

Evacuation of High-Rise Building Part 6

Experiment on Evacuation-Chair Taking Consideration of Change of Rider Weight

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1. INTRODUCTION

It reports on the result of the descent in the stairs experiment that changes the weight of the person (after this, rider) helped with the evacuation-Chair in this report following former Part 5. Moreover, because the experiment that used a general wheelchair was done as example of the means of evacuation other than the Evacuation-Chair, the result is shown.

2. CHANGE OF WEIGHT OF RIDER EXPERIMENT THAT USES EVACUATION-CHAIR

2.1 *Experiment purpose*

It was clarified to the former report to exert the influence with proficiency on the space shape in the stairs and the rider in the operation going out of the wheelchair for more evacuation. However, it has experimented on constant 60kg about the weight of the rider. In this report, it aims to know the influence that the weight of the rider gives at operativeness and the descent in the stairs time.

2.2 *Outline of experiment*

(1) *The subjects*

It experimented on 16 people as well as former report 5. No.1~9 is assumed to be an experienced person of the inexperienced person and No.10~16 according to the frequency though all subjects.

(2)Experimental location

It experimented as former Part 5 one layer in the stairs (*Figure 1*). It was assumed 900mm and 1200mm by the partition wall and experimented on the width of the stairs (Refer to the width change method to former Part 5).

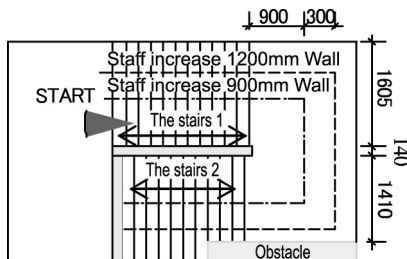


Figure 1 The stairs plan

(3)Experiment method

The stop watch, the video camera, and motion capture system were used for the experiment measurement. As for the method of measuring the descent time, the timekeeper besides the rider measured each of stairs 1, landing, and stairs 2 with the stop watch.

As for the weight of the rider, they wanting are three conditions (20kg, 60kg, and 100kg) and be doing (*Table 1*) because 136kg of the limit load of the evacuation-Chair. The instruction "Please value safety, assume evacuation, and go down stairs" had been given to the testee before it experimented. Moreover, it questioned the subjects concerning the operativeness of the evacuation-Chair after it had experimented.

Table 1 Weight change experiment

Location	TUS
The stairs	Floor 4-R
	1 layer
Floor height	3.96m
Number of steps	11+11 steps
Kicking up	160mm
Wheel tread	280mm
Diagonal degree	Approximately 33°
Weight of rider	
20kg	Weight
60kg	Man
100kg	Man + Weight

2.3 Experiment result and consideration

(1) Descent time

Figure 2 shows the descent time of the width 900mm and 1200mm. The tendency also for the descent time to slow as both weighting it both width becomes heavy is showed.

Moreover, the transition of the mean value is showed to show a similar tendency though a time difference is thought to be an experienced person between the inexperienced person. When one layer descent time and the street time of the landing are showed, the transition of a mean value similar here is showed. It is understood that the traffic time in the landing has a influence from this at the descent time. There is a difference by weight remarkably because it became easy to operate width from 900mm widely in width 1200mm.

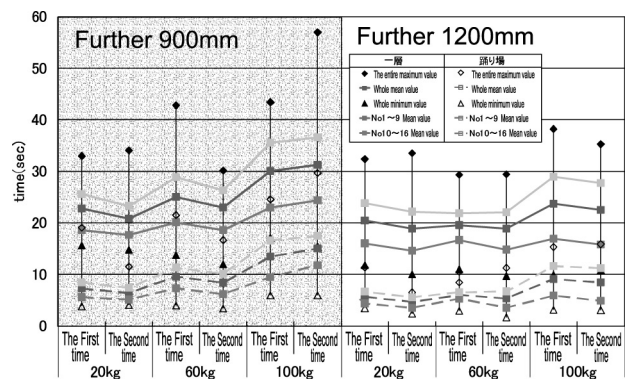


Figure 2 One weight change experiment layer and descent time in landing

(2) Tracks

Figure 3 shows tracks in the landing obtained by Motion capture. It can be said that it will become shape with a distorted tracks as weight becomes heavy as a tendency. However, the influence hardly appears in width 1200m and 60kg is seen both of the 900mm and 1200mm where an almost similar tracks are drawn with 20~100kg of the tendency to draw steady tracks.

