each button, to be lighted when the button is pressed and extinguished when the car stops at the selected floor.
6. Cause the alarm button, when pressed, to ring the alarm bell, located under the car platform, and to operate distress signals such as a buzzer and indicator in a remote location.
7. Provide a key-operated in-car stop switch.
8. For elevator groups located on both sides of a lobby, facing each other, provide duplicate interconnected risers of pushbuttons in the lobby.
9. Provide digital car position indicators located above each car operating panel.
    a. Arrange the indicator to display a number or symbol at least 25 mm high.
    b. Indicate the position of the car at all times, corresponding to the landing through which the car is passing or at which it is stopped.
    c. Provide light-emitting diodes, liquid crystal display, or long-life lamps, with life expectancy greater than 10,000 hours.
    d. Arrange the circuits so as to provide continuous indication of car position.
10. Provide the hall lanterns complete with electronic gongs at each entrance to indicate the future direction of the elevator.
    a. Provide a single light for the fixtures at the upper and lower terminals.
    b. Provide separate up and down lights for the fixture at the intermediate landings.
    c. Maintain the hall lantern illuminated until the car has stopped and the door open time has elapsed.
    d. Do not illuminate the hall lantern on a door re-open unless the re-open is caused by a reversal of direction of travel of the car.
    e. Arrange the operation of the lanterns and gongs to comply with requirements for the handicapped.

f. Design the fixture so that the lamps may be readily changed.

g. Do not mount any equipment to the covers; arrange that the covers can be removed completely without disturbing the electric wiring.

h. Centre lanterns above hoistway entrances or install in the head jamb.

i. Do not locate hall lanterns in recessed elevator transoms and do not obscure hall lanterns by building columns or other structural members.

j. Provide arrow-shaped lenses.

k. Provide signal fixtures from within a manufacturer's standard range of products unless special fixtures are required for aesthetic value or resistance to vandalism.

CHAPTER 4

OFFICE BUILDINGS—SERVICE ELEVATORS

4.1 General

1. Provide a separate service elevator for an office building in excess of 28,000 m^2 gross area, or where building conditions or particular tenant requirements warrant such service.
2. Provide an additional service elevator for each additional 45,000–55,000 m^2 of building gross area.
3. Determine detailed design by the specific use of the service elevator, considering the type of materials to be transported, the anticipated traffic demand and the importance of prompt, efficient service among the governing parameters.

4.2 Location and Arrangement

1. Locate service elevators directly accessible and in close proximity, to building shipping and receiving facilities.
2. Locate service elevators, so that the use of stairs is not required.
3. Separate service elevator lobbies from passenger elevator lobbies and main corridors.
4. Arrange service elevators to service all levels of the building including intermediate mechanical floors.
    a. Do not provide service to mechanical floors at the top of the building unless such service is necessary and the normal overhead height of the elevator machine room will allow service to these levels.
5. Arrange service elevators to serve levels below the main floor, including parking levels.

4.3 Design

1. Do not provide service elevators with a net lifting capacity of less than 1,800 kg.
2. Ensure the design will satisfactorily accommodate the freight in an efficient manner.
3. Do not permit freight to project beyond the car enclosure.
4. Do not provide means to carry freight on the top or bottom of the car.

4.4 Cabs

1. Provide a service-type elevator cab.
2. Provide a cab with front returns, walls, ceilings, and doors, finished in either rigidized stainless steel or mild steel with a plain colour baked enamel finish.
3. Provide overhead fluorescent lighting with wire mesh guards. Consider using LED light sources based on the initial cost, the operating cost of the fixtures, and life-cycle analysis.
4. Provide checker plate aluminum car flooring of minimum 6 mm thickness.
5. Reinforce the car enclosure panels and the car flooring to accommodate wheeled trucks.
6. Provide a minimum clear height to the underside of the car top of 3 m.
    a. Provide a top hat at the rear of the cab if additional cab height is required.

4.5 Entrances

1. Provide power-operated, two-speed side-opening horizontal sliding entrances at least 1,220 mm wide.
2. Provide a clear entrance height of 2,440 mm if permissible by building design limitations.
3. Provide only one car entrance, unless building conditions expressly require the use of front and rear entrances.
4. Do not provide side entrances.
5. Provide floor beams or floor slab extensions to give substantial support for passenger-type entrance sills.
6. Design and construct the entrance to support a minimum unit load, on the sill, equivalent to the capacity of the car.
7. Finish the entrances in baked enamel in a colour as selected by the Architect.
8. Provide satin finish stainless steel kick plates for hoistway doors.

