



Elevators: Fall Hazards and Mechanics

Charanjeet Singh, P.E.

Executive Engineer

Harry Vyas

Technical Director

2015 BUILD SAFE | LIVE SAFE
CONFERENCE

NYC
Buildings

American Institute of Architects Continuing Education System

The NYC Department of Buildings is a registered Provider with The American Institute of Architects Continuing Education Systems (AIA/ CES). Credit earned on completion of this program will be reported to AIA/CES for AIA members. Certificates of Completion for both members and non-AIA members are available upon request.

This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or constructed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



Course Description

In this course, we will learn that elevator work comes with inherent dangers which cannot be eliminated completely. There are many fatalities and injuries reported nationwide arising from construction and repair of elevator and conveying devices. We will discuss the inherent dangers faced by elevator personnel and learn ways to mitigate risks while working on conveying devices. We will review best work practices including use of personal protective equipment that can be used to reduce risk of death or injury.

Learning Objectives

1. Participants will learn about potential hazards/risks that include but are not limited to fall hazards faced by elevator personnel while performing their job.
2. Participants will learn about the use of personal protective equipment to create a safer work environment for elevator personnel.
3. Participants will learn about elevator code provisions contained in the 2014 NYC Building Code which safeguard elevator personnel and public from potential hazards.
4. Participants will learn safety protocols and methods to mitigate hazards on conveying systems under construction and existing equipment.

The Elevator Unit's Mission

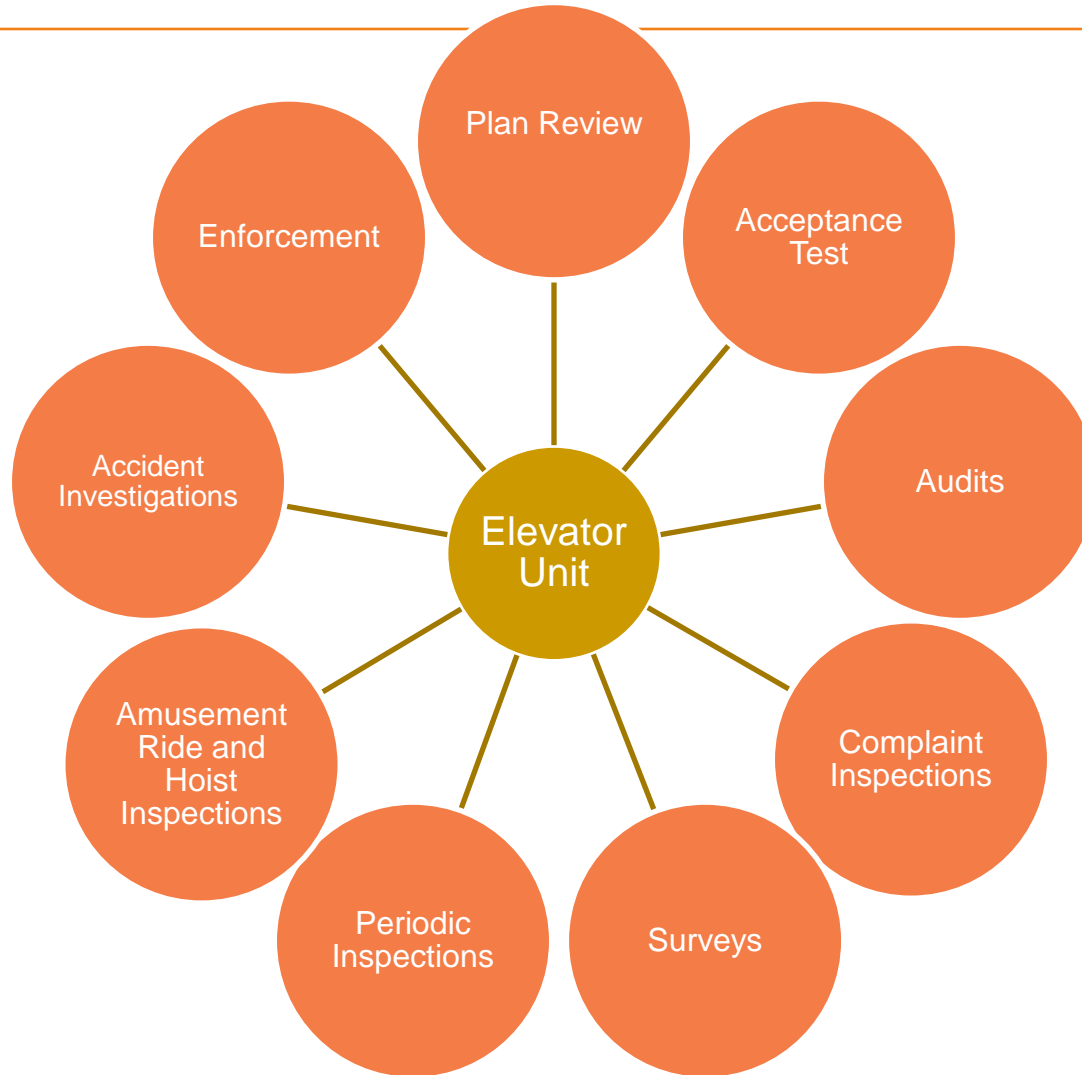
The Elevator Unit is an enforcement unit within the department of buildings and ensures operational safety, reliable service and lawful use of elevators, escalators, amusement rides and other related devices throughout the City of New York by performing inspections and testing.

The Unit enhances compliant development and safety awareness through the Department's various outreach programs. The Unit supports development by permitting new technologies under pilot programs.

OSHA

- Worker safety is under the jurisdiction of OSHA.
- Material presented in this slide that is applicable to worker safety is being presented as a courtesy by the NYC Department of Buildings.

Functions of the Elevator Unit



Elevator Safety

The Public

Elevator
Personnel

Authorized
Personnel

Emergency
Responders

Accident Prevention

Plan Review

- Verify code conformance:
 - New Installations
 - Alterations/ Modifications

Periodic Inspections

- At least one inspection per year by our department

CAT1 Inspections

- Inspections by third party and witness
- Requires report filing
- Perform corrective actions

Accident Prevention (cont.)

CAT3/ CAT5 Inspections

- Extensive test done every 5 years
- Inspections by third party and witness
- Requires report filing
- Perform corrective actions

