Developing Inclusive Emergency Procedures

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ABSTRACT

The performance of a population during an emergency procedure is less predictable than was once thought, especially given recent high-profile events such as 9/11. This has potentially serious consequences for the success of an evacuation, especially for buildings that require the implementation of a staged emergency procedure. The reaction of the resident population to these procedures is sensitive to their normal use of the building and the level to which the population is engaged and familiar with the procedure. A method is presented to develop procedures in partnership with the occupant population, to take advantage of their indigenous knowledge, to improve their familiarity with the procedures in place and to engage them in the safety process.

KEYWORDS: human behavior; human factors; evacuation procedures; circulation; participation; design methodology; egress; implementation.

INTRODUCTION

Safe egress during an emergency, especially where large numbers of people are involved, requires organization. This usually involves the design and implementation of an emergency procedure. When designed and applied successfully an emergency procedure can increase the chances that the egress routes available are used in a more efficient and safe manner.

The concept of the emergency procedure is based on the assumption that a population is receptive to training and that they make use of the information provided to them [1-4]. For many years it was the belief of those planning emergency egress that a population was to be controlled rather than managed. The 'crowd' [1] would not be amenable to information but would instead descend into a panic-based hysteria and could then only be controlled [5]; this control would then shape the movement of the crowd against its will, but still in its interest.

This approach would also see the provision of information to the evacuating population delayed through fear of instilling panic. This fear also influenced the amount of information disseminated with the information provided carefully limited. It was this delay in the provision of information to the evacuating population that often led to the population making sub-optimal judgments. This delay may reduce the egress routes available, forcing the evacuating population to select between several bad alternatives. Even if the population selected the best of this subset of the routes available, the selection is often seen as irrational, self-destructive behavior by third party observers.

In recent years, the idea that egress behavior is primarily governed by panic has largely been debunked [6]. Given this, the development of evacuation procedures is now seen as a viable means to assist in the safe egress of an evacuating population. Indeed many building designs, especially tall buildings, are dependent upon the employment of pre-determined evacuation procedures. Without these procedures, the egress routes (primarily staircases) within many tall buildings would be hopelessly overloaded during an uncontrolled and instantaneous evacuation [2,7-9].

Once the size and density of a population reaches a certain level and the time available is sufficiently short then safe egress will require organization; independent and uncoordinated activities will no longer suffice. This procedural organization will dictate when sub-populations evacuate and where they should go. This paper presents a method to produce procedures from the bottom-up rather than from the top-down to assist in the organized procedural response. These procedures will be designed based on expert opinion and occupant knowledge, rather than being determined completely externally.

An area of expertise has grown in order to satisfy the design of egress procedures. However, the progress of the field as related to tall buildings or buildings with high-density populations has recently been tested. Some of the basic tools available to procedural designers (e.g., the ability to defend in place, to perform

phased evacuations, etc.) may not be available, at least for the foreseeable future, given the occurrence of high-profile, procedural 'failures'.

Although by definition procedural design implies that human behavior can be managed during times of stress and danger, the current process of procedural design completely overlooks the sophistication, value and involvement of the occupants. It also usually ignores the valuable insight that can be provided by these occupant 'experts' [10] in the use of the building during non-emergency situations; an acknowledged influence in the expected evacuee behavior [11,12]. It appears that the evacuee is again relegated to the status of a ball-bearing [5] that needs to be channeled along exit routes designed independently of them, rather than being an active participant in the evacuation and the design process. In addition, the need for the population to engage with the procedure and have confidence in its value should also be addressed.

This paper presents a method for the design and implementation of egress procedures. A theoretical basis for the approach is presented followed by a methodology to apply and test the value of this approach. The method developed will be of particular value to those environments where the population is not transient and where an emergency procedure would have been developed; e.g., an office environment.