4.6 Operation

1. Provide operation of service elevators appropriate for intended use.
2. Provide two-stop automatic operation for single elevators serving only two floors.
3. Provide single automatic operation where it is not necessary to collect calls in the direction of travel.
4. Provide selective collective operation for elevators serving three or more landings.

CHAPTER 5

OFFICE BUILDINGS—FREIGHT ELEVATORS

5.1 General

1. Provide freight elevators in buildings in which a large volume of large freight will be regularly transported throughout the building.
2. Determine detailed design by the specific use of the freight elevator.

5.2 Location and Arrangement

1. Locate freight elevators directly accessible and in close proximity to building shipping and receiving facilities, without using stairs.
2. Provide only one car entrance, unless building conditions expressly require the use of front and rear entrances.
3. Do not provide side entrances (i.e., "corner-post").

5.3 Design

1. Design the freight elevators to suit specific freight requirements.
2. Design for the appropriate class of loading required for a particular application.
   a. Indicate the maximum anticipated weight of a loaded truck in specifications.
3. Ensure the design will satisfactorily accommodate the freight in an efficient manner.
4. Provide adequate car speeds such that terminal-to-terminal express travel does not exceed 60 seconds.
5. Typical car sizes for the required capacity are shown in **Table 5-1** and **Table 5-2**.
6. Do not permit freight to project beyond the car enclosure.
7. Do not provide means to carry freight on the top or bottom of the car.

5.4 Cabs

1. Provide a car frame consisting of steel channels and angles securely welded, bolted, or riveted and substantially reinforced and braced so as to relieve the car enclosure of strain.
2. Enclose the car, on three sides and the ceiling, with sheet steel of #14 (minimum) US gauge, braced and reinforced for rigidity.
3. Provide an enclosure that is virtually flush on the inside.
4. Perforated metal may be used for the enclosure if allowed by the prevailing codes.
5. Provide minimum 250 mm high hardwood bumper rails on both sides of the cab at a height of 100 mm above the car floor.
6. For cabs with only one entrance, provide minimum 250 mm high hardwood bumper rails on the wall opposite the entrance at a height of 100 mm above the car floor.
7. Extend the side bumper rails for the full depth and width of the car with tapers at the entrance.
8. Reinforce the bumper rails by steel channels exterior to the cab rigidly attached to the car platform or frame.
9. Provide checker plate aluminum car flooring of minimum 6 mm thickness.
10. Mount the capacity plate and certificate frame so that they are protected from accidental damage.
11. Provide recessed car operating panels at each end of an elevator car with both front and rear entrances, when the inside cab depth exceeds 3.05 m.
12. Provide recessed fluorescent lighting fixtures with substantial wire mesh guards.
13. Provide, only when required by the prevailing codes, an emergency stop button.
    a. Cause the stop button to operate the distress signal and the alarm bells as outlined above.
    b. Arrange, where allowed by the prevailing codes, that the stop button return by spring action to the normal position.
14. Protect the car entrances by a steel gate of the vertical sliding type.
    a. Use single blade vertical lifting car gates except where overhead is limited when double blade car gates may be required.
15. Provide the car gate with a safety edge device or a multiple beam light ray device extending the full width of the gate.
    a. Arrange this device to automatically cause the gate to return to the open position and remain there for the normal gate open time if the closing of the gate is obstructed by an object in the path of the gate.
    b. If a multiple beam light ray device is used, ensure that the full opening is protected for the width of the gate by the curtain of light and arrange that the elevator will not run unless the device is functioning.

5.5 Entrances

1. Design and construct the entrance to support, as a minimum, a unit load on the sill equivalent to the capacity of the car.
2. Provide hall doors including tracks, interlocks, door closers, and incidental devices necessary for the correct operation of the doors and car gates.
3. Provide hoistway doors of the flush type, of no less than number 14 gauge, all-steel construction, and counterbalanced suitably.
4. Design door equipment and associated components for a minimum of noise.
5. Provide power operation of hoistway doors where elevators are subject to intensive use or where the entrance area is greater than 7.2 m^2.
    a. Provide each hoistway door and car gate with individual electric motors of the direct current type.
    b. Provide electrical controls for these motors to give smooth acceleration, deceleration, and adjustable maximum speed.
6. Open the doors and gate simultaneously and automatically in response to a call when the car reaches the levelling zone, or in response to momentary pressure of the open button on the car or at the landing at which the elevator is stopped.
7. Close the car gate and hoistway door sequentially, the car gate first and then the hoistway door when the car gate has substantially blocked the entrance.
8. Arrange the circuits so that continuous pressure of the car close button or the hall close button at the floor at which the car is stopped causes the doors to close.
9. Arrange that the release of the door close button at any time before both doors and gate are fully closed will initiate a re-opening cycle which will then continue until the doors and gate are fully open.
10. Design the doors such that, in the event that the power door mechanism becomes inoperative, the doors can be opened manually without excessive effort.
11. Where a freight elevator has power-operated front and rear entrances at the same floor, arrange both entrances to open simultaneously.
12. Provide security locking and insulation of freight elevator doors that open to the exterior of the building.