Complaint Inspections

- Full periodic done during complaint inspection

Audit Inspections

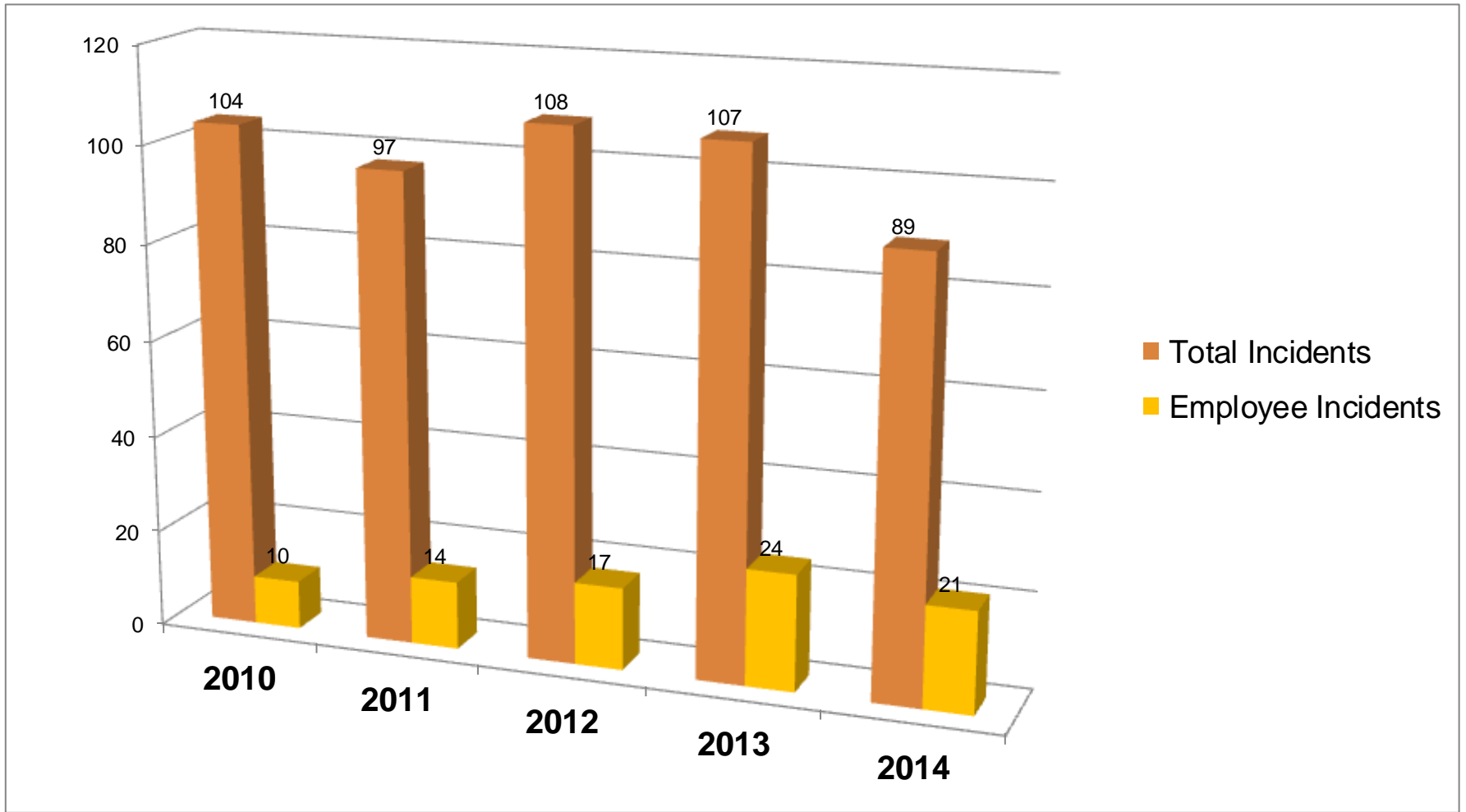
- On already completed jobs and CAT1/ CAT5 inspections

Accident Prevention(cont.)

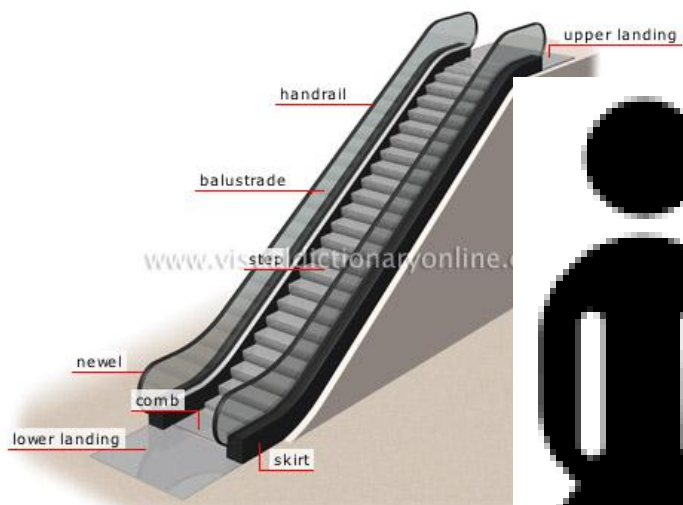
Outreach and Training Programs

- Safe-T Rider
- Meetings with vendors, elevator industry associations
- Communication via Building's website
- Training of inspectors
- Industry Outreach
- Training seminars and conferences

Incident Statistics



Root Cause of Most Accidents



www.vocabularydictionaryonline.com



Elevator Mechanic

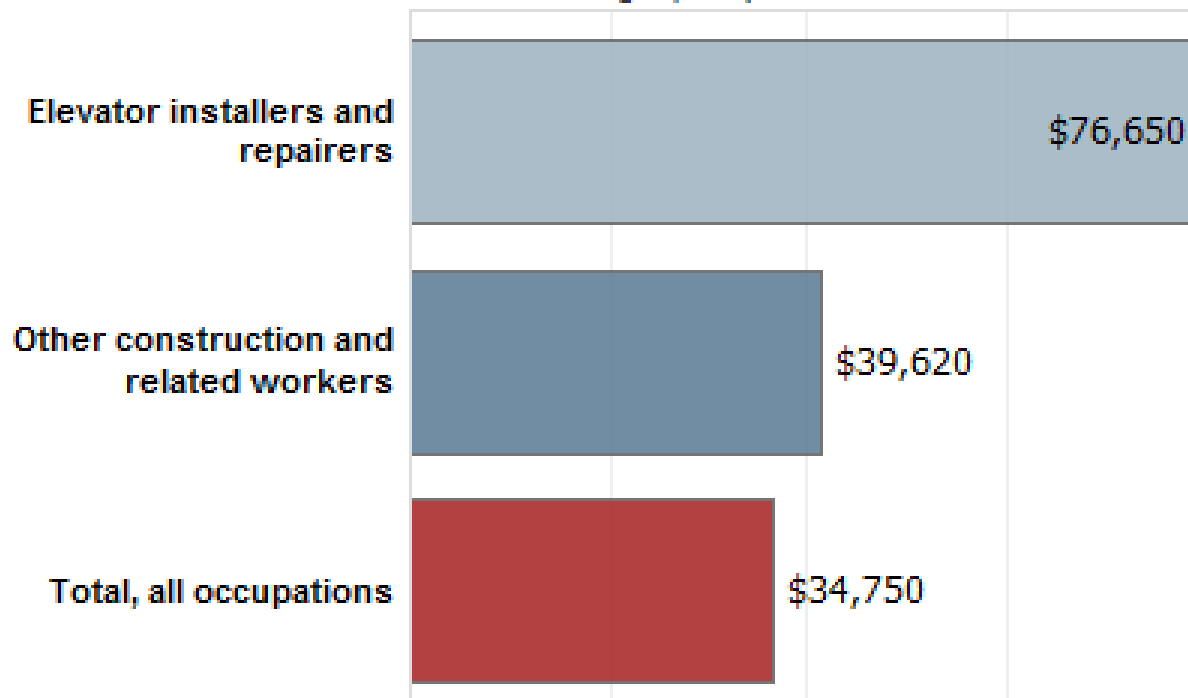
Job Description:	Install, fix and maintain elevators, escalators, moving walkways, and other lifts
Entry level education:	High school diploma or equivalent, Apprenticeship program
Median Pay:	77k/annum
Job growth:	25% (Much faster than average)

Source: United States Department of Labor, Bureau of Labor Statistics

Elevator Mechanic

Elevator Installers and Repairers

Median annual wages, May 2012



Note: All Occupations includes all occupations in the U.S. Economy.

Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Work Environment

- Carry heavy equipment and parts
- Work in confined spaces
- Work at elevations
- Exposure to high voltages
- Exposure to hazardous materials and chemicals



Work Hazards

- Injuries due to lifting or carrying heavy objects and tools
- Injuries caused by awkward postures, vibration of power tools and machinery
- Noise induced hearing loss
- Eye injury from cutting, welding and dust debris
- Trip and Fall hazards
- Fall hazards
- Injuries from falling objects and tools
- Risk of electrocution



Hazardous materials

- Asbestos
- Solvents used for cleaning or degreasing
- Adhesives and epoxies
- Exhaust from gas or diesel powered equipment, welding fumes
- Dust and silica, carbon dust from generators/motors
- Fungi
- Lead based paint
- Bearing greases, lubricants, machine fluids
- Biological hazards (Needles thrown into pits, animal feces, urine)
- Pests



Plan your work



Work Area

- Work area must be properly ventilated
- Work area must be properly illuminated
- Work area must be clear of debris and clutter
- Means of egress must be unobstructed
- Must be secured from unauthorized access
- Store flammable liquids and chemicals in approved containers



Workers attention

Do Not

- Be distracted by cell phones, headphones
- Loud Music
- Put yourself in harms way
- Work under influence of drugs or alcohol
- Play practical jokes or horseplay

Do

- Wear proper attire and personal protective equipment
- Use the right tools
- Lock out tag out as needed
- Obey all safety signs
- Take breaks as needed



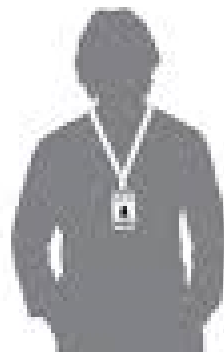
Communication



CAUTION DO NOT ENTER



Dress to Work



PPE - Eye Protection



PPE – Hearing Protection



PPE - Respirator



PPE – Hard Hat



PPE – Fall Protection



OSHA – Big Four



According to OSHA 4 leading causes of worker fatality in 2013 are:

- Falls (39.6%)
- Struck by Object (10.3%)
- Electrocutions (8.9%)
- Caught in between (2.6%)

Electrical Safety

- Lock out/ Tag out
- Area accessible to qualified personnel only
- Use appropriately rated fuses
- Do not jump fuses
- Use grounded equipment and provide GFCI outlets where required by the code
- All circuits shall always be treated as LIVE until test proves otherwise
- Wear proper clothing (Arc Flash)
 - FR Rated Clothing
 - EH rated footwear/ Rubber mat
 - Rated insulated gloves



Working Clearances

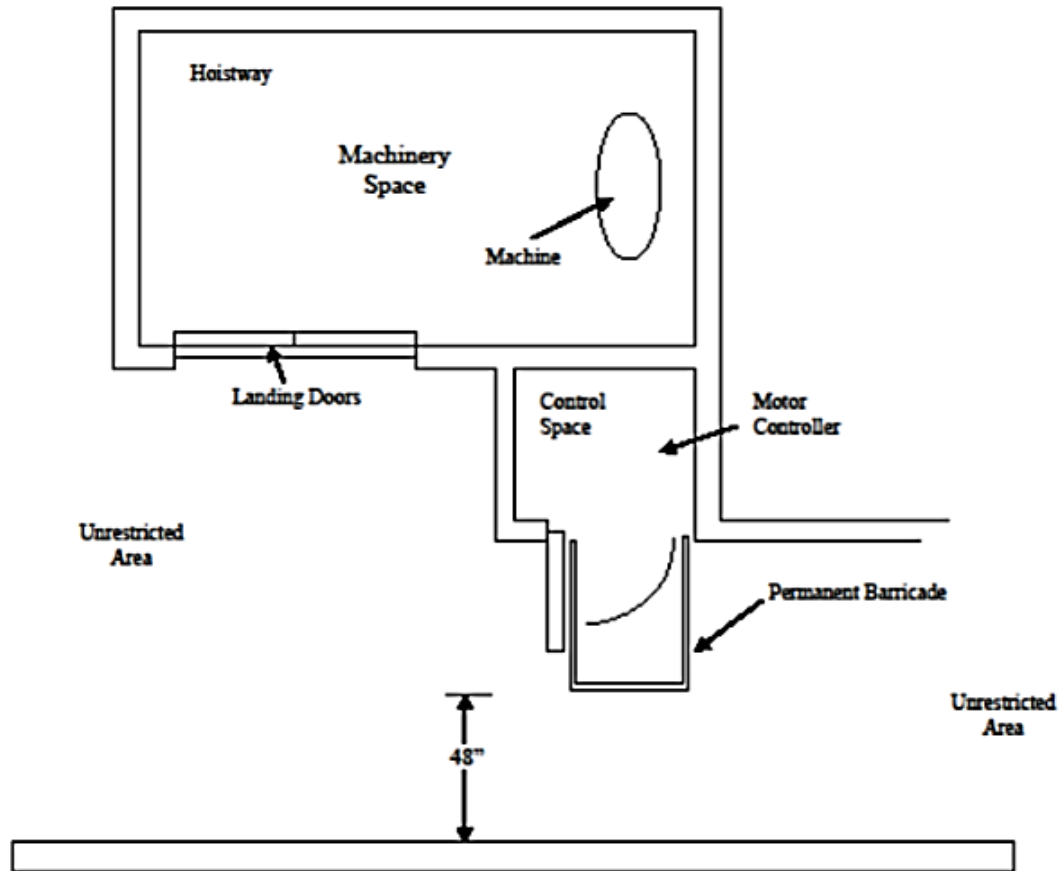


Figure Q-2

Source: Appendix K4

Struck By Object

Do not:

- Allow other trades to work in the hoist way above or below you
- Work in the hoist way below welding or cutting operations
- Store tools on divider beams
- Leave parts, lubricants, etc., on the top of elevator cars



Fall Protection: Ladder Safety

Do Not:



- Use turned buckets, crates or chairs etc., as ladders
- Climb on guard rails to reach machinery
- Climb a ladder with tools in your hands
- Use conductive ladders
- Paint ladders
- Have more than 1 person on ladder at the same time



Fall Protection: Ladder Safety

Do



- Use OSHA-compliant ladder with 1-A (300lb rating) as a minimum
- Use the right ladder for the job
 - Straight, step, or extension
- Ladder with correct height
- Ladder in good working condition
- With correct capacity rating
- Use ladder that extends 3' above the landing
- Maintain ladder free of oil, grease and other slipping hazards



Fall Hazards

Identify fall hazards in the workplace

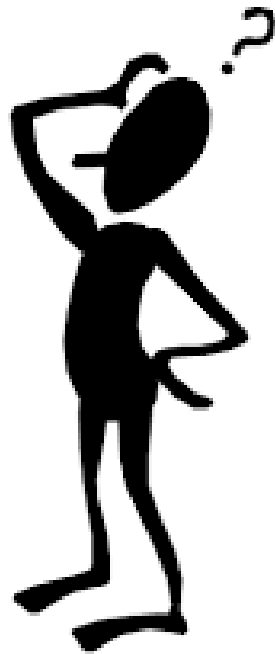
Once identified:

1. Elimination or substitution
2. Engineering Controls
3. Personal Protective Equipment

Eliminate Fall hazards

Elimination or substitution:

An example of eliminating a hazard would be to complete work at ground level instead of working at heights.



Engineering Controls

Guardrail Systems

BC (3308.7)

- Top rail
- Mid rail
- Toe board
- Posts



Safety Netting

BC (3308.5)

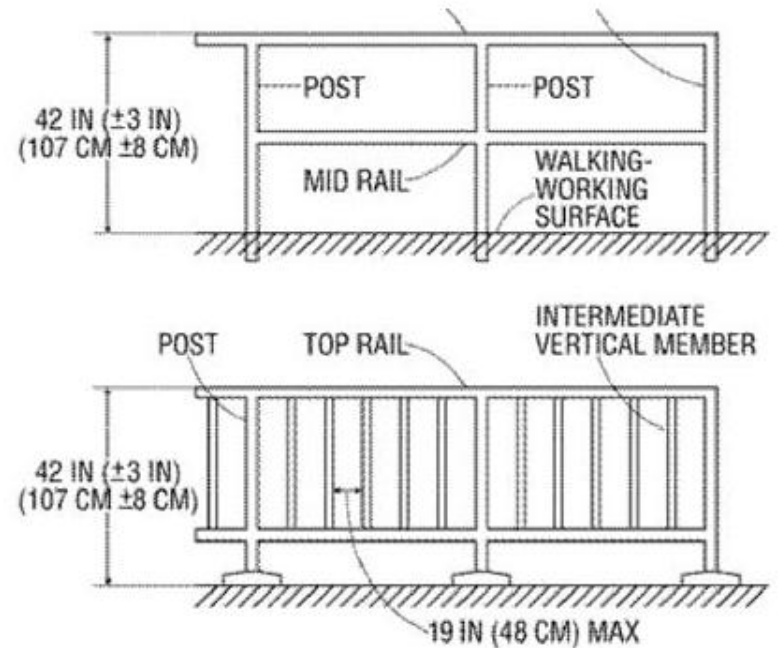


Engineering Controls

Guardrail Systems

BC (3308.7)

- Top rail – 42 in. \pm 3 in.
- Mid rail – 21 in. (centerline)
- Toe board - 3½ in.
- Posts – no greater than 8 ft.
- Top rail shall not deflect lower than 39 in. when 200lb force is applied.



