

Compliance Assessment of Hospital Lifts: A Cross-Sectional Study Across Clinical Buildings in a Tertiary Care Teaching Hospital

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Abstract:

➤ Background:

Lifts are critical infrastructure in tertiary care hospitals to ensure safe patient transfer, accessibility, and emergency evacuation. The National Building Code of India (NBC), 2016 specifies safety and accessibility standards for lift installations.

➤ Objective:

To evaluate compliance of lifts with NBC 2016 across four clinical buildings in a tertiary care government teaching hospital.

➤ Methods:

A descriptive observational study was conducted in Ophthalmology, New Dental, Plastic Surgery, and Pediatric Surgery buildings. Eight functional lifts were assessed using a structured checklist based on NBC 2016 Volume 2 guidelines. Compliance across machine room, controller, pit, car inspection, fire operation, and safety devices was recorded. Downtime index was evaluated from maintenance records.

➤ Results:

Overall compliance ranged from 90% to 95%. The New Dental building and Ophthalmology building lifts showed 95% compliance. Plastic Surgery building lifts showed 90% (patient's Lift) and 94% (office Lift) compliance, while Pediatric Surgery building lift showed 94% compliance. Major non-compliance areas included non-functioning car bottom lights, absence of fireman operation mode in three lifts, missing floor announcement systems, and lack of pit ladder in one lift. No breakdown occurred during study period (downtime index = 0).

➤ Conclusion:

Most lifts demonstrated high compliance with NBC 2016. However, fire safety integration and accessibility features require urgent corrective action. Regular preventive maintenance significantly contributed to zero downtime.

Keywords: Elevator Safety, National Building Code 2016, Hospital Infrastructure, Lift Compliance, Fire Operation, Accessibility.

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I. INTRODUCTION

Vertical transportation systems are indispensable components of modern healthcare infrastructure. Elevators facilitate safe movement of patients, healthcare workers, equipment, and emergency transfers in multi-storey hospitals [1].

The National Building Code of India (NBC) 2016, issued by the Bureau of Indian Standards (BIS), provides comprehensive technical standards governing lift design, safety mechanisms, accessibility, fire operation, and maintenance requirements [2].

Elevator systems include traction or hydraulic mechanisms incorporating safety components such as overspeed governors (OSG), buffers, brake assemblies, limit switches, and emergency alarm systems [3]. In hospital environments, lift performance directly impacts clinical workflow, emergency response time, and patient safety.

Technological advancements have improved elevator safety and performance globally, particularly in high-rise buildings [4]. However, compliance gaps in healthcare institutions may expose patients to preventable risks.

Recent advancements in elevator technology have significantly improved the safety, efficiency, and reliability of vertical transportation systems. Modern elevators incorporate sophisticated control systems, destination dispatch technologies, energy-efficient drives, advanced braking mechanisms, and enhanced safety features that optimize passenger movement while minimizing waiting and travel times. These innovations have become increasingly important in complex facilities such as hospitals, where uninterrupted vertical transportation is essential for patient care, emergency response, and operational efficiency. Furthermore, improvements in elevator design have contributed to greater safety, accessibility, and user comfort, making elevators an integral component of contemporary healthcare infrastructure.[3]

Accessibility is a fundamental principle of healthcare facility design, ensuring that all individuals, including persons with disabilities, older adults, and those with temporary mobility limitations, can access services safely and independently. Inclusive design approaches emphasize the removal of physical and environmental barriers through the provision of accessible features such as adequately sized lift cars, tactile controls, visual and auditory indicators, emergency communication systems, and barrier-free circulation pathways. Such measures not only promote social inclusion and equitable access but also enhance the overall functionality and user-friendliness of healthcare environments.[5]

II. MATERIALS AND METHODS

➤ Study Design and Setting

This study employed a descriptive observational cross-sectional audit design to assess the compliance of lifts

installed in selected hospital buildings with the provisions of the National Building Code (NBC) of India, 2016. A cross-sectional approach was adopted because all observations were made at a single point in time without any intervention or manipulation of the lift systems. The study involved a systematic inspection of existing lift infrastructure, safety features, operational characteristics, accessibility provisions, and maintenance-related components using a structured checklist developed in accordance with NBC 2016 guidelines.

The following hospital building of a tertiary care government teaching hospital were assessed comprising 8 lifts:

- Ophthalmology Building (2 lifts; 1 functional)
- New Dental Building (4 lifts)
- Plastic Surgery Building (2 lifts)
- Pediatric Surgery Building (1 lift)

➤ Inclusion Criteria

All functional lifts in selected buildings.

