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STUDYING FOR SAFE MANAGEMENT REGULATIONS INFLUENCE PEOPLE EVACUATING BEHAVIORS

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Abstract:
In building, sign of fleeing and evacuating and evacuation guiding and training, those hugely influence life and property of people. How to set up and to improve the safe management regulations are important subject to face for government and people. This research is using methods of literature reviewing and questionnaire investigating to understand the influence of people evacuating behaviors because of safe management regulations. The preliminary result is people will lose the golden time of fleeing and evacuating because they do not have the correct concept and behavior of evacuation, when they encounter the fire accident in strange place. Therefore, clear evacuation guide and sign can improve the security of people evacuation.

Keyword: management, fire, evacuation, behaviours

1. INTRODUCTION

The casualty in fire disaster are between 385 and 1069 people each year, according to the statistical data of National Fire Agency, Ministry of the Interior [1], from 1997 to 2012. Meanwhile, the number of the fire disaster happened is greater than the natural disaster. The number of natural disaster happenedis143; the fire disaster is 129,633.The fire disaster is the largest threaten to people in daily life, as shown in Picture 1.The rate of fire and natural disaster happened is shown in Picture 2. The casualty of the fire disaster from 1997 to 2012 is shown in Picture 3. The fire disaster includes building fire, forest fire, vehicle fire, ship fire, airborne vehicle fire and others [1].The "building fire" is the most happened. The rate of building fire to all kinds of fire disaster is 1199 to 5969. The building fire is the first place in all kinds of fire disaster every year, as shown in Table 1 and Picture 4.The rate of building fire happen still remains high even government official, academic circle and industry are trying hard to reduce disasters [1]. Therefore, people should understand the seriousness of fire, how to save oneself and how to ensure the person safety within the fire in building; it is the important subject to face for people and government.

According to relevant research reports and documents, when the fire happened, people would lose the abilities of judgment, distinction and analysis [2].People cannot find the direction of evacuation or the emergency exits when they are not familiar to this building, even the electricity system keeps working, lights remain bright. The worst matter is that people chocked in high temperature flame and thick smoke, and then the electricity is cut off suddenly, they cannot safely remove in the building. The stipulate in Taiwan: it must put up the route map of emergency evacuation in public building [3]. When the accident happened, it can lead people who is in the floor or place of building where it is not fire happened to reach the safe place (for example: the emergency staircase, ground).But if the fire and smoke have already spread everywhere, how to request people recalling the route map of emergency evacuation and following the direction for protecting oneself life, it is worthy to study and find the suitable management method.

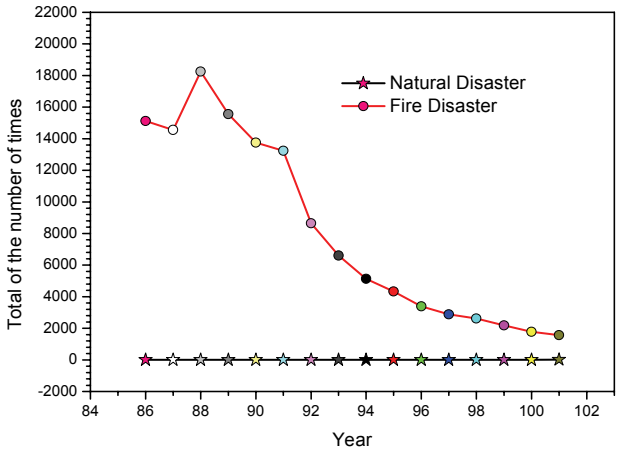
Additionally, no one can predict the fire ignition place. In other words, no one knows the fire would happen in which room or which floor. There are some research reports to predict which room could easily become the fire ignition place with statistical data. For example, the fire happened in the bedroom of the house type building, the probability is the highest [4]. In public building, it is unable to learn which floor or room when will fire accident happen. Hence, the route map of emergency evacuation whether can ensure people security; it is can be discussed and improved.