Engineering Controls

- No unguarded open holes in the floor
- No unguarded skylights



Personal Protective Equipment



When hazard cannot be eliminated

- Horizontal netting (BC 3308.6)
- PPE – Fall Protection

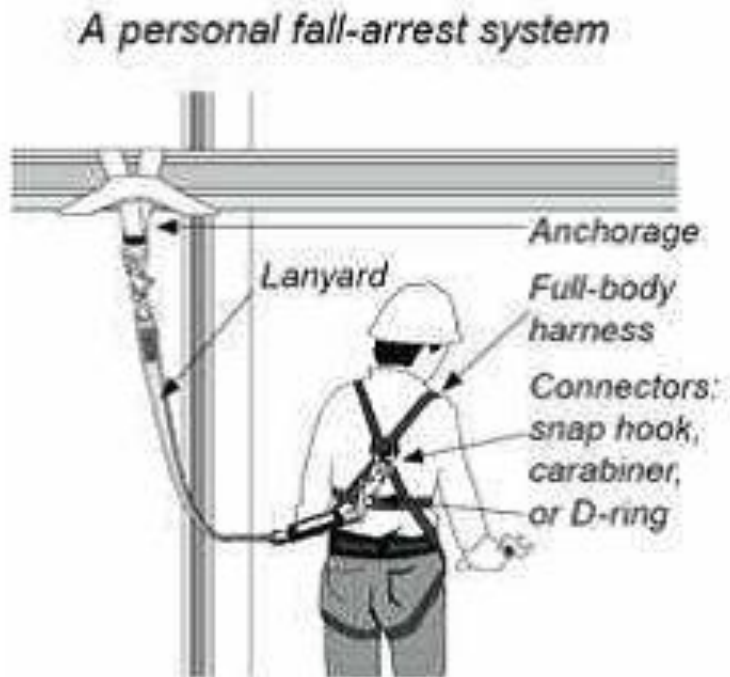


Photos courtesy of Miller® Fall Protection

Personal Fall Arrest System

A Personal Fall Arrest System is comprised of three (3) key components:

- Anchorage connector;
- Body wear;
- Connecting device.



Personal Fall Arrest System

Anchorage and anchorage connectors should be carefully planned.

Should a fall occur, worker's life will depend on it's strength.



Anchorage connector should be positioned to avoid a “swing fall”.



Photos courtesy of Miller® Fall Protection

Personal Fall Arrest System



Chest strap positioned too high and too loose. Leg straps are positioned improperly.



It is important that the full-body harness be worn correctly.

Improper use may result in injury.



Chest strap positioned incorrectly. Should be located at mid-chest to keep shoulder straps snug. Leg straps are too loose.

Photos courtesy of Miller® Fall Protection

Personal Fall Arrest System



Chest and Leg Straps Offer a Snug Fit



Photos courtesy of Miller® Fall Protection

Personal Fall Arrest System

Lanyard:

Connecting device between Anchor point and full- body harness

- Shock-absorbing
- Non shock-absorbing

Self-Retracting Lifeline (SRL):

- Alternative connecting devices to shock-absorbing lanyards.
- Require shorter activation distance

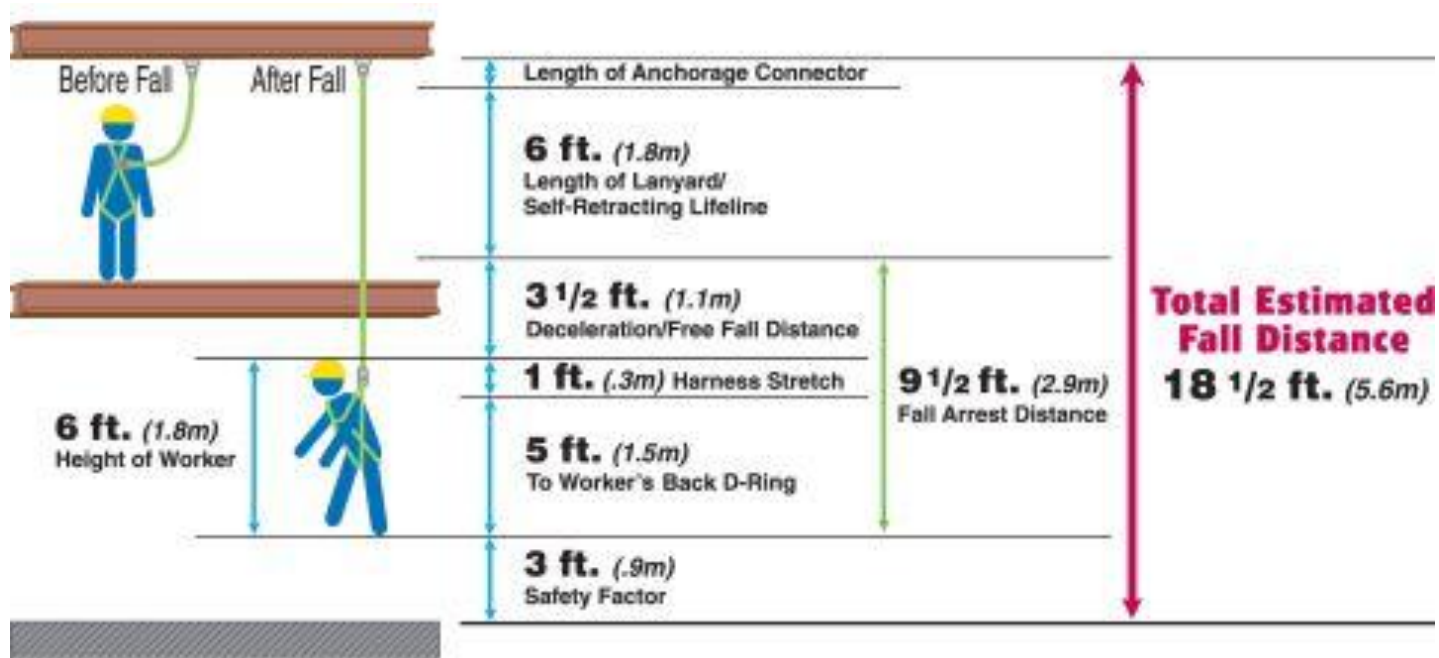


Photos courtesy of Miller® Fall Protection

Calculating Fall Clearance

Shock-Absorbing Lanyard or Self-Retracting Lifeline?

Always know your fall distance and select proper equipment to meet the fall clearance.



"Photos/Illustrations/Information courtesy of Miller® Fall Protection"

Gravity Does Not Discriminate



Parking Devices

Elevators that are operated from within the car only and have manual operated doors that can be opened with a common tool shall have elevator parking devices installed at that landing.

Source: Appendix K (BC)

Interior Car Lighting

Car interior light shall not be extinguished.