CONFIDENCE IN PROCEDURES

The design of a successful emergency procedure requires that several objectives are satisfied. Firstly, it is essential that the procedure in place produces an efficient evacuation. This requires the design and testing of the procedure. The employment of a procedure should at least improve upon the performance of an uncontrolled evacuation. Secondly, it is essential that the procedure is understood by the occupant population [13]. Given that the procedure has been designed, it needs to be adequately conveyed to the target population in time for them to digest and retain the information. During an emergency the procedure should be aided by the timely provision of unambiguous and comprehensive information [3]. However, without a well-understood and well-developed procedure already implemented, this information will only enable better-informed individual (i.e., local, independent) decision-making. Thirdly, it is essential that the procedure is then applied and adopted by the evacuating population. Given that the population understands the procedure, the population then has the confidence in it and the commitment to it in order to put it into action in times of stress and potential danger.

If ever there was an incident to demonstrate our shortcomings in coping with these three factors for procedural success, the debacle of the response to Hurricane Katrina is a case in point [14], although equally ineffective procedural responses can be cited relating to evacuations from fire [15-20]. Although the Katrina evacuation was on a grand scale, the problems evident translate directly to the smaller scale: the procedures were not completely applied, comprehended, accepted, or followed. The procedures did not take into account the local knowledge or local preferences of the evacuees, nor were their objectives explained to the evacuees in sufficient detail (e.g., individuals were put on buses and transported to unfamiliar destinations). The evacuating population was entirely passive in this process – they were instructed, transported and re-located using externally designed and imposed emergency procedures. The evacuees were then subject to the requirements of external agencies without the necessary knowledge to understand the methods and objectives of the procedures to which they were being subjected.

In the case of the World Trade Center incident [21], the behavioral response of the population was inconsistent and made limited reference to the procedures in place. This was due to the catastrophic nature of the incident, but was also influenced by a number of other factors: (1) the normal use of the building; (2) the experience of the population regarding the evacuation of 1993 [21-23]; (3) numerous conflicting procedures being employed in the building; (4) the need to develop local *ad hoc* procedures to cope with the evolving situation; (5) the population's lack of confidence with the procedures applied; (6) the population's lack of familiarity with the procedures applied [21,23,24].

These examples provide useful parallels with the problems that are found in evacuations from fire and the procedures employed. Emergency procedures are typically developed independently of the evacuees. Indeed, in most cases the first time that the evacuee is exposed to the procedure is during a drill, or during an actual evacuation. It is not surprising that there is limited confidence or familiarity in such procedures. This again suggests that the relative comfort gained from assuming that we can adequately design procedures overlooks the difficulty of translating this into action.

Since the World Trade Center incident of 2001, there have been concerns repeatedly voiced in the fire community regarding the future response of a population to an emergency procedure; i.e., that there might be some reluctance in following procedures [13,17,24-27], especially where the procedure requires seemingly counter-intuitive activities. This situation has largely been caused by the confused and conflicting procedural instructions provided during the World Trade Center evacuation (as mentioned in the previous discussion) and the subsequent widespread portrayal of evacuee behavior in the media and in the incident investigation [13,28]. Given the advice provided and the manner in which events superseded the procedures in place, the current expectation is that it will be difficult to convince occupant populations to remain within a building as part of a defend-in-place strategy using current approaches [25], irrespective of the validity of the approach [18]. The assumption that people will remain in place has probably always required some justification. It is now widely felt that given that a procedure has been devised, it cannot be taken for granted that an evacuating population will necessarily follow it, especially if the population doubts the value of such a procedure [17,26].

The likelihood of an evacuating population adopting the procedure is reduced still further if it only has a superficial familiarity and understanding of the procedure itself. Measures should be taken to ensure that procedures are followed. A different approach is therefore required; an approach that instills confidence through engagement, familiarity and local expertise [29-31].

IMPLEMENTING A PROCEDURE

The transition from the design process to the implementation of a procedure often undermines the value of the design; i.e., if the procedure is not applied in practice, then its quality is largely irrelevant. A population's exposure to a procedure prior to an incident usually involves only a brief description via signage or documentation or possibly a brief training seminar. The explanation of the procedure may occur many months prior to the occurrence of an incident and will usually be informal and often resented. This may be followed by the participation of the occupant population in an evacuation exercise, which is often announced beforehand undermining its value and realism. Therefore, the disengaged and reluctant population will not absorb the procedure, and will not value the information provided. In addition the population will not adequately put the procedure to the test during exercises, potentially providing a false sense of security in the appropriateness of the procedure being applied and in the expected response of the population.

