maintenance control plan must be accessible to maintenance personnel, code officials, and others as needed.

To verify the appropriateness of the maintenance control plan for any given unit or building, it is incumbent on the facilities manager to routinely tour the elevator machine rooms and ride the elevator cars and escalators to evaluate the level and quality of maintenance being performed. During these routine reviews, it is essential that as a minimum the manager notes the following:

1. Does the Emergency Telephone/Communication device function?

2. Does the elevator operate smoothly and level properly at the floor?

3. Do all the call buttons illuminate when pressed?

4. Does Firefighter's Operation (where provided) function properly?

5. Is the elevator machine room and equipment clean, with all parts and lubricants properly stored in metal cabinets?

6. Does the escalator operate smoothly and quietly?

7. Are there adequate spare parts stocked on the job site?

8. Are the code-required statutory periodic safety tests current and up to date?

If the manager answers "no" to any of these questions, some improvement in elevator or escalator operation and maintenance is necessary to maximize the safety of the riding public and life cycle of the equipment.

Statutory Periodic Elevator and Escalator Safety Inspections

In North America, owners and facilities managers should become familiar with Part 8 of the ASME A17.1 and CSA B44-07 Safety Code for Elevators and Escalators. Part 8, Section 8.10, covers acceptance inspections and tests of new elevators and escalators before placing them into use. Part 8, Section 8.11, as required by Section 8.6 (Maintenance Control Plan), and the Non-mandatory Appendix N outline the minimum recommended frequency of routine and periodic inspection of all electric traction and hydraulic passenger, service, and freight elevators, and escalators.

Because construction costs, attorney costs, and liability assessments in accidents involving vertical transportation equipment can be costly and time-consuming, all owners and facilities managers should be familiar with safety tests and inspections required by local and national code authorities. Owners and managers should verify that these inspections are current and that inspection certificates are readily available for review by the appropriate authorities.

Asset Management

Today, a number of remote monitoring systems provide valuable information on the operating status of elevator and escalator systems without requiring the maintenance technician to physically check the equipment. These remote monitoring systems are capable of providing real-time information, including operating status of each unit, fault monitoring, and even trouble-shooting information. This information can help a contract maintenance service provider or in-house staff maintenance personnel perform their routine maintenance duties and can assist the owners and facilities managers in managing the assets of the facility.

Remote monitoring systems are available directly from the major elevator manufacturers. These systems provide varying degrees of monitoring capabilities specifically for their control systems. In addition, third-party remote monitoring systems have the capability of linking and communicating with all of the typical manufacturers' control systems found on academic campuses. These Web-based systems provide monitoring results that can be transmitted to a central facilities management location. In addition, they are capable of providing automatic paging or e-mail notification of faults to maintenance personnel, reducing unit downtime. This is especially beneficial in campus environments in which units are spread out over a significant geographic area or include remote campuses in other cities by providing the ability to link all units back to a central facilities management location. In these situations, the monitoring technology provides operating information and status of each unit. This enables maintenance personnel to fully utilize available time in the performance of preventive maintenance by eliminating lost time determining whether units are even running. Because it is a Web-based system, owners and facilities managers can access it anywhere. Some systems are even capable of maintaining parts inventories and alerting the manager when reordering and restocking of parts is required.

Asset Rehabilitation

Even with the "best" preventive maintenance control plan, owners and facilities managers eventually want or need to upgrade older equipment. The reasons to modernize existing equipment include, but are not limited to, the following: (1) to increase system reliability, (2) to reduce energy consumption, (3) to incorporate current life safety code and accessibility requirements, and (4) to increase traffic handling ability.

- ***Increase Reliability.*** Existing elevators and escalators that have reached the end of their useful service life break down frequently, and parts become increasingly difficult or impossible to find. Modernizing this equipment restores reliability to like new condition.
- ***Reduce Energy Consumption.*** Older hydraulic power units, geared traction hoist machines, and escalators utilize outdated technology that is not as energy efficient as modern equipment. A comprehensive modernization should include replacement of obsolete components with new energy-efficient power units and AC hoist motors improving asset value in lieu of replacement with like equipment that attempts to match the old equipment.
- ***Incorporate Current Code and Accessibility Requirements.*** Periodic changes to the ASME A17.1/CSA B44-07 Safety Code for Elevators and Escalators, The ASME A117.1, and the Americans With Disabilities Act (ADA) have brought about new requirements for elevators and escalators to improve and enhance the safety and accessibility of these systems for the riding public. Although generally not retroactive, any elevator or escalator modernization program must comply with these code changes.
- ***Increase Traffic Handling Ability***. The group control systems on older elevators are inefficient compared with modern microprocessor-based controls. Replacing older relay logic-based control systems with new microprocessor control systems often results in a 25 to 40 percent reduction in waiting times as well as substantially increased reliability, the ability to easily add security features, special accessibility features such as infrared call registration for the mobility impaired, etc.

Typically, modernizations at academic institutions are funded via grants or student fees, so opportunity is limited for a "phased" modernization of any given elevator, escalator, or building. As a result, proper equipment selection for modernization requires careful planning and decision making to ensure that the completed modernization represents a long-term reliable and maintainable solution.

Proper selection of the equipment, including replacement or reconditioning of the existing traction hoist machine, replacement of the existing hydraulic power unit, controller, drive unit, door operator, fixtures, and so on, or escalator, is critical to achieve these goals.