5.6 Operation

1. Provide operation of freight elevators appropriate for intended use.
2. Provide two-stop automatic operation for single elevators serving only two floors.
3. Provide single automatic operation where it is not necessary to collect calls in the direction of travel.
4. Provide selective collective operation for elevators serving three or more landings.

Table 5-1: Typical Sizes and Capacities—General Purpose Freight Elevators

Rated Capacity	Platform Dimensions		Hoistway Dimensions		Door Width
(kg)	Width (mm)	Depth (mm)	Width (mm)	Depth (mm)	(mm)
1,125	1,626	2,134	2,184	2,350	1,525
	1,930	2,438	2,489	2,654	1,829
1,350	1,626	2,134	2,184	2,350	1,829
	1,930	2,438	2,489	2,664	1,829
1,575	1,930	2,438	2,489	2,654	1,829
1,800	1,930	2,438	2,489	2,654	1,829
	2,540	3,048	3,150	3,264	2,438
2,250	2,540	3,048	3,150	3,264	2,438
	2,540	3,658	3,200	3,874	2,438
2,700	2,540	3,048	3,150	3,264	2,438
	2,540	3,658	3,200	3,874	2,438
3,600	2,540	3,048	3,150	3,264	2,438
	2,540	3,658	3,200	3,874	2,438
4,500	2,540	3,658	3,200	3,874	2,438
	3,150	4,267	3,851	4,483	3,048

Table 5-2: Typical Sizes and Capacities—Industrial Truck Elevators

Rated Capacity	Platform Dimensions		Hoistway Dimensions		Door Width
(kg)	Width (mm)	Depth (mm)	Width (mm)	Depth (mm)	(mm)
4,500	2,540	3,658	3,434	3,873	2,438
5,400	3,150	4,267	4,089	4,483	3,048
7,200	3,150	4,267	4,216	4,534	3,048
8,100	3,150	4,877	4,242	5,143	3,048
9,000	3,658	6,095	4,801	6,363	3,556

CHAPTER 6

OFFICE BUILDINGS—DUMBWAITERS

6.1 General

1. Provide dumbwaiters for the transportation of supplies such as food, mail, records, books, and medical supplies, etc., across limited distances within a building.
2. Do not locate dumbwaiters in an area used by the general public.
3. Locate dumbwaiters close to areas requiring dumbwaiter service.
4. Provide electrically operated power dumbwaiters.
5. Provide entrances to suit building design.
6. Do not allow habitable space below dumbwaiters unless unavoidable. When habitable space exists below the dumbwaiter hoistway, provide safeties.
7. Arrange dumbwaiters to stop at floor level for truck loading, at stool height for hand loading, or to serve "under counter" as required in the specific application.
8. Provide overhead traction type machines whenever possible.
9. Provide drum machines only for under counter dumbwaiters or where space conditions preclude the use of traction machines.

6.2 Size and Capacity

1. Ensure that the size and capacity are adequate for the required service.
2. Provide a car of not more than 0.81 m^2 in horizontal area and 1,200 mm in height.
3. Provide a net lifting capacity of not more than 225 kg.

6.3 Speed

1. Recommended car speeds are as set out in **Table 6-1**.

Table 6-1: Office Building Dumbwaiter Speeds

Number Of Landings	Speed (m/s)
2	0.25–0.5
3–6	0.5

2. Provide higher speeds for dumbwaiters serving more than six stops, subject to special study.

6.4 Operation

1. Provide one of the following two methods of operation for dumbwaiters:
    a. Automatic Call and Send Operation, which permits, by momentary pressure of the buttons, calling the dumbwaiter car to any landing and dispatching the car from that landing to any other landing served; or
    b. Automatic Central Station Operation, which permits the operation of the dumbwaiter car from one landing which is designated the "central station" and returns the car automatically to the central station upon completion of each trip.
2. Provide Automatic Call and Send Operation for most installations.
    a. Where the number of landings exceeds 10, provide a dial or comparable device for floor selection as an alternative to conventional hall call operating devices.
3. Include inching operation where the door opening is flush with the landing floor.
4. Provide direct current operation for the control and brake circuits.