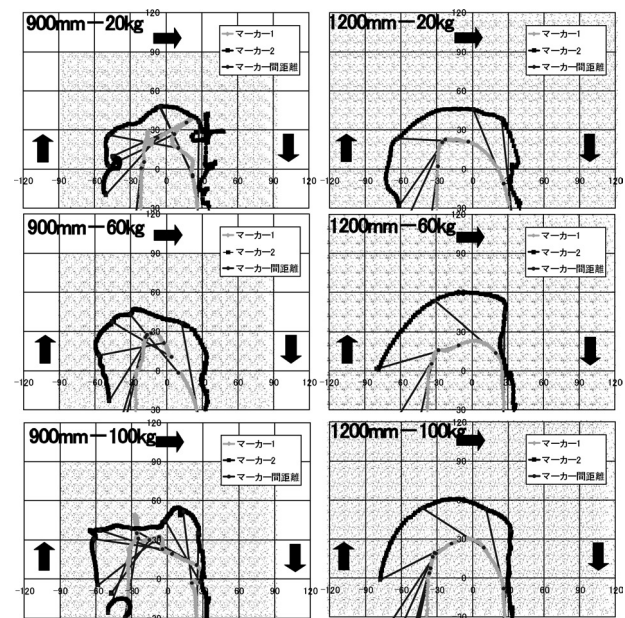


Figure 3 Tracks in landing part

Figure 4 shows the angle that the evacuation-Chair and the floor for requested from Motion capture. It was not seen, and when entering the landing, the angle somewhat grew again to push the wheelchair out when the angle was small, the angle grew for turnabout, and it went out of the landing to the stairs part, and it became a transition of the graph of the decrease in any weight clear the difference of the angle by the change in weight.

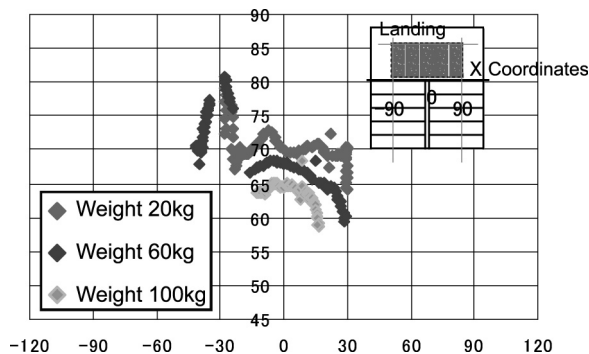


Figure 4 Angle that wheelchair and floor for shelter do

(3) Questionnaire

Figure 5 shows the result of the questionnaire to the subjects who did after it experiments.

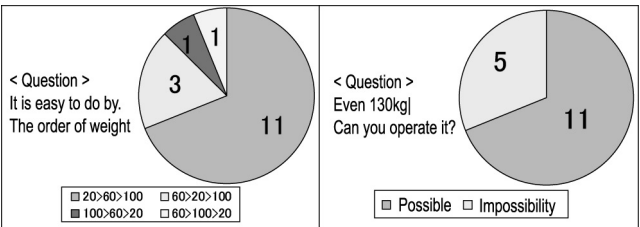


Figure 5 Result of the questionnaire

3. DESCENT IN THE STAIRS EXPERIMENT THAT USES GENERAL WHEELCHAIR

3.1 Experiment purpose

There is no fire escape equipment like the wheelchair for shelter, and the case that breaks while the evacuation-Chair is taking shelter by some causes are assumed, and vertical direction shelter with a general wheelchair is examined.