➤ Exclusion Criteria

Non-functional old lift in Ophthalmology building.

➤ Data Sources and Variables

Structured observational checklist based on:

- NBC 2016 Volume 2 [2]
- Safety and accessibility standards [6]

➤ Domains Assessed

- Machine room
- Power supply
- Machine & brake assembly
- Controller
- Overspeed governor (OSG)
- Car roof inspection
- Pit inspection
- Earthing
- Car inspection
- Landing inspection
- Fire operation
- Safety devices

➤ Data Analysis

Data were compiled and analyzed using Microsoft Office Home & Student 2021, Compliance expressed as percentage.

➤ Ethical Considerations

This study was approved by the Institutional Ethics Committee (IEC), consent was not required.

III. RESULT

A total of eight functional lifts across four clinical buildings were assessed for compliance with NBC 2016

guidelines. Compliance levels ranged from 90% to 95%, with the highest compliance observed in the New Dental and Ophthalmology buildings (95%) and the lowest in the Plastic

Surgery Patient Lift (90%). The overall compliance status of the assessed lifts is presented in Table 1.

Table 1 Overall Compliance Summary of Assessed Lifts with NBC 2016 Guidelines

Building	Number of Lifts	Compliance (%)
New Dental Building	4	95%
Ophthalmology Building (New Lift)	1	95%
Plastic Surgery Building (Patient)	1	90%
Plastic Surgery Building (Office)	1	94%
Pediatric Surgery Building	1	94%

This overall compliance indicates that the majority of lift systems met the prescribed safety, operational, and accessibility requirements; however, certain deficiencies

were identified that warrant corrective action to achieve full compliance with NBC 2016 standards.

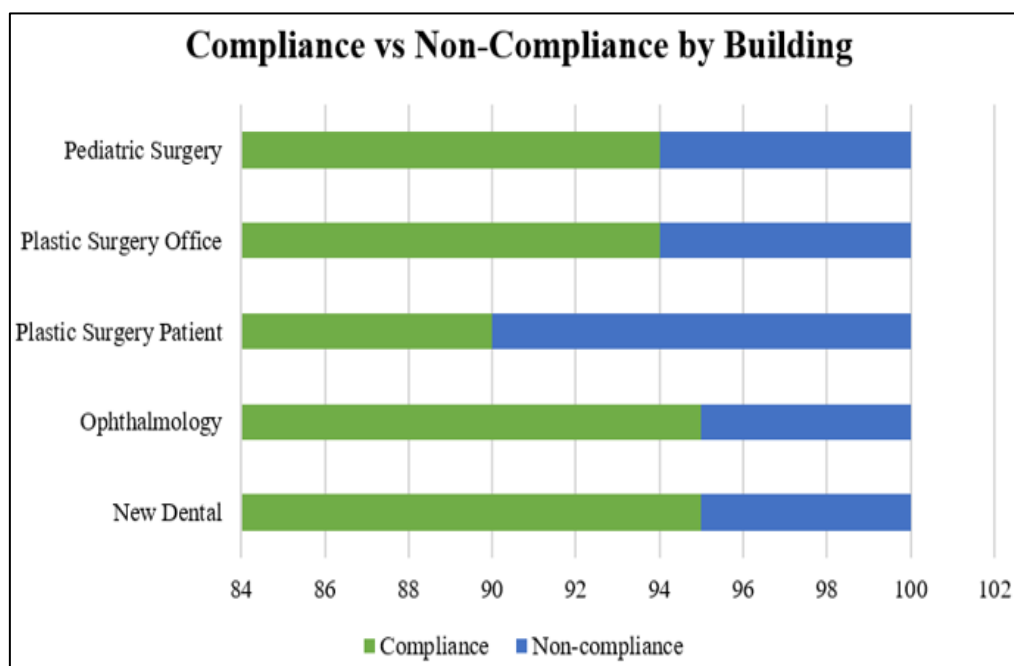


Fig 1 Building Wise Compliance Percentage of Assessed Lifts

Figure 1 illustrates the proportion of compliance and non-compliance observed in the assessed lifts. The New Dental and Ophthalmology lifts demonstrated the highest compliance (95%), whereas the Plastic Surgery Patient Lift exhibited the highest proportion of non-compliance (10%).

➤ Machine Room & Power Supply

- Guards for OSG and machine sheave present in all 8 lifts.
- 415 V incoming power supply confirmed in all lifts.
- Brake assembly, routing, and clearance were compliant in all lifts.

