

GENERAL SERVICES ADMINISTRATION POLICY SPRINKLERS IN ELEVATOR HOISTWAYS AND MACHINE ROOMS

by Stewart J. Levy

The General Services Administration (GSA) is responsible for 230 million square feet of Government-owned or leased office space. In addition, it operates one of the largest design and construction activities in the nation. As part of its responsibility, the GSA must assure the fire and life safety of its employees and visitors to the space under its control. The Safety and Environmental Management Division (S&EM) within the Public Buildings Service of GSA is responsible for developing the policies and procedures used for evaluating the safety of government occupied buildings and coordinating program implementation by the GSA regional offices throughout the nation.

GSA has established a policy of utilizing risk assessment methodology to provide fiscally responsible building safety. Simple adherence to code compliance is not sufficient justification for resource allocation. In many cases, codes can conflict with each other, violate other laws (e.g., historic preservation), or not provide the desired level of protection. The relationship between expenditures on fire safety and the actual impact of these expenditures must be examined.

Continuing research into fire phenomena is making it possible to perform an engineering analysis of the fire safety performance of a building and its systems. This building or its system(s) could differ widely from current perceptions of code conforming buildings or systems. Using analytical engineering tools, the development and impact of fire in a building and on its systems can be assessed. The installation and operation of the building systems can then be analyzed based upon the risks associated with potential fire exposure.

There are several diverse thoughts concerning the protection of elevator machine rooms. Codes and standards concerning protection of elevator hoistways and control rooms are primarily

developed through a consensus of its membership, and often based upon some past event.

Membership generally consists of professionals in the particular code related field and depending upon the basic philosophy of the membership, may have differing approaches in the resolution of a particular area of concern. This is the case with elevator control room protection.

GSA's primary concern during an elevator control room fire is the safety of the elevator passengers. A secondary concern is the protection of the elevator equipment and the building. Based upon these concerns, GSA has analyzed the risks associated with the conditions and the different recommendations for protection and has established a policy, for facilities under its control, which provides an acceptable level of risk to the elevator occupants that is also fiscally responsible. The policy consists of the following elements:

- Smoke detection recalls the elevator to the primary floor,
- Heat detection will shunt trip the power to the elevator controls,
- Sprinkler protection (set to activate at a higher temperature rating than the heat detection) will extinguish or control the fire.

This policy is based on the assumption that the typical elevator control room fire will be a smoke producing fire (most likely due to a transient fault) which should initially activate the smoke detector, recalling the elevator to the designated level. If the fire in the machine room continues, the temperature should increase, activating the heat detector which in turn will disconnect the power supplied to the elevator controller. By this time, the elevator has recalled or at least has increased the distance between the elevator cab and the fire. Continued production of heat would then activate

the sprinkler head and allow for the application of water to extinguish/control the fire.

Some rapid growth fires produce heat at a rate that can cause the power to shut down prior to full elevator recall. In this situation the elevator will stop somewhere in the elevator hoistway prior to reaching the designated floor, and could even stop between floors. Since the distance between the fire (in the elevator control room above the elevator cab) and the elevator cab has been increased, this condition should expose the elevator occupants to minimal danger.

As illustrated in the following two worst case scenarios, GSA policy addresses the risk associated with providing sprinkler protection in elevator machine rooms.

Worst Case Scenario Without Sprinklers

A fire occurs in the control room with an occupied elevator cab located immediately below the elevator machine room.

The elevator controls heat to a temperature which exceeds their reliable operating temperature. This results in complete failure of elevator controls causing the elevator to stop and freeze in place. In turn, this subjects the occupants to smoke and/or heat which is being generated from the control room fire.

Worst Case Scenario With Sprinklers

A fire occurs in the control room with an occupied elevator cab located immediately below the elevator machine room, and the power to the elevator controls is disrupted prior to recall.

The fire is controlled and/or extinguished. The occupants of the elevator could be wet from sprinkler discharge and become trapped as in the

scenario without sprinklers. However, since the fire is controlled and/or extinguished, there is little exposure to heat or smoke generated from the fire.

It is readily apparent that the risk to the elevator occupants is greater in the case without sprinklers.

GSA is using the growing body of fire science knowledge to develop and implement scientific methods of assessing the fire risk to occupants of GSA controlled space. The allocation of resources can no longer be justified solely on the basis of code compliance. After evaluating the two scenarios above, the sprinklered elevator control room with defined actions prevailed and became, in part, the basis for the current GSA policy. This paper will expand on the philosophies used to develop this policy. GSA welcomes comments concerning its policies for providing safe and healthful workplaces.