6.5 Signals

1. Provide a signal system appropriate for the type of operation selected and the method of use.
2. For Automatic Call and Send Operation, provide call registration buttons and lights and in-use lights in each hall station.
3. For Automatic Central Station Operation, provide in-use lights in the hall stations.

6.6 Dumbwaiter Cars

1. Provide stainless steel car enclosure, shelves, and car gates if the dumbwaiter is to be used to carry food or medical supplies.
2. For other uses, finish the enclosure and gates in plain colour baked enamel and the bottom of the box and shelves in stainless steel.
3. Arrange the shelves to be removable.

6.7 Entrances

1. Provide vertical sliding bi-parting entrances with stainless steel stools and plain colour baked enamel doors and frames.
2. Provide entrances bearing a 1.5-hour fire rating, as certified by Underwriters Laboratories of Canada or other factory inspection agency acceptable to the Owner and authorities having jurisdiction.

6.8 Access Door

Where the dumbwaiter machine is located at the bottom within a hoistway, provide a swing door, which matches the general design of the dumbwaiter entrances, to access the machine.

CHAPTER 7

OFFICE BUILDINGS—ESCALATORS

7.1 General

1. Provide escalators to supplement the elevator system in the following circumstances:
    a. Where buildings have two main public entry levels and double-deck elevators are not used, provide escalators between these two levels and provide elevator service from the upper main level;
    b. Where cafeterias, auditoriums, or other building areas with a large traffic volume are not located on a terminal floor;
    c. Where mass movement of people is required in a low-rise structure; or
    d. Where double-deck elevators are used, provide escalators at the main lobby to serve the other floor (above or below) where the second cab of the double-deck elevator has its main stop. Also, provide escalators between upper floors where the double-deck elevator terminates, mainly in designs with long shuttle distances such as super-high-rise buildings.
2. Consider provision of escalators in low-rise office buildings having large floor areas and large populations.
3. Do not provide escalators as the principal means of vertical transportation in buildings over seven floors in height.
4. Provide supplementary elevator service in buildings where escalators are the principal means of vertical transportation.
5. Apply the criteria established for elevator analysis to escalators.
6. Design landings to allow and encourage traffic to egress from an escalator.
7. Do not obstruct access to or egress from the escalator core.
8. Do not serve intermediate blind landings.
9. Avoid outdoor installation of escalators.
    a. When necessary to provide such equipment, provide equipment designed to operate in outdoor environmental conditions. Also provide an open roof over them for protection from weather elements.
10. Provide reversible escalators where large unidirectional morning and evening peak period traffic volumes are expected, such as in access ways to public transit facilities.
11. Restrict automatic operation of escalators to special instances where necessary safety design is possible and only with the approval of the enforcing authority.

7.2 Size, Capacity and Speed

1. Provide escalators in a nominal width of either 800 mm or 1,200 mm.
2. Provide 800 mm wide escalators where traffic is expected to be intermittent or light.
3. Provide 1,200 mm wide escalators in areas where a high traffic volume is anticipated.
4. Design according to the actual attainable carrying capacities as determined from the theoretical carrying capacity as follows:
   a. For 800 mm escalators, use a carrying capacity of 70% of the theoretical capacity;
   b. For 1,200 mm escalators, use a carrying capacity of 75% of the theoretical capacity.
5. Provide escalators operating at a speed of not more than 0.5 m/s.

7.3 Arrangement

1. Arrange and locate escalators in the path of heaviest expected traffic.
2. Use one of the two arrangements as shown in **Figure 7.1** and **Figure 7.2**.
3. Provide the crisscross arrangement when space is limited.
4. Use the parallel arrangement when it is desirable to operate both escalators in the same direction during peak periods, or when aesthetic appeal in prestige buildings is required.
5. With the multiple crisscross arrangements, extended newels may or may not be concentric.
   a. In such a case, provide exterior or extended newels to match the interior of the escalator.
6. Provide either an adjacent or separated arrangement as shown, depending on the application.

7.4 Construction Requirements

1. Use stainless steel or porcelain enamel for the interior of the escalator.
2. Use stainless steel for deck covers and mouldings.
3. Do not use coloured anodic, oxidizing metals or plastic laminated surfaces.
4. Set the skirt panels to minimum running clearances with the steps and amply reinforce to minimize the possibility of passenger injury.
5. Provide skirt switches at the lower end of the escalator, which will cut off the power to the escalator and apply the brake if an object becomes caught between the step and the skirt as the step approaches the lower landing.
6. Design step risers to minimize the possibility of soft footwear being drawn into the space between the steps.