This has far reaching consequences for egress calculations and procedural design. The overloading of egress routes can lead to hazardous conditions developing over which the evacuees have little control or means to avoid. This type of situation has developed on numerous occasions; e.g., Rhode Island, Iroquois Theatre, Gothenburg, etc. [9,20,32,33]. In such situations, decisions made locally may be rational but still can lead to life-threatening conditions arising. Uncoordinated movement prompted by the incident can overload the (possibly reduced) number of egress routes available.

In the following sections a method is presented that attempts to address these issues. It does this by transferring the focus of the procedure from being externally imposed (where the occupant population is passive) to a position of shared interest, responsibility and commitment. Here, the occupant population is actively involved in the procedural design. Whereas currently the occupant receives the procedure as a final product, in the method outlined the occupant influences the design of both the emergency and non-emergency procedure. The emergency planner acts as an instigator, a facilitator, an organizer, and a repository of expert knowledge, rather than dictating all aspects of the design. Ideally, the procedures developed using this method should be as broad as possible coupling non-emergency and emergency responses. If this approach is adopted, the population will then be more likely to implement the procedures (i.e., as part of the daily use of the building) and then see benefit from them, increasing the confidence in procedures in general (both emergency and non-emergency). It is therefore asserted that the population will be more familiar with the procedure, more involved with the whole issue of safety and will be more likely to engage in the issue of safety during the development of the procedure and its implementation in the future. The method therefore represents an approach to increasing the engagement and familiarity of the occupant population with the procedures employed while gaining access to their knowledge, and also a benchmark outlining a goal for safety managers.

It should not be taken for granted that a population will get involved in this type of activity. However, two factors help address this issue. Firstly, it is not necessary for the entire population to be involved. Secondly, a key issue in people's reluctance in getting involved in fire safety is that the threat is not taken seriously, or not seen as likely. Critically, this approach addresses non-emergency and emergency use of the building. Therefore, it is hoped that a population may be more likely to engage in such an activity benefiting both components of people movement.

THE LIFECYCLE OF THE BUILDING

For the vast majority of its life, the building is used in a routine, non-emergency manner. This includes non-emergency ingress, circulation around the building and then non-emergency egress. The non-emergency use of the building will directly influence the individual's understanding of the routes available [11,12]. If the emergency procedure contradicts or ignores the preferred use of the building then the occupant population will be expected to alter its use of the building under stressful conditions. The behavior of the evacuating population and the resultant outcome of the incident are highly coupled to the use of the building during non-emergency situations [11,12,34,35]. This includes both the practices that are a part of this use and the familiarity with the building that it engenders within the occupant population.

When the design of an emergency procedure does take into account the use of a building, it generally relies on the *expected* application of non-emergency procedures rather than how they are actually employed; i.e., the design route usage rather than the numbers that use the routes on a daily basis. Occupants who are subject to these procedures in reality will have a unique insight into the difference between expected (design) and actual procedural application (e.g., they will be aware of the routes most commonly used), allowing discrepancies between the design and actual usage to be identified.

The approach presented in this text assumes that an emergency is one (relatively brief) part of the lifecycle of a building. The use of the building in non-emergency situations is seen as informing our expectation of people during an incident. The application of an emergency procedure is seen as a means of modifying the non-emergency use of the building (e.g., the routes and exits used, etc.); i.e., the emergency procedure is not employed in a vacuum, but in the context of the normal use of the building. Its success in doing so is dependent on whether the non-emergency behavior and preferences of the evacuating population are accommodated, or at least taken into consideration.

