



Elevators, Fire, and Accessibility

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FIRE AND ELEVATORS - THE BUILDING ENVIRONMENT

by George R. Strakosch

ABSTRACT

Recent issues have been to allow the use of elevators during a fire emergency to evacuate the population of a given building. Accepted use, as fostered by both the ASME A17.1 Safety Code for Elevators and Escalators and building code has been to deny their use to the population, provide for the evacuation of riding passengers and reserve the elevators for use by emergency personnel only. To change that philosophy in depth study of the entire building environment must be made as well as the required training of emergency personnel established. Some of the aspects of that approach are presented and the entire question of evacuation explored.

INTRODUCTION

Elevators are appliances installed in buildings to provide transportation to and from upper floors. They are, generally reliable, should be easy to use and the accepted means of accessing and egressing from the floors and travel between various floors of the building. Safety is ensured by design, regulation and inspection. A typical elevator installation is accomplished in hoistways provided in the building. The support of those elevators and the additional needs for the equipment are the machine rooms, usually at the uppermost part of the elevator system and the pit at the lowermost part. Additional support is needed and consists of power to operate the equipment and, in the present era, air conditioning of the machine room. Access must be provided and consists of a lobby at each floor immediately adjacent to and in front of the elevators. For maintenance and repair access must be provided to the machine room and pit.

The elevator installer has little control over the construction of the hoistway, machine rooms, pits and lobbies. Size is critical as are the loads imposed on the building and those provisions are accommodated by the architect and structural

engineer. The equipment, when operating, releases heat and provisions for its dissipation are accommodated by the HVAC engineer. The necessary power based on the characteristics of the equipment is provided by the electrical engineer. Since regulations impose operating restrictions on elevators during building emergencies an interface between the building's life safety system and provisions for response of the elevator system is mandated.

Recognizing that elevators may break down or power may fail and possibly entrap passengers provisions for communication between outside agencies and the elevator car are necessary. Passengers should be able to notify some authority of "being stuck" by an in car alarm and communication systems. Recently elaborate monitoring of the elevator system is available and can often indicate failures and provide notice of the need for assistance or a warning of potential hazard.

The Elevator Contractor and the Building

Since the elevator contractor has little control over the environment in which the elevator is placed building codes have developed additional regulations to control that environment. A fire rated hoistway is required and the entrance assemblies subject to testing and certification as to fire integrity. In many jurisdictions sprinklers are required to be installed in machine rooms and elevator codes have set up conditions under which sprinklers can operate. This, in general, includes provisions so that the elevators are stopped prior sprinkler operation in either or both the machine room and hoistway. Since an elevator hoistway penetrates the floors of a building smoke emanating from any part of the building can find an air path to the hoistway. Proper operation of hoistway doors require minimum clearances around those doors and smoke can infiltrate the hoistway. Building codes have required that the hoistway be vented and specifies a path to the atmosphere at the top of the hoistway.

Another approach has been to induce pressure into the hoistway to prevent smoke infiltration. Such pressurization is in antithesis to the vent and resolution needs to be made.

The crux of the present philosophy of elevator operation during a building emergency is to remove them from serving the occupants and reserve them for use of emergency personnel. This is accomplished by a signal from smoke detectors located in the elevator lobbies and machine room or manually by operation of a keyed switch at the main entry lobby. Whether this is good or bad is an issue facing authorities who regulate building design and operation. The present philosophy has been in place over twenty years and this paper is offered as a basis of review of that philosophy.

Mobility Impaired and Elevators

Impelling a review of that philosophy is the growing awareness of the needs of the handicapped. Society is insisting that more people with limited mobility appear in a workplace. Extensive rules and laws regarding accessibility have been instituted which address getting people to high and remote places in the building. None address getting them out. A reasonable claim is that a path including elevators is used to gain access and the same path should be available for egress. Present rules of emergency operation ignore that aspect or render it such that manual intervention is needed to accomplish egress. People have been conditioned by signs and instructions not to use the elevators during a fire. If the systems set up to remove the elevators from operation fail to function, such as failure of a smoke detector or lack of manual control, the elevators will continue to operate in a normal manner.

A number of issues exist. One is the role of emergency personnel, the firefighter in particular. A common perception of firefighters is that no one wants to see them until an emergency exists and the complaint often is that they were too slow in responding. Firefighters hate fires and their job is to put them out which may entail little regard for what may be in the way. To fight a high rise fire, which, incidentally are rare, one of their needs is a means to move equipment to upper floors expeditiously as possible and the elevator provides that means. The integrity of the elevator is dependent upon the building environment mainly reliable power, conditioned air in the machine room and substantial

hoistways.

In addition we imply a dependency upon designated or emergency personnel to give priority to the mobility impaired in the event of an emergency. Doing so creates a conflict of interest as to what the real role of a firefighter should be. A similar conflict exists as to the firefighters role of prevention or abatement.