GSA is currently developing a policy for elevator recall as it relates to a fire in the elevator pit. The sequence of events for a control room fire may have an adverse effect on elevator occupants if the fire is below the elevator. This paper will address concerns with the implementation of an elevator control room protection system and its potential impact on other elevator related fires.

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reasonably required in the circumstances of the case."

While on the topic of public policy, it is also important to describe a basic difference in ideology, in Britain and in the U.S, regarding accommodation of people with disabilities. In Britain, concern for these people has been generally viewed as a public welfare issue. In the U.S., the concern has been seen more as a matter of civil rights. This basic public policy difference between the two countries has been described by Goldsmith (1983) and is reflected in the recent landmark civil rights legislation known as the Americans with Disabilities Act (ADA) of 1990 (Public Law 101-336 signed in July 1990).

Human Behavior

Regarding the concern about inappropriate human behavior in emergencies (stated as item 5 above) it seems clear, on the basis of evidence from general behavior in fires and other life-threatening events plus evidence on people's evacuation behavior with stairs, that the fears about inappropriate behavior are largely unwarranted. This is especially true if people are provided — both before and during the emergency — with realistic information about their options and about the conditions related to those options. Although disasters can be physically and psychologically harmful to people, we can see some truth in the opinion expressed by some investigators of disaster behavior: "Disaster brings out the best in people" (Bryn, 1973). The term "best" refers, for example, to altruistic responses which often characterize coping behavior. Furthermore, these experts often emphasize that the greatest need, of people in emergencies, is for useful information.

Nonetheless, despite findings from studies of actual behavior in emergencies, it will be difficult to change some long-held attitudes about behavior of people in emergencies (item 5 above). One reason is that there has been little if any research in the last few years on the general matter of behavior of people in fires (i.e., work subsequent to that reviewed by Bryan, 1988). Neither has there been work on the particular topic of evacuation logistics plus behavior when elevator use is an option. Apparently, not since 1977 has the technical literature (in the U.S.) even addressed simulation of egress by elevator from a logistical perspective (Bazjanac, 1977; Pauls, 1977). Even this literature is not well known in the firesafety field.

It is especially important to hold realistic attitudes about human behavior in emergencies when we are dealing with emergency egress, including that on stairs and in elevator systems. Some problems, such as inappropriate overcrowding behavior with elevators, are likely to be more perceived than real. The reality has been, and is expected to continue, that people tend to take each other's needs into account to at least the same extent as is normally the case. Indeed, altruism is even more marked in emergencies. This characteristic complements that of information-seeking behavior, a topic again addressed later in this paper.

History of Concern about Life Safety for People with Disabilities

The literature on human behavior and on elevator-based evacuation logistics largely predated the marked, recent growth of concern about egress, refuge, and life safety generally for people with disabilities. Even with the increased concern over the last few years in the U.S. and Britain, about emergency egress for people with disabilities, nobody has picked up the incomplete work on evacuation logistics. Moreover, for noninstitutional buildings, little has been done to spell out the details of operational aspects of refuge concepts. A notable exception is the British Standard, BS 5588:Part 8: 1988, in which details of operational aspects are provided (BSI, 1988).

Much of the history of the concern, research, and regulatory developments on life safety for people with disabilities has been reviewed in publications and presentations by Pauls and Juillet (e.g., the article, "Recent social and technical developments influencing the life safety of people with disabilities," Pauls and Juillet, 1990). There has been an international scope to the work of these authors. However, with current developments, their focus is on the U.S. scene, especially with regard to proposals recently processed through the National Fire Protection Association (NFPA) Life Safety Code (NFPA 101, 1991 edition), the International Conference of Building Officials (ICBO) Uniform Building Code (1991 edition), and the Council of American Building Officials (CABO) Board for the Coordination of the Model Codes (BCMC) report on accessibility scoping, means of egress, and mainstreaming.

National concern for life safety of people with disabilities was first marked by a seminar, "Fire Safety for the Handicapped," held in Edinburgh,

egress. In November 1990, NFPA membership approved a "menu item" for the 1991 edition of the Life Safety Code covering areas of refuge and elevator use for egress. During 1991, the memberships of the two other BCMC organizations, BOCA and SBCCI, are expected to process the BCMC recommendations for areas of refuge and elevator use for egress. This would result in revisions to the BOCA National Building Code and the Standard Building Code respectively.