➤ Controller

- Warning stickers present in all lifts.
- Extra cables not neatly arranged in Pediatric Surgery building lift.
- Battery terminals covered in all lifts.

➤ Overspeed Governor (OSG)

- Installed and functioning in all lifts.
- Governor ropes free and properly aligned.

➤ Car Roof Inspection

- Barricade missing in 2 lifts (Plastic Surgery building (Office) & Pediatric Surgery building).
- Remaining parameters compliant.

➤ Pit Inspection

- Car bottom lights non-functional in 8/8 lifts.
- Pit ladder absent in Plastic Surgery building (Patient) Lift.
- Counterweight screens and buffers compliant.

➤ Lift Car Inspection

- Floor announcement & ARD missing in:

- ✓ All Plastic Surgery building & Pediatric Surgery building lifts
- ✓ Ophthalmology building new lift

- Safety warning plate missing in New Dental building lifts.
- Riding comfort acceptable except mild vibration in Ophthalmology building lift.

➤ Fire Operation

- Fully functional in New Dental building & Ophthalmology building lifts.
- Not functioning in all Plastic Surgery building & Pediatric Surgery building lifts.

➤ Safety Devices

All lifts demonstrated:

- Functional OSG
- Car & landing door contacts
- Limit switches
- Safety gear compliance
- Screen sensors working

➤ Downtime Index

No breakdown recorded during study period. Preventive maintenance conducted on weekly offs and public holidays. Downtime Index = 0.

To identify the most frequent areas of non-compliance, the observed deficiencies were analyzed according to their occurrence across the assessed lifts. The distribution of these deficiencies is presented in Figure 2. Non-functional car bottom lights constituted the most common deficiency, followed by the absence of floor announcement systems, safety warning plates, and fire operation systems.

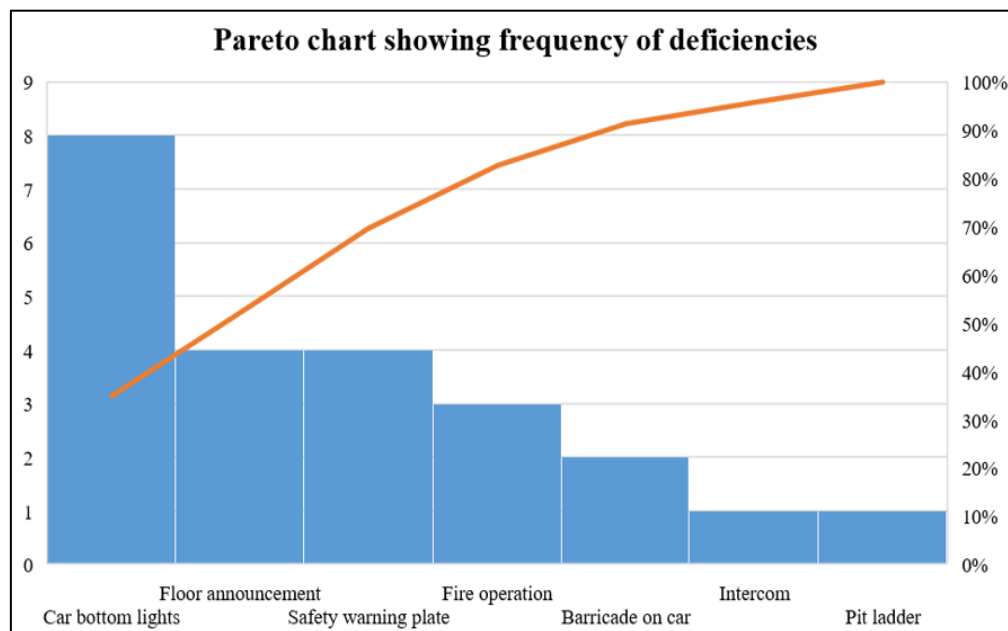


Fig 2 Pareto Chart Showing the Frequency of Identified Non-Compliance Findings Across Assessed Lifts

Figure 2 demonstrates that non-functional car bottom lights were the most frequently observed deficiency, followed by the absence of floor announcement systems, safety warning plates, and fire operation systems. These findings accounted for the majority of the observed non-compliance across the assessed lifts and represent priority areas for corrective action.

IV. DISCUSSION

Elevator safety is critical in hospital settings due to patient dependency and emergency movement requirements. NBC 2016 provides clear guidelines on mechanical safety, accessibility, and fire integration [2].

The high compliance (90–95%) observed aligns with findings from infrastructure audits in healthcare facilities emphasizing routine preventive maintenance [3].