Elevator Usage during Emergencies

If we analyze three high rise fires we can find that the elevators were essentially intact. In Los Angeles at the Interstate fire the fatality was due to the ill advised operation of an elevator to the fire floor. This was done in a manner which would not have happened if the elevators complied with the A17.1 rules in effect at the time. At Meridian in Philadelphia lack of power rendered the elevators useless. At the Las Vegas MGM Grand the lack of automatic recall per the A17.1 rules and subsequent loss of power disabled the elevators. Analysis of other high rise fires or any fire in an building with elevators suggests that the elevators can be used in fire emergencies under some recognized conditions.

Most will agree that prevention is essential and needs to be a way of life. Again analysis of the high rise fires indicate a lack of such prevention and a carelessness on the part of people doing alteration or work in the buildings. This is an area where the authorities need to consider and develop a suitable approach. Another step is preparation and alarm. We have developed some means of preparation against emergencies and early warning that an emergency is imminent. Sprinklers are common and detection systems have been mandated in many jurisdictions. Periodic testing and maintenance plus a means to ensure they are reliable is in order. Elevators are conditioned to respond to an emergency by being recalled out of service to an entry level where they can be used by emergency personnel. This operation depends upon the proper functioning of the smoke detectors or by manual intervention which is beyond the control of the elevator system. The concern about elevators is that they will operate as intended given the proper signal and periodic testing is essential as reasonable insurance. The A17.1 rules require monthly testing and logging of test results. Few jurisdictions mandate such testing or fail to enforce the requirement and a reaction is to seek redundancy.

Redundancy may take the form of adding equipment to the elevator which is intended to prevent failure due to supposed effects of either a fire or fighting a fire. An example is to "waterproof" an elevator so it may be used after sprinkler application or after watering down a fire. Another example is to "seal" the hoistway to prevent smoke infiltration. A recent proposal is to provide a special duct in the hoistway to induce pressurized air into the elevator and onto the floor where the elevator is stopped to avoid smoke infiltration. Each implies more equipment and more difficult maintenance which, given economics and human nature, may lead to a lesser maintenance of the initial system. The logic is simple. If it is easy to maintain and requires minimum down time it is more likely to be done. If it involves dismantling for access it either will be ignored or the intended protection removed and discarded so maintenance can be made easier. One only need to visit a few buildings to see how many protective covers are stored in machine rooms and pits.

Other proposals have been to isolate the elevator system and their necessary lobbies from the remainder of the building. The intent is to create an area of refuge which, agreeably, is a good idea. The limitation is that it is, in general, only applicable to buildings yet to be built. Another proposal is to install the elevator power feeders within a fire-proof hoistway which assumes that the source will remain intact. The list could go on and the "what if's" abound. Of course we could mandate that outside elevators be added to all buildings. The industry would love that. The real issue is what sensible approaches can be made in the thousands of existing buildings. They may be the more vulnerable.

As mentioned the systems of elevator recall upon the detection of fire activity and reserving the equipment for emergency personnel use have been developed and accepted as reasonable. The A17.1 Emergency Operations Committee is constantly reviewing and updating those requirements and have reacted positively to the many contingencies brought to their attention. The elevator manufacturers are astute in providing the necessary equipment and circuits. They depend upon the Life Safety systems in the buildings for indication of emergency and have designed and installed to respond. The rules for design and installation have been well codified but the serious lack is the enforcement of maintenance and training.

It is relatively easy to test the elevator response. One need only to operate the recall key switch in the main lobby and observe that all the elevators respond. Testing in-car operation is also relatively easy. Condition the elevator by key operation, operate a car floor button and a start or door close button and travel to the chosen floor. Operate the door open button to ensure the doors respond as intended. Operate the main floor button then close doors to return to the main floor and do the same with the other cars. What is not easy is to trigger various smoke detectors to see if the proper response and alarm is accomplished. These are electrical and mechanical systems and need to be maintained and tested and, with present micro-computers and monitoring, hopefully, should be relatively easy to ensure their operation.

The Missing Factors

Lacking from the entire process is the judgement of the personnel present and the strategy required during any emergency. Initial steps are taken by enforcing fire drills which seldom do more than alert people to assemble in given areas. It is rare that an evacuation ever takes place and we can recognize the negative economic and psychological impacts of requiring that. We can, however, develop plans to do so if that is ever required. This is a formidable task since the plan may be more elaborate than anticipating every move possible in a chess game.

A proposed plan will be loaded with many theoretical "what if's". Presume that if fire activity is detected the elevators are not recalled to a main floor, people on a floor or floors are directed to go to the elevator lobby and not use the stairs and the elevators are conditioned to go to a floor where it is possible to evacuate the occupants. This could be a step one and the conditions that need to be created are the creation of an elevator lobby which now becomes an area of refuge. Considerations of that can mean enclosing the lobby with fire doors at the entrances, providing the necessary air for lobby pressurization and, possibly pressuring the hoistways to avoid smoke infiltration. An elevator step one would be to program to recognize the floor where the alarm is initiated and to further program the cars to respond to the proper floor or floors to effect the evacuation. This is well within the realm of current elevator micro-processor technology and the "what if's" of particular buildings will be required.