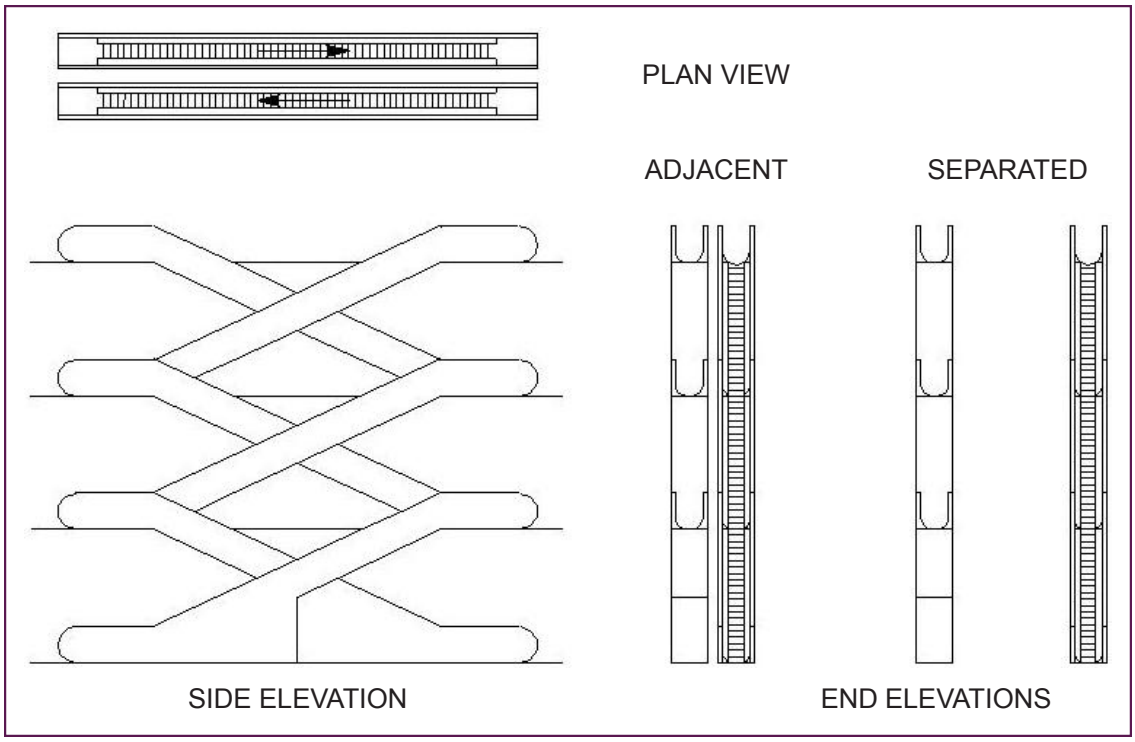

Figure 7.1: Criss-Cross Escalator Arrangement

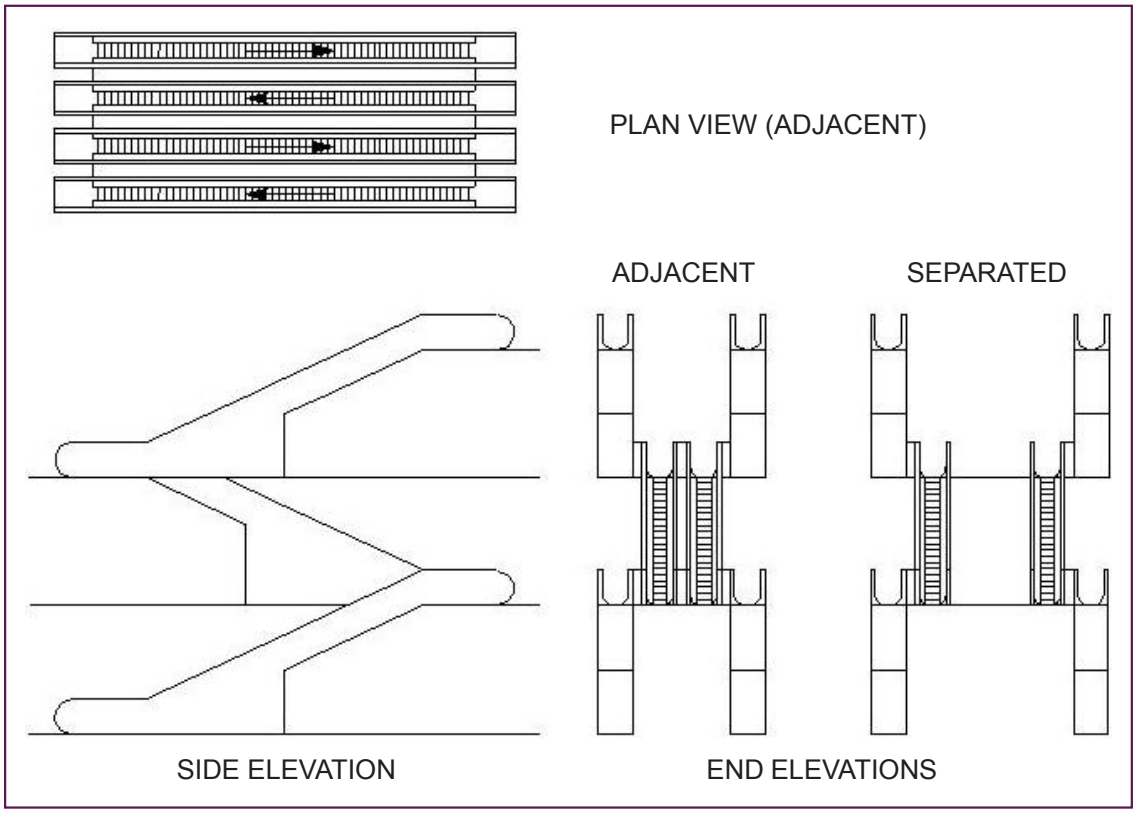

Figure 7.2: Parallel Escalator Arrangement

7. Provide access panels where required to permit inspection of the interior of the truss.
8. Provide transparent balustrades only where required for aesthetic value or building prestige.
    a. Use laminated or tempered safety glass for transparent balustrades.
9. Arrange escalator machines for emergency manual movement.
10. Provide rigid support for balustrades.
    a. Laminate interior panels, except glass panels, to suitable backing material and support to provide a solid panel assembly.
11. Design steps to include means to distinguish the division between step treads.
12. Illuminate comb plates to 50 lx minimum independent of the normal building illumination.
13. Design the building lighting system to illuminate step treads to 50 lx minimum.
14. Do not use spot welding processes on exposed surfaces, which may cause dimples in finished surfaces.

CHAPTER 8

SPECIFICATIONS

1. The clauses contained in the National Master Specification cover most of the usual types of vertical transportation encountered in most instances. Where unusual conditions or circumstances exist, additional clauses may be added or existing clauses edited to suit the project requirements.

2. A quality assurance review of the draft concept drawings and the specification documents prior to tendering and construction should be conducted by a departmental specialist with experience and knowledge in vertical transportation systems design and engineering practices.

CHAPTER 9

COMMISSIONING AND PROJECT CLOSE-OUT

1. Provide, at the time of the final acceptance of the elevator, one (1) AutoCAD version and three (3) hard copies of the wiring and schematic diagrams.