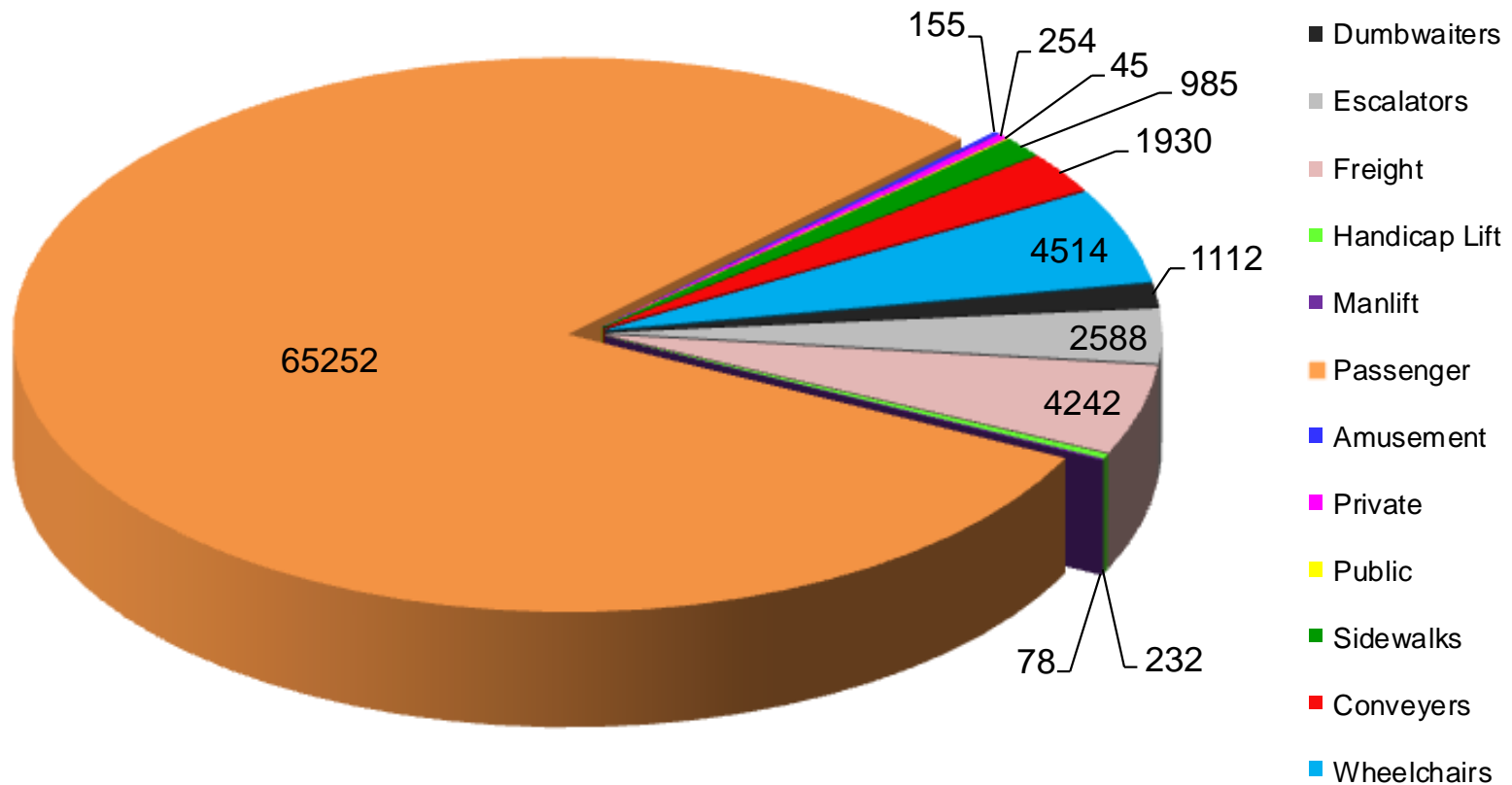


Source: Appendix K (BC)

New York City Elevator Overview

- 150** Years of Elevator History (since 1857)
- 81,417** Devices Under the Department's Jurisdiction
- 500** Average Daily Elevator Trips
- 30** Million Daily Citywide Trips
- 12** Percent of all US Elevators in NYC

Types of Elevators (Devices)



Safety Process

- Development of Codes and Standards
- Application and Registration Process
- Inspection and Testing
- Training
- Quality Assurance
- Enforcement
- Outreach Programs
- Maintenance Requirements

Codes and Standards Purpose

- Standards are communication vehicle for producers & users.
- They serve as common language defining quality and establishing safety criteria.
- Developed to protect the health and welfare of the public.
- Costs are lower if procedures are standardized.
- Training is simplified.

Purpose of Codes and Standards (continued)

- Allow new development and technical advances.
- Consumers accept products more readily when the products can be judged on merit of codes and standards.
- Harmonization of standards enhance industry innovation, improve safety, reduce costs and can be used in all markets.
- The Code is a standard that has been adopted by governmental bodies or regulators and has the force of law.

Code Committee

The NYC Elevator Code Committee consisted of elevator stakeholder groups, organizations, associations and government agencies. The committee reviewed each section of the code and standards and made decisions to enhance safety and reliability for our riders. The committee used consensus-based process.

AFFILIATION/ REPRESENTATION	
NEII	National Elevator Industry, Inc.
NYCHA	New York City Housing Authority
REBNY	Real Estate Board of New York
ECNY	Elevator Conference of NY
Port Authority of NY & NJ	
EMANY	Elevator Manufacturers Association of NY
FDNY	New York City Fire Department
ASME	Code Committee Member
BOMA	Buildings Owners and Managers Association of NY
Local Union – 1, 3	
NYC - DOB	New York City Department of Buildings
NAEC	National Association of Elevator Contractors
DCAS	Department of Citywide Administrative Services

2014 Building Code and Standards

IBC 2009 as modified by NYC Building Code 2014 – Elevators and Conveying System: Chapter 30

- **ICC/ANSI A117.1-2009:** Accessible and usable buildings and facilities.
- **ASME A 17.1/2000 with 2002 and 2003** addendum as modified by NYC Building Code Appendix K; Chapter K1.
- **ASME B20.1-2006:** Safety standard for conveyors and related equipment as modified by Appendix K; Chapter K2.
- **ASME A 17.3/2002:** Existing elevators and escalators as modified by Appendix K; Chapter K3.

2014 Building Code and Standards (continued)

- **ASME A 17.1-2005:** Machine Room Less (MRL) elevators as modified by Appendix K; Chapter K4.
- **ASME A 17.6-2010:** Standards for elevator suspension, compensation and governor system as modified by Appendix K; chapter K4.

Effective: December 31, 2014.

2014 Building Code and Standards (new)

Occupant Evacuation Elevators- OEE- (BC 403.5.2 and BC 3008)

- **When required:** Option in lieu of providing an additional exit stair for new, non-residential buildings taller than 420 feet per BC 403.5.2.
- **Effective:** BC 403.5.2 is mandated for projects filed on or after* the **later** of **June 30, 2015** or the date of the Zoning Text Amendment that amends the definition of floor area in the NYC Zoning Resolution to exclude the floor area of the additional exit stair and additional exit stair width from the calculation of zoning floor area.

* See Buildings Bulletin 2014-2015

2014 Building Code and Standards (continued)

- **Rule:** After input from committees & FDNY, Rules for OEE operation (ASME A17/2013) and Fire Alarm requirements for OEEs (NFPA 72/2013) poised to begin formal rule-making process.

Fire Service Access Elevator-FSAE- (BC 403.6.1 and BC 3007)

- **When required:** At least one FSAE must be provided in new buildings with occupied floors above 120 feet.
- **Effective Date:** Projects filed on or after* December 31, 2014.