It is a key component of this work that the building's life-cycle and what can be expected of the population during an emergency is inextricably coupled. Procedures should therefore be employed to benefit both aspects of the building's use and should make reference to each other. The life-cycle of the building involves a number of movement components: ingress, circulation and emergency and non-emergency egress. It is likely that in complex buildings several of these movement components co-exist and may interact. This again indicates the importance of addressing the overall movement system rather than addressing a single component (e.g., emergency movement) in isolation. Therefore, procedural development should ideally benefit and shape these often coinciding movement components (see Fig.1).
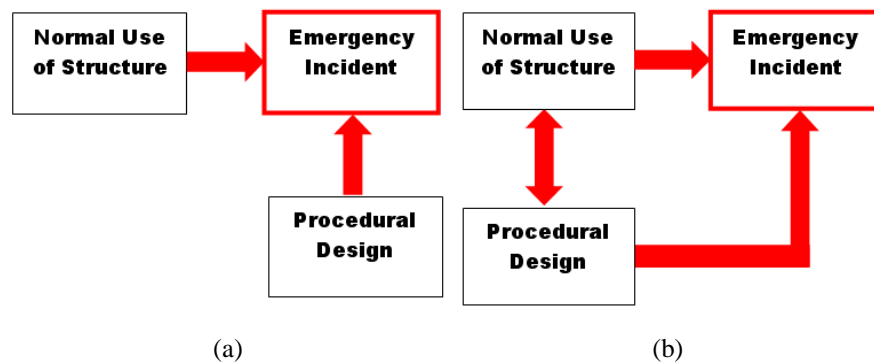

Fig. 1. (a) Traditional Approach; (b) Suggested Approach.

In the approach suggested, the non-emergency and emergency components are addressed simultaneously from the outset, acknowledging the dependent relationship between them. This twofold development is based on the following assumptions

- that understanding and improving the circulation around the building has great value;

- that by basing the development of emergency procedures on the reported rather than assumed usage of the building, there is a greater probability of these developments being perceived as valuable and initially employed; and

- that by improving the use of the building under normal conditions it will contribute to the use of the building during an emergency evacuation.

In the next section, the theory supporting the involvement of the occupant population and the means of eliciting their input into procedural design is discussed.

PARTICIPATORY RESEARCH

The improvement in non-emergency conditions and evacuation performance are issues that can be addressed using an approach that is analogous to Participatory Research (PR) [10,36-42]. In PR, the standard separation between investigator and subject population is deliberately blurred. The 'theory' represents a *practical* tool to improve the conditions, opportunities and well-being of the population involved. In doing so, the population is intimately involved in the activity (in this case of procedural development). This is an approach primarily designed to be of value to the target population and then secondarily to advance our understanding of a particular subject area. As stated by Park

"The people on whose behalf the investigation-action cycle is carried out get directly involved in the process, from problem formation, to inquiry, to action." [38]

The individual initiating the project (referred to as the facilitator) does not enter into a study to test a pre-defined hypothesis. Instead, the hypothesis arises out of the interaction with the target population. The target population is as much responsible for determining the direction of the work as the facilitator. The facilitator enables the work, which is then 'performed' predominantly by the target population [36-39]. The target population resolves to examine those aspects of their lives that require improvement. This population will have been identified as being in need of assistance and from this requirement a focus will develop. It is also claimed that through the involvement of the target population to such a high degree their normal reluctance to engage in the planning and execution of the project is avoided and that the artificiality of the work is reduced. By doing so, the approach gains access to untapped information provided by the target population. These last two statements are deemed vital to the development of every procedure.

This process is enabled through the provision of the necessary analytical tools, theoretical guidance and support by the facilitator. As such, rather than being distant from the object of the work, the facilitator is seen as inextricably linked to the population – on 'their side'. In order to enable improvement the facilitator must gain the trust of the population and must be aware of the comprehensive set of information available to them rather than focus on a pre-determined sub-set of information.

The facilitator identifies a population where some 'injustice' exists that may benefit from the project. During the project, the facilitator and the occupant population engage in a dialogue intended to acquire as much local knowledge as possible and use the relevant aspects of this knowledge within the project. From the very outset the occupant population is involved in the design and application of the project. The facilitator and the occupant population formulate the needs that need to be addressed. As such, the objectives of the project arise rather than being imposed by the facilitator.