As in Britain, the elevator egress requirements evolving in the U.S. do not affect the required capacity of conventional egress routes. Also egress-related elevator use is expected to be restricted to those people who cannot safely use the exit stairs.

Mobility Disability Demographics. It should be recognized that most of the people, who are sometimes included in the group improperly called "the disabled" (reported as including 43 million Americans to help justify passage of the ADA), are quite capable of using stairs. According to U.S. demographic data noted by Pauls and Juillet (1990), only about 0.3 percent of the civilian noninstitutionalized population use wheelchairs. A similar percentage use walkers for getting around. The percentages of noninstitutionalized civilians 65-74 years, using wheelchairs and walkers, are 1.1 and 1.2 respectively. The percentages of those 75 years and over using wheelchairs and walkers are 2.3 and 4.8 respectively. Generally, in the U.S., about 3 percent of noninstitutionalized civilians use one or more mobility aids (i.e. wheelchairs, walkers, crutches, canes, special shoes, braces, artificial limbs). This rate is only 1.8 percent for the 0-64 age group and rises to 8.3 percent for the 65-74 age group and to 22.4 percent for the 75-and-over age group. In buildings used predominantly by people under 65 years of age, we can assume that about 3 percent of building occupants have mobility disabilities but can independently use exit stairs if moving behind others who are able to move faster. We can *conservatively* assume that 0.5 percent, in such buildings, cannot use stairs without assistance. This percentage includes users of wheelchairs, walkers, or crutches. They might need elevators.

Summing up developments: generally the last fourteen years have witnessed many developments on this topic, including many publications on research, standards, and recommended safety programs. Indeed it came as a surprise -- even to researchers active in the area -- that a recent published literature review of the area included some 350 documents (Pauls, 1988e). A more recent, unpublished review included 526 items

(Pauls, 1988b). Therefore, this brief paper can do little more than merely introduce a small part of the background to the matter of egress by elevators for people unable to use exit stairs.

LOGISTICS OF EGRESS VIA ELEVATORS

Bazjanac's Simulations of Elevator Use for Egress

Bazjanac and colleagues at the University of California, Berkeley, performed computer simulations of elevator use for evacuating all or portions of tall office buildings (Bazjanac, 1977). Although funded for two years by the National Science Foundation this work had little impact in firesafety and standards organizations. An assumed reliance on *automatic operation* of elevators, with procedures calling for first response to the fire floor, might have had something to do with the work's small impact. Indeed some attitudes against such egress methods might have hardened because of Bazjanac's work.

Partial Evacuation. The simplest strategy explored by Bazjanac and his team was to have elevators operate in a "down-peak" mode and respond only to three floors in an evacuation zone. The computer simulation predicted that the last person would be evacuated from any three-floor zone in less than eight minutes. The simulation also suggested that this time could be improved, to less than five minutes, if people were unloaded at an intermediate floor rather than going all the way to the ground floor. Some uncertainty was noted about how short the actual time might be because "it is impossible to predict what percentage of the floor population might escape through means other than elevators in an actual emergency in which elevators *are available*" (Bazjanac, 1977). It was concluded that the "fastest method of evacuation of any individual floor is the simultaneous dispatch of all available elevators to that floor" and "the success of this strategy depends entirely on the ability to get everybody on the floor to the elevator lobby in the short time it takes the elevators to reach the floor and load people."

Complete Evacuation. Bazjanac's simulation suggested that all buildings could be completely evacuated, using elevators, in less than 30 minutes. It was noted that, because of their use of elevator zones and high-speed elevators, some tall buildings could be evacuated in less than half the time of buildings with half as many floors.

The Need for Management Control. Bazjanac compared results of an actual complete evacuation of a 22-story office building in San Francisco with results of a computer simulation. In the actual evacuation, which occurred because of smoke spread from a fire, "using both elevators and stairwells it took over half an hour to evacuate the building. The evacuation caused a lot of confusion and was far from efficient." The evacuation was simulated with the elevators in normal "down-peak" mode. "The simulated evacuation of the entire building (with no use of stairwells) was accomplished in 8 minutes and 20 seconds." The difference was attributed to "the extent of control exercised in the evacuation exercise." Bazjanac noted that "all experimental results are based on the assumptions of a steady flow of people to be evacuated to the elevators and the smooth loading of elevators without any delay. . . . In fact, the ability to provide such controlled loading of elevators is by far the most critical factor for accomplishment of fast evacuation."