***See Buildings Bulletin 2014-2015**

Inspection Statistics – CY 2013

- **Total Number of inspections performed CY 2013: 180,847**
- **Department of Buildings**
 - ✓ Inspectorial Staff : 34
 - ✓ Inspections/ Tests Performed: 23,105
- **Contract agency inspections (on behalf of the Department)**
 - ✓ Agencies: 3
 - ✓ Inspectorial Staff: 44
 - ✓ Inspections Performed: 60,172
- **Approved (licensed agency inspections on behalf of building owner)**
 - ✓ Approved (licensed) Agencies: 168
 - ✓ Approved Agencies' Directors: 287
 - ✓ Approved Agencies' Inspectors: 829
 - ✓ Inspections/ Tests Performed: 97,560

Safety - Rule



- **No Job Takes Priority Over Safety**
- **Plan Safety Into Every Job**
- **Take Care of Each Other**
- **Safety is Everyone's Responsibility**

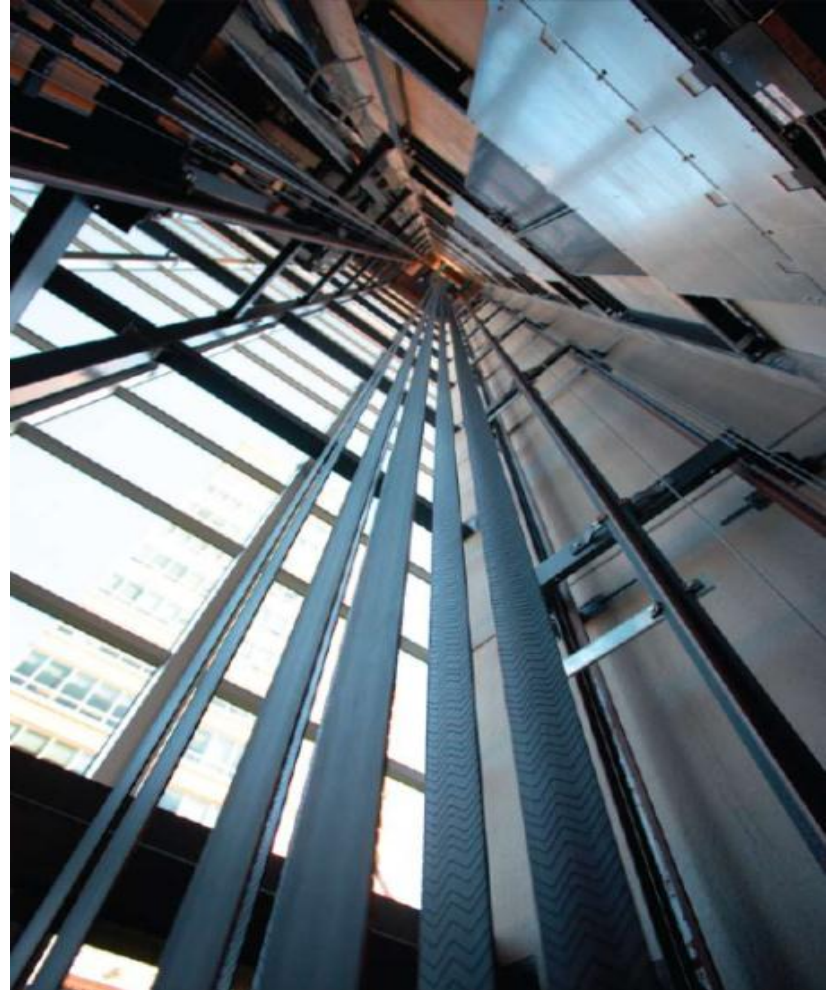
Elevator Safety

Public Safety Factors

- ✓ Car Control
- ✓ Jumper Management
- ✓ Caution Tape
- ✓ Deep Pit Protection
- ✓ Barricades

Mechanic Safety Practices

- ✓ Access/Egress MR
- ✓ LOTO/Electrical Safety
- ✓ Jumpers
- ✓ Mechanical Safety
- ✓ Hoist way Access Procedure
- ✓ Fall Protection
- ✓ Safety Culture, Creation & Maintenance



Elevator Safety

- **Safety of Workers:** Occupational Safety and Health Administration (OSHA) Safety Regulation.
- **Fall Protection:** Personal Fall – Arrest system, guardrail system, barricades.
- **Electrical Safety:** Personal protective equipment, safety checklist.
- **Proper Use of Jumpers:** Use extreme caution, only use on inspection and ensure jumpers removed before placing equipment back in service.
- **Lock-out and Tag-out**
- **Use of Caution Tape when Elevators are being serviced**
NYC Building code Section BC-3009.

Jobsite Inspections

Although the elevator industry continues to drastically reduce the number of injuries, serious injuries still occur.

As a result, some members have developed special observation programs to assess the level of understanding of mechanics of the key hazard areas, while performing typical procedures.

This assessment focuses on preventing the leading causes of serious and fatal injuries.



1. **Fall Protection**
2. **Control of the Hazardous Energy**
3. **Control of the Elevator**
4. **High Risk Practices**
 - ✓ Scaffolding
 - ✓ False Cars/ Running Platforms
 - ✓ Hoisting & Rigging
 - ✓ Jumpers

Safety Culture Development

- **Minimum Operational Requirements**
 - ✓ Comply with Federal, State and City regulations
- **Develop a Culture of Safety**
 - ✓ Develop a Safety Management System
 - ✓ Proactively and thoroughly manage safety
 - ✓ Employee training & communication
 - ✓ Proper safety equipment & tools
 - ✓ Create an environment where mechanics champion safety
 - ✓ Empower mechanics to own safety
 - ✓ Support the safest work, not the fastest
 - ✓ Vehicle Management/ Driver Accountability
 - ✓ Invest in the safety program



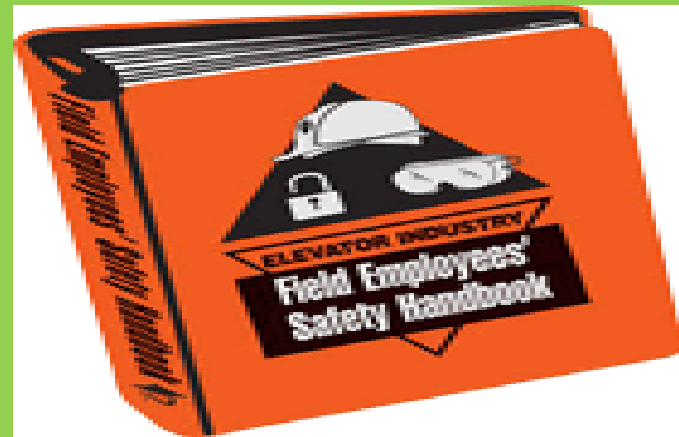
Educating Mechanics on the Process

- Classroom and hands-on training reinforces the learning process
- Improves accountability and compliance
- Frequent training/ communication
- Elevator Field Employees' Safety Handbook

Engaged Training



Safety Handbook



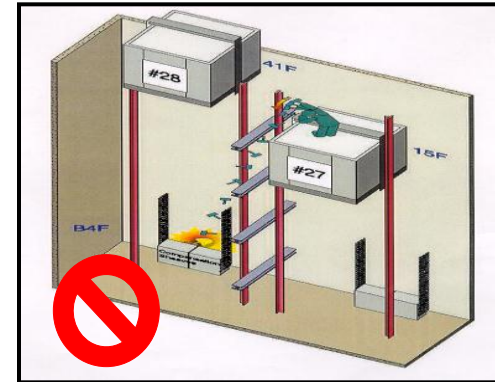
Establish the Rules



NEVER ride escalator when steps are removed.