2. Provide, at the time of final acceptance, a complete catalogue of spare parts, including a price list. The Contractor should, at PWGSC request, promptly supply all spare parts for a period of fifteen (15) years following final acceptance of the elevators. Spare parts to be obtained at the current market cost at the time of purchasing.
3. The Contractor should provide to the Engineer, at the time of acceptance, one updated revised manual that includes the manufacturer's recommended procedures and detailed description of the operation, adjustments, and troubleshooting sequences for all equipment.
4. Upon completion of the work, arrange with the Engineer to provide a seminar for the Building Maintenance staff. The seminar should include a complete review of all documentation, operation of equipment, and demonstration of special features.
5. Provide final "as built" engineered general elevator equipment layout drawings, bearing the signature and seal of the professional engineer who prepared the drawings and reviewed the final installation of the elevating device, and associated systems, incorporated in the final as-built building drawings (AutoCAD Files).
6. Provide Operational and Maintenance manuals for the elevating device and associated systems that interface with the elevator's operation including directory, emergency information, equipment/system function, etc.
7. Perform field Quality Control, as required by CSA B44 safety code for elevators, and provide reports to the Engineer.
8. Provide to the Engineer a copy of the official final inspection report from the provincial inspection authority.
9. Provide an official copy of the operating permit.
10. Provide a letter stating warranty information.
11. Prior to issuing of the project final certificate of completion, a complete documentation Quality Assurance review should be conducted by a departmental specialist with experience and knowledge in vertical transportation systems operations, design, and engineering practice.