➤ However, Significant Deficiencies were Observed:

- Non-functional fireman mode in three lifts – a major safety risk.
- Absence of floor announcement systems – reduces accessibility for visually impaired individuals.
- Missing car bottom lights – maintenance safety hazard.
- Missing pit ladder in one lift – violation of NBC pit safety norms.

Technological reviews suggest fire integration and accessibility features are integral components of modern lift systems [3,4].

The zero downtime observed indicates strong preventive maintenance practices, supporting literature suggesting routine inspections reduce mechanical failure by up to 15% [1].

Despite the high compliance observed, deficiencies were identified in fire operation systems, accessibility features, and maintenance-related components. The absence of floor announcement systems and Automatic Rescue Device (ARD) announcements in several lifts may adversely affect accessibility for visually impaired users and patients requiring assistance. Inclusive design principles advocate the integration of audible and visual communication systems within vertical transportation facilities to improve usability and promote equitable access to healthcare services. Such accessibility measures are increasingly recognized as essential components of patient-centered healthcare infrastructure.[5]

The non-functioning fireman operation observed in the Plastic Surgery and Pediatric Surgery lifts is a matter of concern because elevators play a critical role during emergency evacuation and disaster response. Studies have shown that effective integration of fire safety systems within elevator operations enhances building resilience and occupant safety during emergencies. Healthcare facilities, in particular, require fully functional fire operation modes to facilitate rapid evacuation and uninterrupted emergency response activities.[7]

Furthermore, the absence of car bottom lights and pit ladders in some lifts indicates the need for strengthening maintenance monitoring mechanisms. Although these deficiencies may not directly affect routine passenger operations, they can compromise the safety of maintenance personnel during inspection and repair activities. Implementation of periodic compliance audits based on standardized checklists can help identify such deficiencies early and ensure continuous adherence to safety regulations.[8]

The absence of lift breakdowns during the study period and the resulting downtime index of zero demonstrate the effectiveness of preventive maintenance practices adopted by the institution. Previous studies have similarly reported that planned maintenance schedules significantly reduce equipment failures, improve service availability, and extend the operational lifespan of elevator systems.[6,9]

V. CONCLUSION

The present study demonstrated that the majority of lifts installed across the Ophthalmology, New Dental, Plastic Surgery, and Pediatric Surgery buildings exhibited a high level of compliance (90–95%) with the provisions of the National Building Code of India, 2016. Critical safety components, including overspeed governors, braking systems, door contacts, limit switches, and other safety devices, were found to be functional in all assessed lifts, contributing to safe and reliable operation. Furthermore, the absence of lift breakdowns during the study period resulted in a downtime index of zero, highlighting the effectiveness of the existing preventive maintenance practices. However, certain deficiencies were identified, particularly related to fire operation systems, accessibility features such as floor announcement and ARD systems, non-functional car bottom

lights, and the absence of a pit ladder in one lift. Addressing these gaps through regular compliance audits, timely corrective measures, and continued preventive maintenance will further enhance lift safety, accessibility, and operational efficiency, thereby supporting the delivery of quality healthcare services in the hospital..

➤ Ethical Consideration

This study was approved by the Institutional Ethics Committee (IEC), the study involved an observational assessment of lift infrastructure, safety systems, and maintenance practices within hospital buildings. As no patient-related data, personal identifiers, or direct human participation were involved, informed consent was not required.

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➤ Conflict of Interest

There are no conflicts of interest.

REFERENCES

- [1]. Agarwal T. What is elevator (lift): Working principle, different types and their uses. 2019.
- [2]. Bureau of Indian Standards. National Building Code of India 2016, Volume 2. New Delhi: BIS; 2016.
- [3]. Al-Kodmany K. Tall buildings and elevators: A review of recent technological advances. *Buildings*. 2015;5(3):1070–1104.
- [4]. Encyclopaedia Britannica. Elevator – Vertical transport system. 2024.
- [5]. Imrie R, Hall P. Inclusive design and the built environment: Accessibility, participation and social inclusion. *Building Research & Information*. 2001;29(4):295–305. doi:10.1080/09613210110057435.
- [6]. Ministry of Health and Family Welfare, Government of India. Accessibility standards for healthcare facilities. 2021.
- [7]. Ronchi E, Nilsson D. Fire evacuation in high-rise buildings: A review of human behaviour and modelling research. *Fire Science Reviews*. 2013;2(1):7.
- [8]. Wang K, Zhang Y, Wang H. Reliability analysis and preventive maintenance strategy for elevator systems based on failure characteristics. *Eksploracja i Niezawodność – Maintenance and Reliability*. 2019;21(3):451–459.