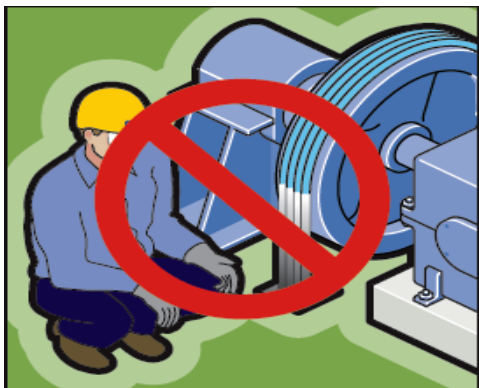


NEVER ride the car top with the elevator in normal operation.



NEVER work above or below others when working in the Hoistway.

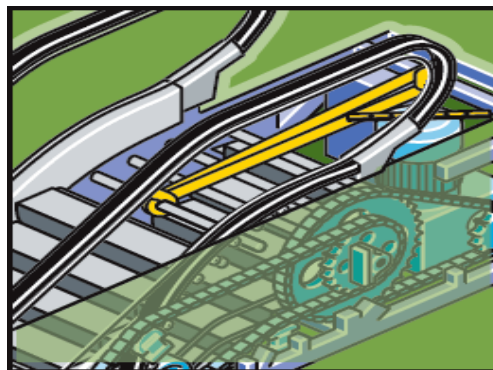
Establish the Rules (continued)



ALWAYS control live electricity and rotating equipment when working within close proximity.

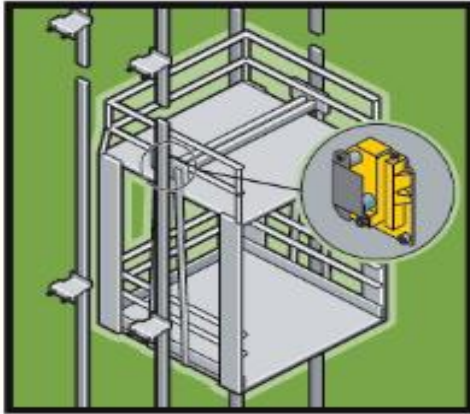


ALWAYS use barriers and redundant controls (LOTO) when unattended.



ALWAYS secure the step chain from movement.

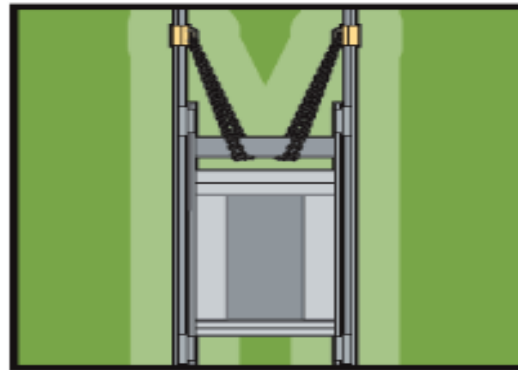
Establish the Rules (continued)



ALWAYS follow the operation authorized procedures for false cars/ running platforms.



ALWAYS follow proper jumper procedures.



ALWAYS use certified & inspected hoisting & rigging equipment.

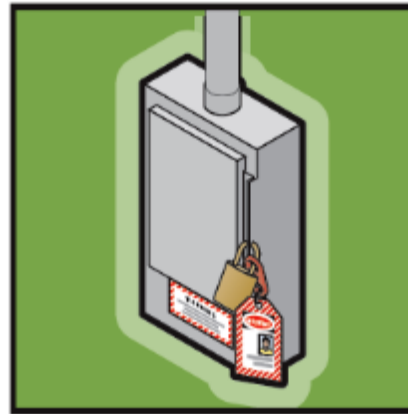
Establish the Rules (continued)



ALWAYS use fall protection when a fall hazard exists.



ALWAYS establish and maintain control of the unit prior to accessing.



ALWAYS lock and tag out equipment when power is not required.

Escalator Safety – General Public

Barricades: Preventing Incidents from occurring



Elevator Safety – Elevator Mechanic

Fall Protection: Elevator mechanics can be exposed to falls.

- Guardrails eliminate the hazard

Guardrails



Fall Protection



Elevator Safety – Elevator Mechanic

Hoistway Access

Serious injuries occur when control of the car is lost.

- Specialized tooling and processes to validate the safety circuits is a best practice.

Specialized Tools



Improvised Control



Elevator Safety – Elevator Mechanic

Mechanical Hazards

- Elevator companies maintain equipment that is owned by another party.
- Retrofitting of permanent guards is an owner decision.
- Use of temporary guarding is a best practice.

Guarded



Not Guarded



Elevator Safety – Elevator Mechanic

Electrical Hazards

- If electricity is required for the task, the mechanic must work safely around it.
- Increase distance from the hazard.
- Temporarily guard the hazard.
- Permanently guard the hazard.

Temporary Electrical



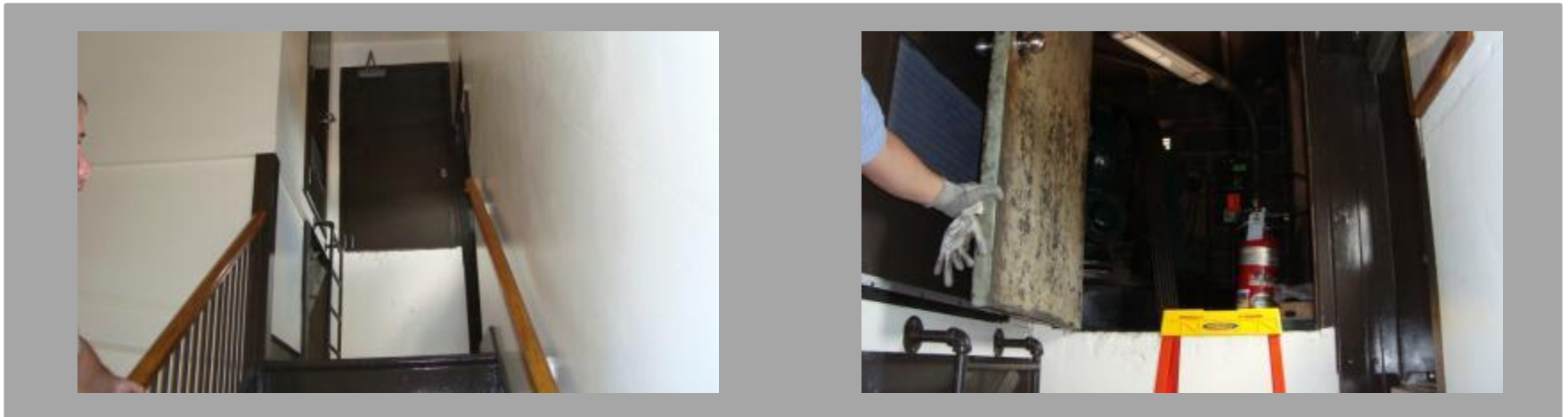
Exposed Electrical



Elevator Safety – Elevator Mechanic

Access/ Egress Machine Room

- Presents hazard to the mechanic.
- Must commonly access rooftops, staircases and mechanical spaces not designed for public access.



Elevator Safety – General Public

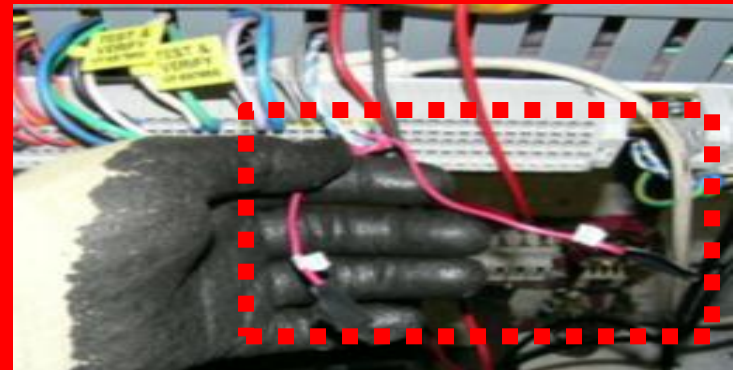
Jumper Management

- The controller is programmed to prevent unwanted movement of the car, jumpers defeat these circuits.
- Robust management practices must be applied.
- Personal accountability for jumpers must start with the mechanic.