The theory of PR involves three key areas of data acquisition: instrumental, interactive, and critical phases. All three approaches are adopted in the framework outlined here. During the instrumental phase, a traditional observational approach is adopted to better understand the existing situation and the occupant population. During the interactive phase discussion and dialogue are employed between the facilitator and the occupant population in order to promote ideas, reveal (and interrogate) local knowledge and fully engage the occupant population in the process. This process not only familiarizes the population with the facilitator, but should also encourage members of the population to engage with each other. In the critical phase of data acquisition, the population re-engages with the outcome of the project once a preliminary

result has been produced, in order to reflect and to determine whether iterative modifications are required. This phase not only improves the outcome but, by encouraging reflection, initiates a process of engagement and analysis will have been initiated that will continue after the facilitator has departed.

The application of this approach to fire safety deviates from standard theory in several ways: (1) instead of a population that is vulnerable generally, it involves a population in a vulnerable situation; (2) in comparison to other examples of PR work, the method/project(s) proposed here are relatively short-term; (3) there is a broad pre-determined subject area of interest here (i.e., the safety and well-being of the occupants of a particular building); (4) although the target population will aid in the analysis of the data produced, additional guidance will be provided by the facilitator given the regulatory requirements involved.

It is recognized that the approach would benefit from overcoming these discrepancies. However, it is felt that this represents the first step along this route and that beneficial results can be gained from even this small step.

In this approach, the occupant population is an active partner rather than passive recipient, providing vital information rather than simply being a consideration after the fact. Given their involvement in the development of the procedure, the population should not just have a vague understanding of what instructions to follow, but will have a deep understanding of the basis of these actions and their final objectives. The procedure will provide a set of tools that facilitate safe egress rather than simply constraining movement. By adopting this approach, the probability of the procedure being understood, accepted and then employed is increased. This inclusive approach addresses the most significant problems highlighted in emergency procedural design, while also benefiting non-emergency issues.

DEVELOPING EMERGENCY PROCEDURES

The principles described in the previous sections have been developed into a practical approach for developing emergency procedures [43-54]. An outline of this approach is now presented.

The key objectives of the approach are: (1) the improvement in the building's use and therefore in the daily experience of the occupants; (2) the development of an emergency procedure that is sensitive to the daily use of the building; (3) the implementation of an emergency procedure with which the population is familiar and engaged through their involvement in the design process. The target population will therefore be involved in the design of emergency and non-emergency procedures, as well as in other associated developments that arise during the dialogue.

Feasibility

Ideally, the target organization should already employ a procedure and should be of sufficient size for the procedure to require design and testing. This process will require contacting the management to determine whether the approach is feasible, desirable and appropriate. Management may be able to provide information regarding previous emergency incidents, problems that have arisen and the rationale behind the non-emergency and emergency practices currently employed within the organization. This approach requires a non-transient population that is sufficiently structured to require formal emergency procedures to be employed; e.g., a population that resides in the space on a frequent basis and is familiar with the space and will be subject to the efforts of safety management and the procedures employed. A transient population (e.g., visitors to a shopping mall) may not be subject to the training and formal procedural requirements of a static population.

Providing a Benchmark

An evacuation drill should be conducted and discretely monitored. Discretion at this stage is required in order to prevent the outcome of this initial evacuation from being influenced by prior knowledge of the recording process. For the same reason it is important that the evacuation is unannounced [12]. The performance of this evacuation will provide a benchmark against which later procedural developments can be compared [55-59].

Engaging the Population

The team employing the PR method will engage the occupant population and describe in detail the nature and objectives of the process; it is vital that their motives are as transparent as possible. The team should be

seen as organizing, facilitating and managing the process, but not dictating it entirely. The team will explain the purpose of the work: to improve the quality and safety of the lives of those involved both in the course of their daily activities and during an emergency. However, addressing other issues should certainly not be precluded from the work. It should be emphasized that the exercise is not part of a management imposed efficiency study and that any increase in productivity is entirely coincidental. The team will develop a brief seminar introducing the population to some of the topics that will be addressed, why they are important and what the population can contribute and get out of it. Although the objectives of this work may not initially be the highest priority of the occupant population (e.g., in comparison to wages and pension rights), the work will certainly have some benefit to their daily lives and to their peace of mind. This approach is based on the assumption that it is not enough to tell people what they need to do, but to explain to them why it needs to be done and demonstrate the value of it [1,3,36-39].