When existing relay logic elevator and escalator controllers are replaced with modern microprocessor-based controllers, a service technician with more specialized training is needed for proper maintenance. These controllers, whether supplied by major manufacturers or 'open architecture' third-party suppliers, require a diagnostic device for trouble shooting and repair. Open architecture control systems generally incorporate the diagnostics within the controller itself whereas systems from major manufacturers require a 'plug – in' service tool which should be purchased as part of the elevator package.

Beginning with the introduction of microprocessor-based elevator controllers in the 1980s, the major manufacturers created a stigma with owners and facilities managers regarding maintenance and maintainability of their controllers when they coined the term proprietary. This was quickly echoed by the independent elevator companies and service providers with allegations that these systems were not maintainable by any company other than the original installing company, and remains prevalent today. This brought about the rapid development of the less sophisticated, so – called, "non – proprietary" control systems for low and medium rise applications which could be more easily maintained by qualified independent service providers.

It is true that the microprocessor products of this period required sophisticated diagnostic tools, access codes, and training available only from the manufacturer of the equipment. However, this is not unlike the most sophisticated solid-state systems that immediately preceded this first generation of microprocessor controllers. Furthermore, it is true that the current generation of sophisticated 'Destination Dispatch' microprocessor controls for major metropolitan high-rise office buildings still require sophisticated diagnostics and training.

In reality, the term 'non – proprietary' is a misnomer as even the third-party "open architecture" control products typically supplied by independent elevator companies in low-rise and mid-rise academic and commercial buildings are, at their root programming, proprietary. Low- and moderate-rise controllers supplied by either the major manufacturers or the open architecture products provided by third-party suppliers incorporate built-in digital diagnostic displays that are integrated with the controller. These displays provide diagnostic, fault, and adjustment codes, which, when cross-referenced to the controller maintenance manual, allow for effective troubleshooting and maintenance, and thus they are maintainable by any qualified service provider. These diagnostics displays also provide the necessary access to allow all statutory periodic safety tests to be performed.

Complete modernization of any vertical transportation system can be quite expensive, often costing as much or more than the initial installation. For this reason, it is important to have a clear understanding of what is to be accomplished in the modernization program not only from an elevator or escalator standpoint but also from the standpoint of related building work necessary for code compliance and acceptance by building officials upon completion. Part 8 of the ASME A17.1/CSA B44-07 Safety Code for Elevators and Escalators, Section 8.7, outlines the requirements for alterations, repairs, replacement, and maintenance of elevators and escalators.

Current accessibility guidelines dictate the height of car and hall call buttons, the requirements for Braille plates, and visual and audible signals in the car and elevator lobby. Elevators installed before 1980 were not equipped with any accessibility features. Some of these elevators have been upgraded subsequently to meet the requirements of the ADA or Section E of the Canadian B44 elevator code; however, other units still have not been upgraded.

Modernization of existing elevator and escalator systems may also require compliance with certain changes in the building code, electrical code, and/or NFPA occurring since the building was originally constructed. In some cases, these changes can be very expensive.

Independent Elevator Consultants

Impartial, objective assistance regarding elevator and escalator issues is available through independent elevator consultants. Owners and facilities managers utilize elevator consultants to gain a broader understanding of the purchase, installation, maintenance, performance evaluation, and modernization of elevator and escalator systems. These specialists have varying backgrounds, abilities, and specialties within their respective practices, such as design, modernization, maintenance evaluation, and litigation. Active consulting firms have contacts within the elevator industry that are valuable in solving problems should they arise. Always remember, however, to check the past performance of consultants and their experience with similar types of projects before contracting for services.

Summary

Elevators, escalators, and other types of vertical transportation equipment are an integral part of all multistory buildings. Ensuring that these systems are safe and reliable is, in large part, the responsibility of the owner and the facilities manager. Resources available to support this effort are readily available from the Authority Having Jurisdiction (AHJ), which is responsible for oversight of code-required statutory periodic inspections, qualified service providers, and independent third-party consultants.

References

Additional resources are available to the owner, facilities manager, and in-house staff maintenance technicians from Elevator World Inc., P.O. Box 6507, Mobile, AL 36660 USA or via phone at 251-479-4514, or toll-free at 1-800-730-5093. Suggested publications include the following:

Certified Elevator Technician (CET) Program, National Association of Elevator Contractors.

Elevator and Escalator Maintenance for Building Managers, 2nd ed. 2006. Mobile, Alabama: Elevator World Inc.

Elevator Industry Field Employees' Safety Handbook. 2012. National Elevator Industry, Inc. Safety Committee. (Available in English and Spanish.)

*Elevator World Educational Package and Reference Library,*Vols.1-3. 1990. Mobile, Alabama: Elevator World Inc.

Elevator World Monthly Magazine. Mobile, Alabama: Elevator World Inc.

Lewis, Bernard T. *Facility Manager's Operation and Maintenance Handbook.* 1999. New York: McGraw Hill.

McCain, Zack. *Elevator Industry Inspection Handbook,* 4th ed. 2007. Mobile, Alabama: Elevator World Inc.

Strakosch, George R. *The Vertical Transportation Handbook,* 4th ed. 2010. New York: John Wiley & Sons, Inc.