Table 1: The times of all kind type of fire happened [1]

year	building	forest	vehicle	ship	airborne	others	total
1997	5,689	3,997	2,068	56	0	3,305	15,115
1998	5,828	3,375	2,158	43	2	3,149	14,555
1999	5,969	5,829	2,149	53	6	4,248	18,254
2000	5,216	4,345	2,201	47	1	3,750	15,560
2001	5,075	3,476	2,033	38	0	3,128	13,750
2002	4,499	4,284	1,674	42	1	2,744	13,244
2003	3,754	2,026	1,406	25	0	1,431	8,642
2004	3,340	1,176	1,081	34	0	980	6,611
2005	3,054	680	935	17	0	453	5,139
2006	2,745	542	724	16	0	305	4,332
2007	2,200	356	546	26	0	264	3,392
2008	1,885	257	506	21	0	217	2,886
2009	1,634	484	326	21	1	155	2,621
2010	1,458	236	299	11	1	181	2,186
2011	1,248	166	213	6	0	139	1,772
2012	1,199	42	204	11	0	118	1,574

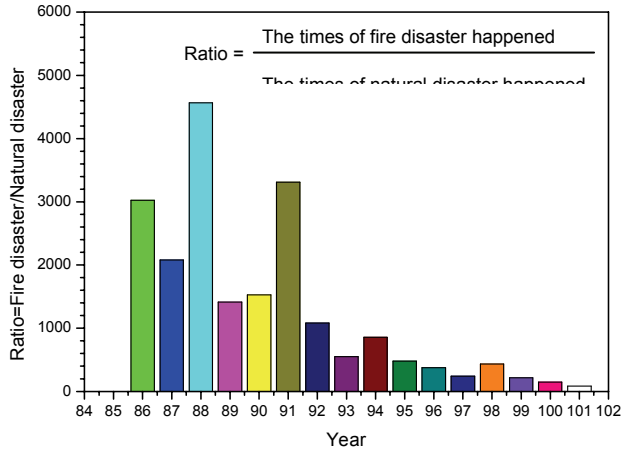
Source: 2012 fire safety annual statistical reports of National Fire Agency, Ministry of the Interior

Figure 1: The times of natural and fire disaster happened



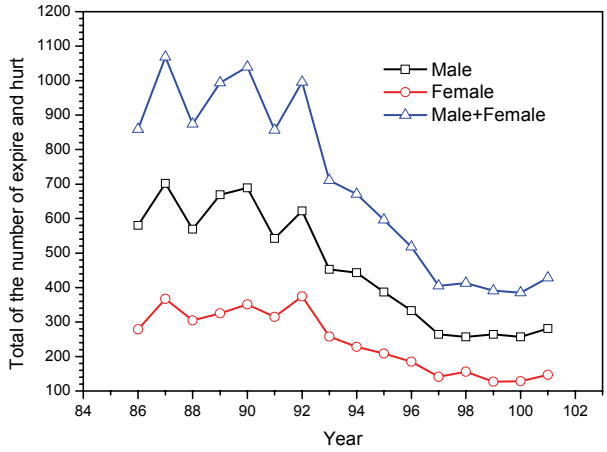
Source: 2012 fire safety annual statistical reports of National Fire Agency, Ministry of the Interior

Figure 2: The ratio of fire disaster to natural disaster



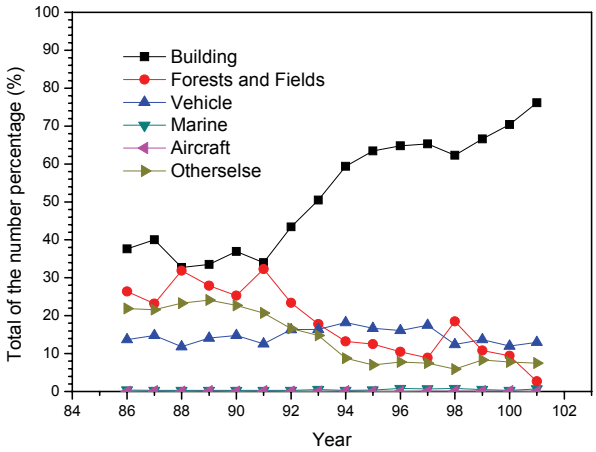
Source: 2012 fire safety annual statistical reports of National Fire Agency, Ministry of the Interior

Figure 3: The casualty in fire from 1997-2012



Source: 2012 fire safety annual statistical reports of National Fire Agency, Ministry of the Interior

Figure 4: The percentage of all kind type of fire



Source: 2012 fire safety annual statistical reports of National Fire Agency, Ministry of the Interior