We will further presume that fire drills have conditioned people to go to the refuge areas. When elevators arrive or if they are there the major concern becomes one of crowd control and all the limitations of human nature and response are involved. This was one of the major factors in the initial decisions to advise individuals to use the stairs rather than the elevators. Past incidents include reports of people trying to board to the point where they prevented elevator operation and perished even though the elevator was capable of making the trip. Unfortunately there is no nobility in a panic situation. Therein lies the crux of the entire scenario. Even though the conditions can be set up who will assume the monitoring and policing to ensure orderly use?

The premise that elevators can evacuate a building floor or floors is well within practicality. An elevator making two stops is operating at its most efficient traffic handling mode. All in at one stop and all out at another and subsequent return for another trip. John Kote from NIST has demonstrated that in his paper and program for ELEVAC. The time between the initial indication and the arrival of personnel to control the fire may be a number of minutes and, once in the building, commandeering either all or some of the elevators is easy to program by use of the lobby switch. Even the cars returning after the initial evacuation can be readily accessed and continuing crowd control assumed by emergency personnel.

A number of municipalities have instituted a position of a building "Fire Safety Director" or equivalent function. They are given a course in the various fire safety approaches and certified by examination to assume the role. Most courses do not include information regarding elevator operation or use during a fire emergency. In fact, few firefighter training courses include information about elevators. In New York City, where elevators are prominent, a two hour session on elevator operation during a fire emergency has been, until recently, offered as an option. It does not, however, offer any direction as to the role of the person taking the lecture other than advice regarding the periodic testing of elevator recall response.

Possibilities

As we have stated the elevators have the potential of being programmed to operate in any way desired

based on given criteria. Given a signal they can be sent to a chosen floor and, subsequently, automatically operate to and from floors within their hoistways. Within energy and thrust limitations established by the A17.1 Code doors can be forced to close and, almost but not quite, push people out of the way so the doors can be fully closed and locked so the car can be safely started. The elevator cannot force the person who insists upon blocking the full closure of the doors. That is up to the human intervention which the industry cannot control and remains in the hands of the people at the scene.

The "people at the scene" is the key to any expansion of the use of elevators in an emergency. We recognize that buildings can be anywhere from two to a hundred or more floors in height and each has its own configuration and conditions. Higher rise office buildings usually have individual groups of elevators serving each segment of fifteen or so floors. Elevators serving higher segments "express" past the lower floors and building codes prescribe the fire rating of the hoistways. Elevator configurations will differ for higher rise hospitals or apartments and each building will be the subject of varying personnel evacuation and fire fighting strategies.

Development of typical strategies for a variety of building appears feasible and the concern of all the agencies affected need to be enlisted. This could be a super task force of building code authorities, fire fighting interests such as NFPA, insurance interests, handicapped advocates, elevator people plus governmental bodies. we can expect state and local jurisdictions to become involved. The goal will be to develop unified standards for building evacuation during emergencies. That is a long term goal.

For the immediate term the people most concerned can be enlisted. These are the building operators such as BOMA, the Association of College and University Physical Plant Administrators, The Association of Hospital Engineers and others who have the day to day responsibility. They could be admonished to view the fire safety aspects of their building and develop plans as to what they would do in emergencies. Such plans can consider the evacuation of both the disabled and abled. we are certain some splendid ideas will be forthcoming from that sector and, perhaps, a workable intermediate plan which could be used as the basis of training "the people at the scene".

The need is becoming more and more prominent. The elevators take people up in the building. The demand is now to take them out in a safe and effective manner in an emergency. Satisfying that demand is contingent, not upon the elevators, but the overall environment present during that emergency. That environment is created by the building, the personnel in charge and the nature of the emergency. All the elements needs to be mobilized and we can be certain the vertical transportation industry will do its part. The overall strategy is beyond their control and indicates the need for a super task force for its development. The many papers given at both this and the previous fire symposium outline what elevators can and cannot do under various circumstances. The question is what can the other concerned agencies do and how to go about it.

REFERENCE

ASME A17.1, Safety Code for Elevators and Escalators

George Strakosch has enjoyed a varied career in practically all phases of the elevator industry. Starting as a construction helper with Otis in 1946, he advanced to mechanic, field adjuster, sales representative, traffic engineer, product manager and senior project manager, separating in 1977. He joined Jaros Baum & Bolles as a consultant, and in 1987, became director of Educational Services and technical editor for ELEVATOR WORLD. He is known for his book Vertical Transportation and dozens of papers and articles on all aspects of the industry, including The Guide to Elevating, edited and published by Elevator World, Inc. Presently he is an independent consultant, vice chairman of the ASME A17 Elevator Code Committee and technical consultant to ELEVATOR WORLD. One of his latest activities is educational program manager for WORLD ELEVATOR EXPO '95 - and still writing.