By way of conclusion, Bazjanac contended that "the decision to pull elevators out of service should be made according to the spread of danger in each individual case by an authorized person on location—not a priori through legislation."

Simulations by Pauls

While Pauls' simulation efforts were contemporary with those by Bazjanac, they (and their funding) were far less extensive than Bazjanac's. Pauls presented a graphical simulation of a few procedures in which elevators were used — in *non*-automatic mode and with fire service supervision — in conjunction with stairs to evacuate tall office buildings (Pauls, 1977). Like Bazjanac, Pauls considered treating sky lobbies (the floors where elevator zones overlap) as "refuge areas" but the usage was quite different; Bazjanac treated these floors as ones to which the elevators would take people; Pauls used these floors as points of departure for the majority of people who would first utilize exit stairs to move downward to the closest sky lobby. From this level the building occupants could then utilize elevators serving a zone other than one in which a fire was occurring. This should be safer and would also leave the fire-zone elevators — if safe — free for possible use by firefighters.

Graphical Simulation. First published by Pauls (1977), Figure 1 is a graphical simulation showing the complete evacuation of 4500 persons, in 35 minutes, from a 41-story office building. Of

the total time, fully 15 minutes are assumed to be needed for fire department response, elevator capture (Phase I in ASME/ANSI A17.1), elevator system checking, and dedicated (Phase II) use to remove people, unable to walk down stairs, from all of the 40 above-grade, office floors. The other 20 minutes are used for express trips from three refuge floors or sky lobbies to which ambulatory, stair-capable persons descend by means of the exit stairs before boarding elevators in an organized fashion. The simulation assumes that there are four 3500-pound (1600 kg), 19-passenger elevator cars per elevator zone with vertical speeds in the range of 800 to 1200 feet per minute (4.1 to 6.1 m/s). Due to fire conditions and fire fighting, one zone of elevators is assumed to be unusable for the egress from these transfer floors. If stair use were increased — with one-third of those above the 12th floor using stairs for their entire egress, the evacuation time could be reduced to under 30 minutes. A superimposed simulation of 4500 persons able to use stairs, utilizing only the exit stairs, predicts a total evacuation time of nearly 40 minutes, including 27 minutes of queuing by the uppermost occupants before they can descend. For this simulation, each of the two exit stairs is assumed to be 44 inches (1120 mm) in nominal width and each is assumed to be optimally used.

General Prediction. Figure 2, also from Pauls (1977), can be used to predict evacuation times for various building heights, evacuation procedures, and populations utilizing stairs alone or elevators with stairs. As with Figure 1, it is assumed that there are four 3500 pound, 19 passenger elevator cars per elevator zone with vertical speeds in the range of 800 to 1200 feet per minute (4.1 to 6.1 m/s). Although evacuation time increases linearly with total building population when only stairs are used, the combined use of elevators and stairs — with a conservative 15 minute period allowed before mass use of elevators begins — is shown as requiring approximately 30 to 35 minutes, starting from the first alarm. A less conservative 5 minute delay in beginning elevator egress is also shown. However, it is felt that such a short delay does not permit sufficient time for the supervisory personnel (firefighters or specially trained building staff) to assess the situation and decide on the best course of action for the particular situation encountered.

Finally, as discussed more completely elsewhere (Pauls 1980, 1988f), the population figures assumed in Pauls' simulations are actual occupants, not building-code occupant loads based on one occupant per 100 square feet (9.3 sq. m) of gross floor area. The latter are generally too high by a factor of two or more for office buildings.