2. RESEARCH REVIEWING

Knowing from research documents, when the fire accidents happened, people evacuation behaviors will be including: behavior of following light, behavior of following others, behavior of entering familiar routes and behavior of looking for exits nearby and so on[5~14]. Basically, when fire happened, most of people will gather to a few emergency exits within short times, then people congested, blocked off, push, shoved, collided, trampled etc., so people cannot escape from the fire in time, and will die in the emergency exits [15, 16]. In fact, there are usually enough emergency exits for people to evacuate in each floor of the building, but people lack of being lead, some emergency exits are unused [17]. So no matter the government or people should promote concepts and methods of oneself safety management and evacuating security.

3. METHOD

In order to construct the correct concept of evacuation for people, and to understand the model of evacuating behavior and cognition behavior of people, this research carries on questionnaire investigation to understand evacuating concept of people, then analyze in cluster by demography.

First of all, design and examine the content of questionnaire, then begin doing pilot studies. The members of this research take the questionnaire first, and correct the unsuitable questions. Second, invite five persons to take the corrected questionnaire, and correct the questionnaire again bases on the feedback and opinion from those five persons. At last, after the pilot studies, invite other 5~10 persons to take the questionnaire again to make sure the content of questionnaire is suitable, and take questionnaire test with Likert 5 scales, it is group studies. The final questionnaire is completed.

4. RESULT AND ANALYSIS

People must contest with time for evacuating, as there is the fire accident happened and the fire expands and spreads. People would lose the direction and judgment because of fear, panic and fright. Usually, people is hard to follow the instruction when they are in panic, is hard to find the emergency exits when they are in the dark smoke. Hence it is important and urgent thing how to choose the correct evacuation route to reach the emergency exits and arrive safely on the ground in short time.

There are 15 questions with Likert 5 scales on the questionnaire of this research. The Likert scale which is psychology reflection scale is set up by Rensis Likert. The tester point out degree of agreement after reading the question statement, and point out one of these: “disagree strongly”, “disagree”, “ordinary”, “agree”, and “agree strongly”. Not including the invalid questionnaire, there are 331 valid questionnaires. The questions and the answers are shown in Table 2.

Table 2: The results of questionnaires

No.	questions	disagree strongly	disagree	ordinary	agree	agree strongly
1	The route map of emergency evacuation put up in the building is important instruction to help people evacuate from fire situation	5%	2%	7%	27%	58%
2	It is helpful to evacuate from fire situation to you, reading the route map first before you enter the totally strange building	3%	3%	9%	36%	49%
3	The bad air or insufficient light both will cause people spirit not well	5%	0%	3%	34%	58%
4	People spirit is not well, it will influence people's judgment and movement ability	5%	0%	3%	35%	57%
5	The bad air and insufficient light both will influence people's judgment and movement ability	4%	1%	3%	33%	58%
6	People 's judgment and movement ability are insufficient, it will postpone the time that people begin to evacuate from fire situation	5%	1%	2%	34%	59%
7	The bad air and insufficient light indoor will postpone the time that people begin to evacuate from fire situation	5%	1%	2%	35%	57%
8	Insufficient light indoor will hinder you evacuating from fire situation	3%	1%	3%	32%	61%
9	To set up bright lights on the both side wall of corridor, it can help you to evacuate from fire situation	3%	1%	3%	32%	62%
10	To set up the exit direction light in building will help you to evacuate from fire situation	2%	1%	5%	34%	58%
11	You will follow the exit direction light to evacuate from fire situation	2%	1%	5%	40%	52%
12	To decorate the photos or pictures on the both side wall of corridor will help people recognize the route of movement	5%	2%	5%	28%	61%
13	You will follow broadcast leading to evacuate from fire situation	2%	1%	7%	43%	47%
14	For evacuating from fire smoothly, you should follow the route of the exit direction lights or broadcast leading, lower your head, bend over, walking along wall or corridor to reach the emergency exit as soon as possible	2%	0%	6%	40%	52%
15	In the process of evacuating, you will walk in or out the rooms	20%	28%	18%	17%	17%

Knowing from the results mentioned above, people think evacuation behaviors will be influenced by those factors, including "the route map of emergency exit", "the quality of air indoor", "the bright light indoor", "the characteristics of corridor", "broadcast leading", and "exit direction light". The percentage of all questions on "agree" and "agree strongly" is about from 85% to 94%. There are about 17%-34% people will walk in or out the rooms when they are evacuating from the fire situation. It is a dangerous behavior in fire situation, because to walk in or out the rooms in fire situation will obscure the direction. Therefore, government should educate people to construct the correct concept of evacuation.