APPENDIX A

BILINGUAL SIGNAGE

A.1 Scope

1. Provide all signs and instructions in both English and French including:
    a. Car operating panels
    b. Telephone cabinets
    c. Service and attendant cabinets
    d. Top of car operating devices
    e. Special risers and hoistway access switches
    f. Corridor control and indicator panels
    g. Central control and emergency power selection switches
    h. Signal fixtures

A.2 Language Preference

Locate English wording above and French wording below, or English to the left and French to the right, in all provinces except Québec. In Québec, reverse the order.

A.3 Lettering

1. Style: Helvetica medium
2. Size: Vinyl lettering sized to suit location
3. Case: Upper and lower case. Capitalize beginning of sentences
4. Accents: Include
5. Colour:
    a. Buttons
        i. Engraved and filled black on white or white on black
        ii. Emergency stop switch—red
    b. Faceplates
        i. Engraved and filled with black enamel
        ii. Emergency stop switch wording filled with red enamel
    c. Telephone
        i. Wording filled with orange phosphorescent enamel

A.4 Telephone Boxes

A.4.1 Exterior surface of cover

1. Symbol: 3" high, engraving width of 1/16".
2. The lettering on the following signs should be 36 points high (Letraset 724):
   a. In case of emergency
      Push Button
      Wait for answer
   b. En cas d'urgence
      Appuyer sur le bouton
      Attendre une réponse

A.4.2 Interior surface of cover

Indicate elevator number.

A.5 Freight Elevator Emergency Stop Button

Engrave the following on the plate as per manufacturer's standards:

Emergency stop while pressed	Arrêt d'urgence pression constante
Stop	Arrêt
Push to stop Pull to run	Presser pour arrêter Tirer pour démarrer

A.6 Door Operating Buttons (in car)

1. Place the Open door and Close door buttons at some distance from the Stop and Alarm buttons.
2. Place the Open door button and Close door button side by side, with the Close button on the door side.
3. Refer to CSA B44 for control buttons symbols and engrave the following on the plate:

Open		Close
	Doors	
	Portes	
Ouvrir		Fermer

A.7 Capacity Sign

1. Engrave the following on the control panel:

Maximum capacity _____ kilograms (pounds) or _____ persons Capacité maximale _____ kilogrammes (livres) ou _____ personnes

2. Use 36-point letters.

A.8 Lobby Level

The button indicating the main entrance level should be marked as follows:

Main entrance Entrée principale

A.9 Floor Buttons

1. Manufacturer's standard numerals may be used, except as follows:
   a. Basement buttons: B1/SS1, B2/SS2, B3/SS3, etc.;
   b. Mezzanine: abbreviate Mezz;
   c. Parking levels: P1, P2, P3, etc.

A.10 Dispatching Signal Fixtures

Do not use "This car up" or similar signs at the main lobby. Use hall lanterns instead with arrows.

A.11 Identical Words

Repeat words that are identical in both languages.

A.12 Glossary of Terms

English	Français
Access-U-D-off	Accès-M-D-arrêt
Alarm	Alarme
Attendant	Préposé
Automatic	Automatique
Balanced	Équilibré
Basement	Sous-sol
Bell	Sonnerie
Buzzer	Avertisseur
Call	Appel
Cancel Calls	Appels annulés
Close	Fermer
Dispatch protection	Protection d'envoi
Door	Porte
Door stop	Butoir
Down peak	Pointe de trafic descendant
Emergency power	Alimentation électrique de secours
Emergency stop while pressed	Arrêt d'urgence pression constante
Fan	Ventilateur
Firefighter's service	Service de secours spécial (pompiers)
For Down Use	Descente seulement
Freight	Marchandises
Freight elevator	Monte-charge
Freight service	Service de monte-charge
Front door	Porte avant
Generator	Groupe électrogène
Home landing	Palier d'attache
In case of emergency	En cas d'urgence
In use	En marche
Inspection	Inspection
Lift receiver	Décrocher le récepteur
Light	Lumière
Light ray	Rayon lumineux
Main entrance	Entrée principale
Manual	Manuel
Maximum capacity	Capacité maximale
Mezzanine	Mezzanine
Non-stop	Sans arrêt
Off	Arrêt

A.12 Glossary of Terms (continued)

English	Français
On[8]	Marche
Open	Ouvrir
Out of service	Hors service
Overload	Surcharge
Persons	Personnes
Please hold handrail	Tenir la rampe s.v.p.
Please hold handrail	Tenir la main-courante s.v.p.
Pounds	Livres
Push to talk	Appuyer et parler
Rear door	Porte arrière
Reset	Réenclencher
Service elevator	Ascenseur de service
Up peak	Pointe de trafic montant
Wait for answer	Attendre une réponse

A.13 Abbreviations

English		Français	
Basement	B	Sous-sol	S-S
Inspection	Insp	Inspection	Insp
Mezzanine	Mezz	Mezzanine	Mezz
Parking	P	Stationnement (parc de)	P
Up	U	Montant	M
Down	D	Descendant	D
Inching down	I.D.	Nivelage en descente	N.D.
Inching up	I.U.	Nivelage en montée	N.M.