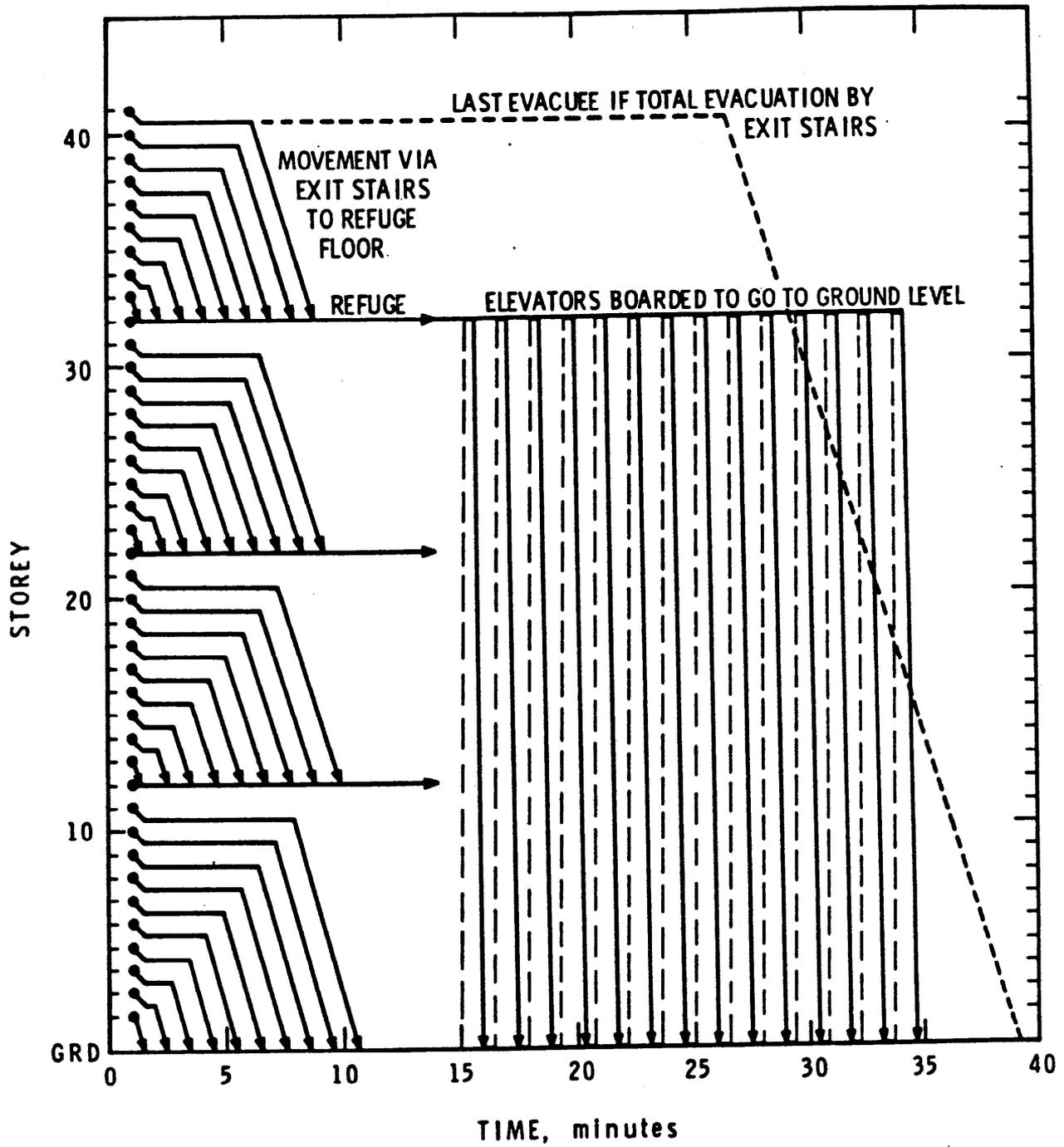


FIG. 1
STAGED EVACUATION VIE ATAIR AND ELEVATORS IN 41-STORY BUILDING
(From: Pauls, 1977)