3.2 Outline of experiments

(1) Test subjects

It made to one group, and it made it in people number 3 or 4 person random necessary to lift the wheelchair by five groups from among ten schoolboys in the one's twenties.

(2) Experimental location

It experimented on the stairs of this learning as well as the experiment on the evacuation-Chair (Figure 1). Width descends without the limitation continuously for three layers in the stairs.

(3) Experiment method

The timekeeper measures time from entering of the first special person who is raising the wheelchair in each point (stairs part and landing part) to the pass of the wheelchair to the experiment measurement with a stop watch and a video camera. The wheelchair used medium size of JIS (Figure 6).

The first time, we experimented on the method of lifting the wheelchair by arranging three subjects as shown in Figure 7. It was not possible to lift perfectly, and experimented from the second time by arranging four subjects as shown in Figure 8. It experimented five times. The rider made it to the man of 60kg. "Please value safety, assume evacuation, and go down stairs" was given as an instruction before it experimented.



Figure 6 Wheelchair
(JIS medium)



Figure 7 Method of helping
wheelchair



Figure 8 Experiment scenery
(four people)

3.3 Result of experiment and consideration

Figure 9 shows the descent time and the descent speed. Group 1 of the first time reached a value close to the past study. However, the group that did by the other four people has descended at an almost twice as much speed. The passing time of the landing has slowed because group 2 is taking the rest in the second landing (landing 2) after it begins to descend on the way. It is understood that help person's load is high. The average of one layer descent time of group 2~5 reached time of the evacuation-Chair for 19.3 seconds and width 1400mm, 60kg in weight and almost the same value. However, the help method of lifting the wheelchair is difficult if there are neither a lot of wide stairs nor those who help enough. Because the occupation area in the stairs compared with twice the evacuation-Chair.

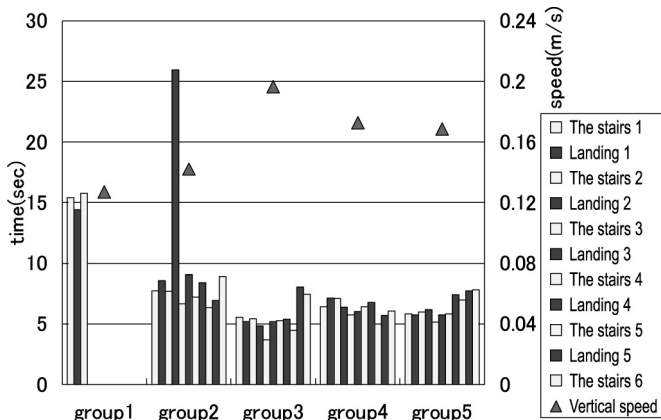


Figure 9 Wheelchair lift experiment descent time

4. SUMMARY

The influence appears more remarkably if the descent in the stairs time slows by becoming of the weight of the rider of the evacuation-Chair heavily, too and width narrows. Moreover, it has been understood to use power to accelerate by becoming of the rider heavily in the stairs part, and to suppress it. It is thought that is difficult for multilayer might take the rest on the way, and to descend though the descent time in the stairs to lift a general wheelchair reached almost the same value as the evacuation-Chair.. As for the number of helps, four people are faster than three people and help person's load is also fewer.

REFERENCES

1. Urayasu city official homepage, "<http://www.city.urayasu.chiba.jp/a006/b001/bousai/17.htm>"
2. The 18th Safety Plan Symposium, "Barrier Free Plan for Evacuation Safety"
3. Murosaki Y. et al., A Study on Hospital Evacuation Planning: No. 2 Quantitative Analysis of Patient Evacuation Behavioral Ability, Summaries of technical papers of Annual Meeting Architectural Institute of Japan. A-2, Fire safety, off-shore engineering and architecture, information systems technology, pp.289-290, 1986 (in Japanese)
4. Morita T., Results of the fire drill at nighttime in a home for the aged, Journal of Japan Association for Fire Science and Engineering, vol.38, No3, pp.16-22, 1988