Getting 'Expert' Feedback

A series of meetings between the team and the occupant population will then be held. Although the management will be aware of this process, it will not initially be involved. This is to produce an open, non-threatening atmosphere that is conducive to the staff participating fully. The meetings should take place in a familiar environment, although one that affords some privacy [40].

Although the team may prompt responses and facilitate discussion it is important that the population perceives that they have a credible influence at an early stage. Therefore, additional latitude should be shown in the early stages of this phase allowing the population to contribute and direct the proceedings as much as possible [40]; i.e., that the participants should be allowed to discuss subject matter that is not directly relevant, and also provide solutions that might not be considered practical.

Several separate small meetings should be organized maximizing the input of the members of each group [40]. After a few meetings, the size of the groups should increase until finally there will be meetings where everyone is in attendance. These meetings will eventually include management. Within the meetings the openness and attitudes of the workforce will be treated as equivalent, irrespective of their employment position.

Establishing Route Use

These discussions will initially require the occupants to describe their daily routine in detail. This will refer to the use of the building and any issues that they feel arise during this routine. This will provide invaluable information relating to the function of certain areas of the workplace, the regularity with which these functions are performed, when and where these occur and who is involved. The team will need to probe in order to elicit this information. The facilitator will provide an outline for these meetings to structure them and encourage participation. The facilitator will set some broad topic areas to be covered allowing some control over the direction of the meetings.

Care should be shown when developing these topics, as they should present an area that will generate debate and engage the occupants. The topics should address the experience of the occupant within the building; the emergency and circulation practices will be part of this set of information. These topics are intended to promote discussion; provide insight into the non-emergency and emergency requirements of the organization; determine what can be expected of the workforce; engage them in the process of procedural development; and engage them with each other.

Ideas from the occupants should be recorded and compiled by the facilitator. It is important that this practice is recognized by the occupants. At every opportunity the findings from these discussions should then be echoed back to the population for reflection using storyboards, presentations, visual aids and other interactive methods. This will encourage the population's involvement and will also ensure that the facilitator has clearly understood the information provided.

A detailed picture of the work place will be established: its actual use, the procedures and the practices involved. This is useful as it will enable work issues to be identified; establish the actual procedures employed rather than those thought to be practiced; and it will demonstrate that the project relates to the occupant's work lives in general as well as the less commonly employed emergency procedures. From the discussion of the current practices and the current problems with them, a list of issues will be presented by the facilitator. These will act as discussion points in order to generate ideas for improvements to these existing procedures.

Estimating Emergency Use

Once an understanding of the daily routine is established then the dialogue should be moved onto emergency procedures [60]. The same process should then be applied. It is important not only to understand what the emergency procedures are within the building, but also the population's understanding of them, training levels, willingness to engage in them and their experiences of previous events relating to these procedures. Importantly, the relationship between these procedures and the non-emergency procedures employed within the building should also be explored. As with the non-emergency procedures, problems and alternatives should be aired and discussed until a consensus is reached.

Developing New Procedures

From this understanding of the current 'normal' and emergency activities, suggestions can be made by all parties regarding the potential for their improvement. The facilitator will encourage this process by identifying standard guidance and alternatives to the current practices. Suggestions made will then be organized by the facilitator to formalize them into a set of new procedures. Once developed, these procedures will be discussed and re-examined in order to reiterate the value of the population's input, identify possible improvements over the current situation, and elicit further comments.

After this iterative approach, a set of procedures will have been produced. These will be sensitive to both 'normal' and emergency use of the building and informed directly by the experience of the occupant population and by standard practice (through the input of the facilitator(s)). In this manner, *the procedures will have been designed using indigenous experience and external expert opinion.*

Testing the New Approach

Where the technology and expertise is available, it may be useful for the team to test these new procedures. For instance, computational tools can be applied to investigate the effectiveness of these new procedures [61]. The results produced can be fed back to the occupant population further demonstrating that the input provided was valued and providing evidence for accepting or rejecting the procedures.