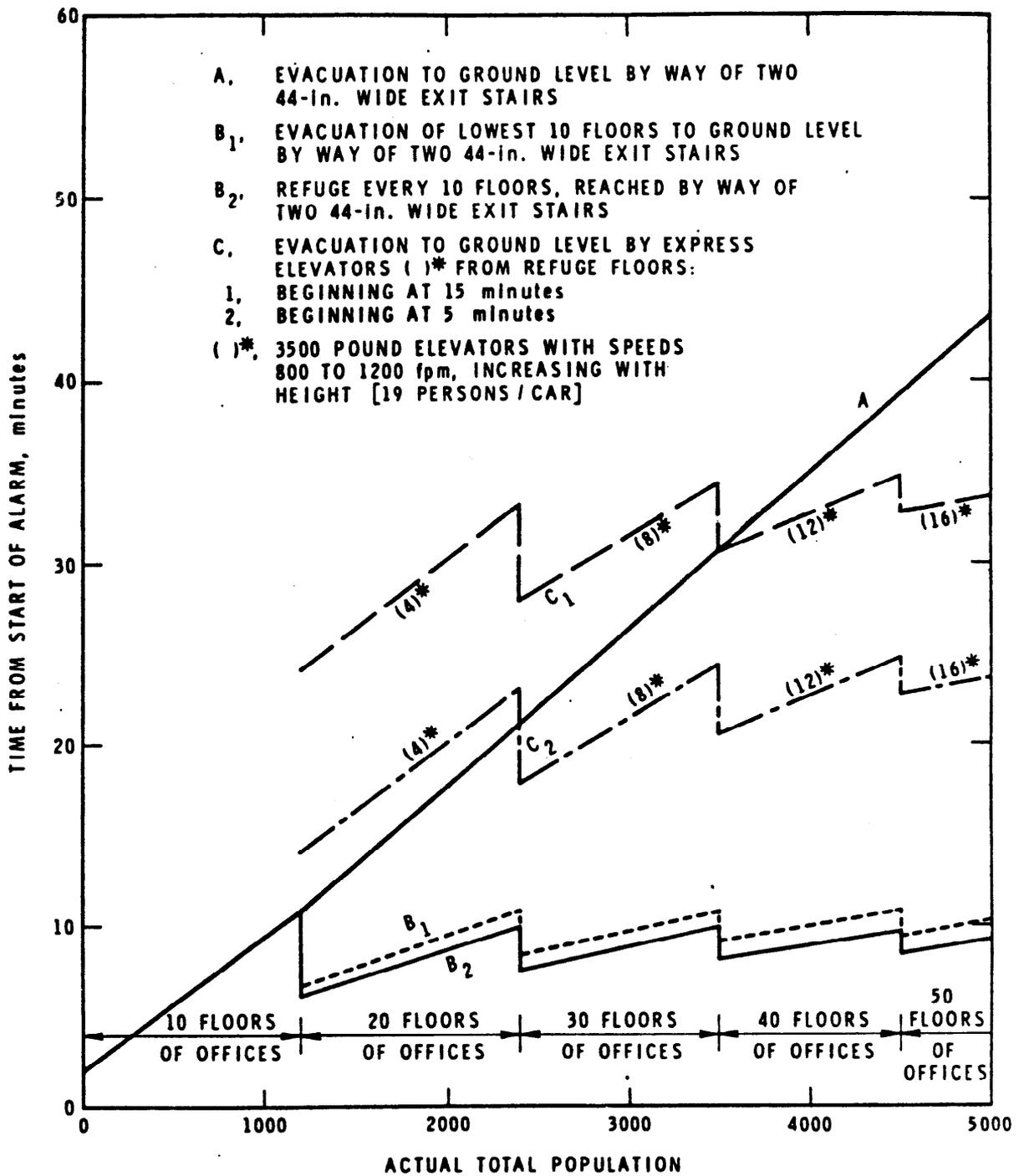


FIG. 2
TIMES NEEDED FOR VARIOUS REFUGE AND EVACUATION PROCEDURES USING
AND ELEVATORS IN TALL OFFICE BUILDINGS
 (From: Pauls, 1977)

CURRENT PROSPECTS FOR EGRESS UTILIZING ELEVATORS

The U.S. Situation

The Elevator System. Following the lead of other countries, in the U.S., proposals entailing elevator use for egress by people with disabilities have been discussed and voted upon during 1990 within BCMC, ICBO, and NFPA. Further deliberations are likely during 1991 within BOCA and SBCCI. The proposals assume limited egress use of elevators, with supervised, ASME/ANSI A17.1 (Rule 211.3) procedures, to evacuate people who are unable to use stairs. Protected elevator lobbies (for temporary refuge while awaiting the elevator) and protected elevators are required although the details — such as pressurization-based, smoke management methods — are not spelled out consistently. The BCMC report, completed in October 1990, simply specifies that:

Elevators intended for use from areas of refuge shall conform to the requirements in Section 211 of A17.1. Standby power shall be provided. Elevator shafts and adjacent lobbies provided to comply with 8.2.2 (the section dealing with required accessible means of egress) shall comply with the requirements for smokeproof towers (which are covered by a previously issued BCMC report). An exception is permitted for elevators in an area of refuge formed by a horizontal exit or smoke barrier.