Controlled Jumper



Uncontrolled jumper



Elevator Safety – General Public

Jumper Best Practices

- Jumpers must not be used as a diagnostic tool.
- Temporary bridging devices must never be used to short out hall door contacts.
- Exceptions must have a written JHA approved by supervision.
- Never jump-out door and gate contacts at the same time.
- Ensure that elevator is on inspection prior to placing jumpers on door, gate, or safety circuits.
- When passenger(s) are trapped inside a stalled car, mechanic must never jump car gate and move the car from the machine room unless they have communication either directly with the passenger(s) or with a second mechanic. In these types of situations it is preferable to move the elevator using TOCI.

Elevator Safety – General Public

Caution Tape (NYC)

- The Code specifies 3” yellow caution safety tape installed at 18” and 54” on the inside car door threshold when working on the elevator.
- Tape must be utilized when elevator is removed from normal service and a mechanic is not working in front of the entrance of the actual device.
- Prevents unintended public entrance.
- Lights out/ doors open communicates that the car is out of service.

CAUTION CAUTION CAUTION

Outreach Program

- Elevator Code Review and Interpretation Committee.
- Safety and Code Presentation to the Real Estate Industry, Elevator Industry and other stakeholders.
- Elevator and Escalator SafeT-Rider Program in City Schools.

During the month of November, the Department celebrates National Elevator and Escalator Safety Week. Representatives from the Department visit various schools to provide safety awareness classes to students 2nd through 4th grade. This program is sponsored by the National Elevator and Escalator Safety Foundation.

Safe T-Rider Program

BE A SAFE RIDER



SAFE RIDER RULES

Escalators & Moving Walks

- Step on and off carefully
- People only — no strollers
- Hold handrail
- Take care of younger children
- Do not touch sides below handrail
- Stand facing forward

Elevators

- Watch your step
- Leave closing doors alone
- If doors don't open, ring alarm button and wait
- If there is a fire in the building, use stairs

NYC Buildings JUN INSP

NYC BUILDINGS ELEVATOR SAFETY TIPS

IF YOU GET STUCK IN AN ELEVATOR:

- 1. RING** the alarm. 
- 2. RELAX** because help is on the way. 
- 3. WAIT** without opening the doors. 

Don't forget:
IF THERE'S A FIRE USE THE STAIRS!



Call 311 for an elevator safety class at your school.

Michael R. Bloomberg, Mayor
Robert D. LiMandri, Commissioner

Outreach Program



Program Recognition & Enforcement

Mature programs

- Motivate employees to “do the right thing”
- Reinforces compliance to rules
- Formally document history
- Verbal warning to termination options
- Automatic suspensions for violations, even first time

Safety Message



Safety Tip:

A few over-the-counter drugs like antihistamines, cough syrups, and cold medications can create drowsiness.

During allergy season, take notice of the side affects and adjust use accordingly.

Our Vision

- Safety
- Reliable Service
- Comfortable Ride
- Sustainable-Foster Greener Solutions (Environment, Climate and Energy)
- Workplace is free from hazards and injury free

Example of an Over Speed Governor



Hoist Counterweight Roller New vs. Worn



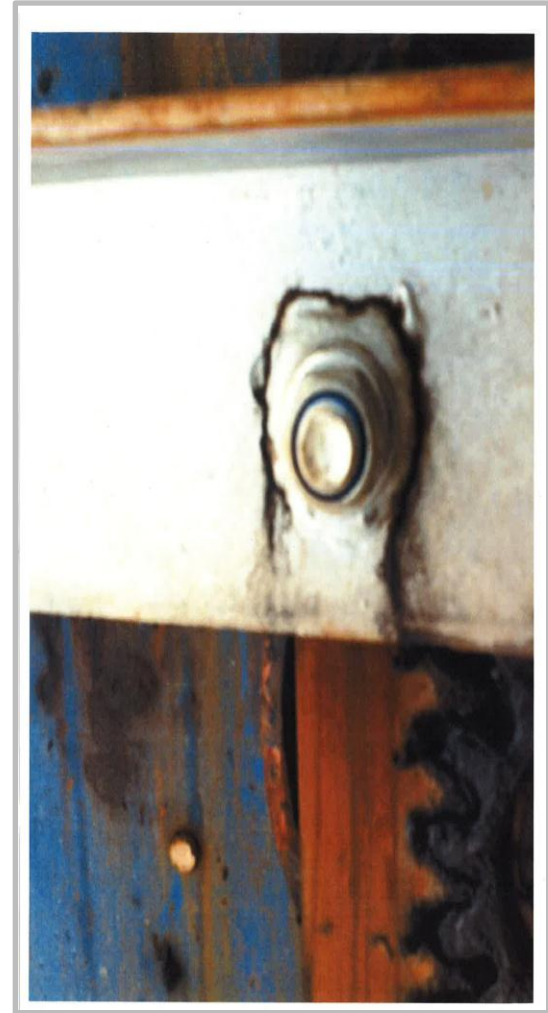
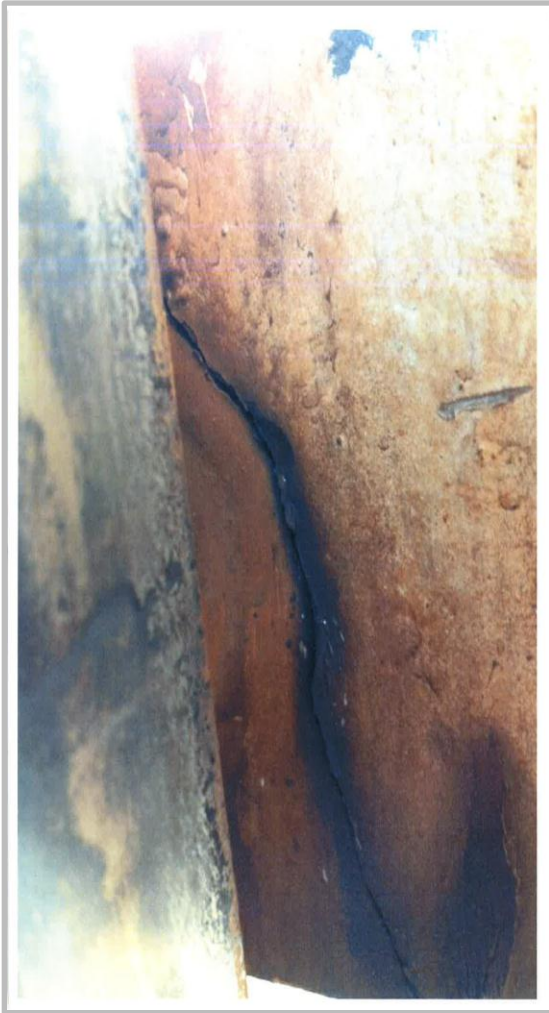
Missing Hoist way Enclosure



Illegal Hoist way Landing



Hoist Mast Metallurgy Defects



Damaged Hoist Rack Using Gauge



Damage Safety Device Idler Pinion After No Load Test



Future State Inspections

- Implementation of Bar-code and star-rating system for device.
- Develop risk analysis based inspection protocol.
- Zero tolerance for unsafe, unreliable elevator service and unsafe work practice.
- Increase percentage of audit/quality assurance inspections to enhance compliance.
- Computerized process for scheduling inspection/ test, submission of checklist, inspection results, reviewing building profile, online filing and payments.
- “My Elevator” tab on the Department’s Building Information System.
- Support new technology for sustainable growth.

Questions?

**This concludes the American Institute of Architects
Continuing Education Systems Course.**

AIA Point of Contact:

Allison Ginsburg

Aginsburg@buildings.nyc.gov

212.393.2167