[8]The use of "on/off" should be avoided. "On" can be indicated graphically by an arrow pointing to a dot; "Off" is then understood to be away from the dot.

A.14 Elevator Safety Code Signage

English	Français
This elevator designed for general freight loading	Monte-charge destiné au transport des marchandises diverses
This elevator designed for motor-vehicle loading	Monte-charge destiné au transport de véhicules motorisés
This elevator designed for industrial truck loading	Monte-charge destiné au chargement par chariots industriels
This is not a passenger elevator. No persons other than the operator and the freight handlers are permitted to ride on this elevator	Accès interdit aux passagers. Seuls le conducteur et les manutentionnaires sont autorisés utiliser ce monte-charge
Capacity lifting one-piece loads _____	Capacité de levage de charges d'une Seule pièce _____
Stop button	Bouton d'arrêt
Stop switch	Interrupteur d'arrêt

APPENDIX B
NEWER TECHNOLOGIES

LULA (limited use limited application) elevators are devices relatively new to Canada, having only been introduced in recent editions of elevator safety code CSA B44. Section 5.2 of CSA B44 addresses the requirements. This device was first introduced into the American market in response to requirements in the United States of almost all buildings to meet the ADA (Americans with Disabilities Act). Building owners found that it was prohibitively expensive to retrofit existing buildings to accommodate commercially rated passenger elevators. However, not complying with the ADA could result in government fines or lawsuits from building users. Accordingly, regulating authorities developed the concept of the LULA Lift as a low-cost elevator with minimal shaft requirements. Additionally, a number of the safety features required of elevators are not required in LULA Lifts installations. Unlike a lift for persons with disabilities, a LULA Lift can be left operational at all times and can be used by all persons. In order to discourage building owners from installing a LULA Lift when a passenger elevator is required, the LULA was limited to a speed of 30 ft. per minute and a capacity of 1,400 pounds.

LULAs are available in several different platforms. A typical model provides for clear car inside 54 in. by 54 in. by 84 in. in height. Options for the door include a manual swing door, a power swing door, as well as an elevator-style power side-sliding door.

LULAs essentially are meant to provide a low-cost elevator to achieve barrier-free accessibility while sacrificing some of the safety features of a conventional elevator. As a trade-off to the missing safety features, the B44 code limits the platform size of the device to about half of that of even a small elevator, and limits the operating speed to about a third of that of the slowest elevator. Accordingly, use of LULAs in government-developed sites should be avoided in favour of conventional elevators, or at least considered very carefully in terms of implications to barrier-free accessibility.

MRL (machine room less) elevators are traction elevators (see **section 2.12** of this document) where the traction machine is placed within the elevator hoistway in order to save the construction cost of the overhead elevator machine room. Drawbacks of this arrangement include the fact that elevator machine noise and vibration can be much harder to isolate from the tenant space. Access to the elevator machine from a repair viewpoint is restricted, meaning that often machine repairs to MRL elevators are more time-consuming and disruptive to tenant operations. MRL elevators often are sold as a package by the elevator contractor's overseas factories, thus increasing their proprietary nature, and other cost-saving measures are incorporated such as miniaturized governors, use of single-skin doors rather than conventional hollow doors, and alternative rope technologies. These modifications all serve to reduce the weight and cost of the elevator but are generally thought to reduce overall equipment life as well as elevator ride quality in terms of noise and vibrations.

One big improvement brought about by the advent of MRL technology is the employment of permanent magnet AC motors. These motors generally are energy-efficient and are able to operate at lower motor speed, meaning that they can be substituted for conventional motors that would otherwise require speed-reducing gear sets.

Accordingly, the use of permanent magnet AC motors is typically associated with MRL elevators, but employing them instead in a conventional overhead machine room to facilitate maintainability and reduce noise, is a highly recommended approach.

Remote Monitoring Systems for Elevators and Escalators. An interactive, non-proprietary system to monitor and manage elevator and escalator equipment from a remote location through Internet connections. The data collected, data storage, and real-time monitoring of the system should be based on Microsoft Windows and be capable of interfacing with all makes and types of elevating devices.