Instructions for Use. Notably, unlike the British Standard, BS 5588:Part 8: 1988, the U.S. proposals provide little or no guidance on operating procedures. For example, the BCMC report, completed in October 1990, for areas of refuge which could be an enlarged exit stair landing or an elevator lobby, simply focuses on the physical aspects of the facility.

Every area of refuge using an emergency (fire fighter) service elevator or stair enclosure complying with 8.2.1 (with adequately sized landing area and width between handrails) shall be provided with a two-way communication system between the area of refuge and a central control point used for emergency management of the elevator.

Each area of refuge shall be identified by a sign stating AREA OF REFUGE and

the International Symbol of Accessibility. The sign shall be illuminated as required for exit signs where exit sign illumination is required. Instructions shall be posted on the use of these facilities under emergency conditions. Tactile signage complying with ANSI A117.1 (4.28) shall be located at each door to an area of refuge.

No guidance is provided here on the content of posted instructions which should, almost certainly, be markedly different from the instructions on signs typically found today at elevators. Under all the U.S. model building codes, a sign is required indicating that, in case of fire, the elevator will not operate or must not be used and that exit stairways should be used. (This ignores or evades the fact that, under ASME/ANSI A17.1, only certain modes of detection or manual recall will take the elevator out of automatic service. That is, there could be a fire which neither recalls the elevator nor is known to the person desiring to use the elevator.) In those buildings which will employ the elevator egress option information should be provided such as in the following draft. Note that this text is not all intended for incorporation on a posted sign, but rather should be tailored for an information program, including signage.

Elevator use in fire emergencies

In this building, elevator use is an evacuation option only for persons unable to use the exit stairs. If possible, such people should prearrange with building management to have their special evacuation assistance requirements incorporated in the emergency plan for the building. In an emergency, everyone who can use the stairs should do so, otherwise the evacuation of those needing to use the elevator will be delayed.

Under emergency conditions the elevator should be operated only by trained emergency service personnel who will first verify that elevator use is safe and then will check each elevator lobby to take waiting people to the ground floor lobby.

If there is a fire incident in the building make sure that the doors are closed between the elevator lobby and the rest of the floor. If unable to use stairs, stay in the lobby for instructions to be given over the speakers/intercom. Use the

telephone/intercom only if there is a delay of more than several minutes before the emergency personnel arrive or if conditions become life-threatening and you are unable to leave to lobby and move to one of the exit stairs.

Alternative refuge areas are provided in the exit stairs located at each end of the corridor. Use these alternative refuge areas if you cannot safely stay in the elevator lobby. Assistance will be provided in the exit stairs and a telephone/intercom is available also.

Availability of Options. In the view of some, it is highly desirable to have both the elevator(s) and one exit stair served directly by a common protected lobby. Ironically, while this is the preferred practice in Britain (under BS 5588:Part 8:1988), it is prohibited by one U.S. model building code, specifically 506.6.2 of the 1988 edition of the Standard Building Code in relation to special provisions for high rise buildings. The pros and cons of this arrangement — which appears to be useful from normal stair use, evacuation logistics, and smoke management perspectives — should be examined further.

The British Situation

With its somewhat different traditions of fire protection in buildings there is greater emphasis on compartmentation generally and protected lobby access specifically or, as it sometimes put, "two-door protection to vertical escape routes." Having the protected lobby directly accessing the elevator and an exit stair is also highly favored, the situation referred to above as being prohibited by one U.S. model building code. One British reaction to this was, "I am at a loss to understand why one building code prohibits a stairway opening onto a lift landing/lobby" (Gatfield, 1989b). At a minimum, it is believed that the refuge should have direct access to a stair. Here it is acknowledged that contemplating the use of a stair contradicts the whole rationale for using elevators but, as a means of last resort, the inherent difficulties and risks may be unavoidable and must be accepted. In other words, a "belt and braces" approach is warranted.

In Britain, the protection of the elevator — counted on for egress use — is comparable to what is called for with less detail in the U.S. For this BS 5588:Part 5, "Code of practice for firefighting stairways and lifts" (BSI, 1986) is utilized.

Generally, the elevator should have the "firefighter service" control system and be designed so that the risks which can be eliminated are eliminated; and for those which cannot, the means to mitigate them must be provided.