5. CONCLUSION

There is a golden time; people in the fire situation must contest with the speed of smoke spreading and dropping. No matter people are on the ignited floor or non-ignited floor, people should reach to the emergency exit along the corridor. According to the result of this research, only reading the route map of emergency evacuation cannot ensure people safely evacuating from fire situation. Therefore, to educate people correct concept of evacuation, such as not walking in or out the rooms in the fire situation, is worthy of be thought about. More, the most important method is to stipulate the safe management regulations of buildings, such as maintenance of the air conditioner system, maintenance of the electricity system, maintenance of the equipment in building, to improve the static route map of emergency evacuation, to set up the dynamic exit direction lights etc., all methods might correct people wrong behaviors of evacuation and reduce the casualty in fire disaster.

REFERENCE LIST

1. Bang-Lee Chang, Ching-YuanLin, Peng-chihWang,Ying-YuehChen, Chieh-YiChang. "*A Study for Pressurization in Relatively Safety Shelter of House Building*", 21th Symposium of Research of Architectural Institute of Taiwan, (in Chinese).
2. Bang-Lee Chang, Ming-Jing Ho, Yen-Ku Kuo, I-Yun Hsia. (2013). "*Relationship between Disaster Prevention Cognitions and Evacuation Behaviors of the Invisible Disable in Large-scale Underground Space*", 25th Symposium of Research of Architectural Institute of Taiwan, (in Chinese).
3. Chu-Cai Huang. (1987). "*Fire behavioral research of taking refuge*", the thesis of master degree of research institute of policy of central police's university, (in Chinese).
4. Guylène Proulx. (2001). "*Occupant Behavior and Evacuation*", 9th International Fire Protection Seminar, Fire Risk Management Program, Institute for Research in Construction, National Research Council Canada, Munich.
5. Ho, M. J.,& Jian, S.W.. (1999). "*Basic Study on the Behavior Mode of Evacuation in Urban Space*", Architecture & Building Research Institute Case Study Report.
6. Horiuchi, S., H. Negishi, K. Abe, A. Kamimura and Y. FujinawaAn. (2005) "Automatic Processing System for Broadcasting Earthquake Alarms", *Bull. Seism. Soc. Am. 95*, pp.708-718.
7. John P. Keating. (1985). "*Human Response during Fire Situations: A Role for Social Engineering*", American Institute of Architects, University of Washington, March.
8. Liberty Times, "*Fire of Snow Hotel*", http://news.ltn.com.tw/news/society/paper/284311. (in Chinese)
9. Lin Wang, Lu Pai. (1990). "*The intersection behavior on fire situation of resident*", Ministry of Science and Technology research report, NSC78-0414-9033-02B, (in Chinese).
10. Margrethe Kobes,Ira Helsloot,Bauke de Vries, Jos G. Post. (2010). "Building safety and human behaviour in fire: A literature review*", Fire Safety Journal 45(*1), p.1-11 , Abstract.
11. Ming-Chuan Liao. (1984). "Human psychology and behavioral research", *Police Science Quarterly, third issue, Vol.14*, page 41-47, (in Chinese).
12. National Fire Agency, Ministry of the Interior. (1995). Document No. 8451178,1995
13. National Fire Agency, Ministry of the Interior. (2012). *The annual statistical report.*
14. Norman E. Groner, Bernard M. Levin. (1992). "*Human Factors Considerations in the Potential for Using Elevators in Building Emergency Evacuation Plans"*, George Mason University, July.
15. Peter G. Woo. (1980). "*A Survey of behavior in fires, fires and human behavior*", edited by David Canter, John Wiley & Sons, Ltd.
16. United Daily News, France-Press Agency, European Press photo Agency and Liberty Times Associated Press, "*Fire of Kayettuli*", Capital of Bangladesh (in Chinese)
17. Yu-Qun Zheng. (2010). *"Fire and security*", http://teacher.yuntech.edu.tw/~leesh/15-fs.htm.