The suggested ideas and developments should be implemented and examined. Initially this will refer primarily to the non-emergency procedures, as these are the easiest to assess. This implementation should again rely on the full involvement of the occupant population so that they feel engaged and they feel a degree of ownership of the changes made. This should encourage their familiarity, understanding and confidence in these changes. A mechanism will be required allowing feedback to be provided on the performance of these new procedures (e.g., e-mail, drop boxes, additional discussion groups, etc.).

Once the changes have been applied and assessed, the results produced should be compared with the conditions previously identified in a second round of discussions. This comparison will be made with the occupant population. If modifications are required then further rounds of assessments can be performed until the developed procedures are satisfactory.

Once the procedures have been designed and implemented satisfactorily, the team should withdraw from the building/population. A seminar that summarizes the achievements of the process will be presented to promote further feedback from the population both on the achievements and on the basic approach adopted. This will then aid future applications of this approach.

Several months after the team has disengaged a follow-up emergency exercise (drill) should be conducted. The elapsed time between the end of the project and this exercise should be sufficient for emergency training to have been conducted, the population to be familiar with the new non-emergency and emergency procedures, and for the project to be more remote in the memories of the population.

This emergency exercise (and the monitoring of it) should adhere to the format of that performed earlier in the process to enable direct comparison to be made. Once collected, the team should compile and analyze this data to establish whether there has been improvement over the previous exercise. This may also be an opportunity for the team to re-visit the population in order to assess their opinions and provide further feedback.

It is recognized that this approach represents a long-term effort that requires a deal of expertise and the prolonged participation of the occupant population. However, the potential benefits are high, both for the normal and emergency use of the building. This approach addresses two key issues with the emergency

procedure: the relationship to the normal use of the building and the adoption and application of the emergency procedure by the occupant population. It is felt that these benefits may well justify the administrative and technical hurdles posed by this approach. Further information on this approach can be found elsewhere [62].

CONCLUSIONS

In many situations, the evacuation from a building will require management. This is particularly important in tall buildings that have been designed assuming the success of such procedures, and situations where high-density populations can form. This management is achieved through the development and implementation of an emergency procedure. It is vital that the evacuating population is familiar with this procedure and willing to follow it. Otherwise the evacuation may operate less efficiently and egress routes may become overloaded, potentially producing dangerous situations.

Having an engaged population would have reduced the problems in a number of high profile evacuations by having the population be more familiar with the procedure and having them follow it when required. Given the possibility that people are currently more skeptical of emergency procedures, especially relating to tall buildings, any method to engage and reassure the population would be of great value.

To follow a procedure, a population must be familiar with it, must understand it and must trust it. If this is not the case, then the population may not know what to do; may not know why the actions are being performed; and may disregard the procedure quickly should conditions deteriorate. Often procedures meet none of these requirements. Indeed, the manner in which the population perceives the procedure is often entirely neglected during the design phase. To exacerbate matters, procedural training is often sporadic, superficial and resented.

In this paper, a method has been presented to address these issues. This method can be applied in situations where emergency procedures are developed and the population is not transient. This method addresses the issues highlighted by engaging the occupant population in the design process and making use of its unique knowledge of the normal practices within the building. It then uses this information to improve upon both the emergency and non-emergency (normal) practices in the building. These practices are assumed to be highly coupled. Therefore, by understanding and improving upon the daily use of the building, the developed emergency procedure will be more appropriate and effective.

It is certainly not suggested that procedures should be developed independently of expert opinion. There are regulatory limitations regarding the development of these procedures that need to be followed, and there are guiding principles in the design of these procedures that will be of great value in their development. However, it is suggested that the expertise of all those involved should be pooled, so that the procedures are developed on the actual use and capabilities of those involved rather than a theoretical expectation. In this way the procedures will better suit the situation, will be better understood and will be more likely to be used.

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