Operations. The most important component in the strategy for use of an elevator for egress is people, or what could be called an assistance system. This need not necessarily be a "buddy system" where one person is assigned to a specific "buddy," to help in case of emergency. There is some concern that it might be unsafe to leave it to people with disabilities to use an elevator on their own initiative; they might be unable to deal with crowding and excessive demand by others. This might cause delays. (Here it is useful to recall the remarks made previously on the welfare-approach taken in Britain, versus the individual-oriented, civil-rights approach which is more common in the U.S. All candidates for assisted egress cannot be identified in advance. Thus the system, and the emergency plan generally, must be flexible while taking into account identifiable requirements of those who pre-notify building management of their needs.)

In the British scheme of things, it is recommended that evacuation of people with disabilities should begin at the first alert of a fire and not wait until a hazardous situation has been confirmed. (That is, others — not considered disabled — might be permitted to remain at this early stage.) Responsible people should be detailed in advance by building management to undertake specific responsibilities in the event of fire. These should include, for example:

(1) One person should obtain control of the elevator, (using the emergency recall switch) take the car only to those floors where there are people with disabilities waiting for assistance, starting with those at most immediate risk, and taking them to the evacuation level. No person other than those necessary to assist with the evacuation should be permitted in the car.

(2) Others should assist people with disabilities to the elevator lobby, notify their presence and stay with them for as long as necessary. If the elevator is delayed they must be prepared to move their charges into the stair or another place of refuge.

Information and Communication Systems. For the evacuation strategy to work effectively information is needed. The location of danger influences the choice of egress routes; a fire alarm and indicating (annunciation) system will provide this information.

(1) The elevator operator will need to know on which floors people are waiting for the car.

(2) Therefore it follows that people waiting for the car must be able to indicate their whereabouts to the person controlling the evacuation.

(3) The persons controlling the evacuation must be able to give directions to the elevator operator and building occupants.

(4) The elevator operator must be able to communicate with the controller.

Choice of Elevators. Whenever possible, an elevator with firefighter service would be used for the evacuation. There has been some concern that use of the firefighting elevator for evacuation will delay fire service operations but with the British specification, which uses a simple rocker switch for the recall, this need not be so. They are able to recapture the elevator without delay by operating the recall switch, first restoring 'NORMAL SERVICE' and then the 'RECALL'. The communication system will enable firefighters to seek information from the elevator operator so that they can decide on their priorities for further action. This will inevitably include taking responsibility for the continuing evacuation. Where an elevator without firefighter service is used for evacuation, operation on 'car preference' (key) control will afford the means to avoid unwanted stops and the crowding and delay caused by unauthorized passengers.

CONCLUDING REMARKS

It should be clear that, to some extent (and perhaps especially in North America), an attitudinal turn of 180 degrees is required to implement the recently proposed or adopted measures formalizing use of elevators for egress by persons unable to use stairs. Long-held attitudes might well turn out to be a bigger impediment than the technology needed (and largely available) to make elevators relatively safe in many fire conditions and to make the options known to building occupants plus the fire services before and during a fire emergency. A case in point was the opening (in September 1990) of a new, 200 foot (61 m) deep station (Forest Glen) in the Washington Metro subway system. The station utilizes elevators for access and egress. Originally, elevator lobbies were provided with signs stating, "Use These Elevators in Case of Fire or Emergency." Adverse reactions (including some from fire safety personnel) were dramatically reported by news media. This was followed by the posting of new signs: "These Elevators for both

Normal and Emergency Use."

Of course some of the reticence about elevator use in emergencies is warranted. Other than in Britain, little has been done to even outline, let alone detail, the operational aspects of refuge and the combinations of stair and elevator egress. Generally the British work (Gatfield, 1989a, 1989b) demonstrates how elevator use can be a reasonably safe option provided that perceived risks are properly analyzed and addressed in design codes, and that there are competent personnel available to manage such use. Although the traditions of building design and use, plus fire protection strategies, differ between North America and Britain, there is much benefit in greater North American awareness of the detailed attention given to operational or management procedures in the British literature on the topic of elevator use for emergency egress for people with disabilities. The British standard, BS 5588:Part 8, for example has four and a half pages devoted to Appendix A: Advice to management. Included are:

- A1 Procedures in case of fire
- A2 Techniques for the evacuation of disabled people down (or up) stairways
- A3 Management of evacuation lifts
- A4 Examples of fire plan strategies in buildings provided with evacuation lifts
- A5 Fire alarm systems.

Within the U.S. fire protection, elevator systems, and building safety communities there should be greater recognition of the need for this kind of detail in readily available documents. If this paper spurs the effort to develop, and make widely available, such information it will have accomplished an important objective.

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