



STUDY OF ESCAPE CHUTE SYSTEM

Dhananjay S. Khuje¹, Govil A. Nagdive², Amit P. Halwele³, M. A. Jirapure⁴

¹U.G. Student, Civil Engineering, J.D.I.E.T, Yavatmal, Maharashtra, India, ahalwele@gmail.com

²U.G. Student, Civil Engineering, J.D.I.E.T, Yavatmal, Maharashtra, India, dhananjayskhuje@gmail.com

³U.G. Student, Civil Engineering, J.D.I.E.T, Yavatmal, Maharashtra, India, govilnagdive100@gmail.com

⁴Assistant Professor, Civil Engineering, J.D.I.E.T, Yavatmal, Maharashtra, India, mjlenviron@gmail.com

Abstract

This paper is on the study of escape chute system. In this paper we describe the construction, working, types, advantages, environmental impact, application of chute assembly. The motto of this paper is rapid evacuation of people from high rise building and many other structures like automobile etc at the time of emergency using these chute escape systems around 400 lives' can be saved within 15-20 minutes. for the convenience and safety of people this system is specially made device offers a fire-proof, high temperature-proof and multi entrance passage for collective escapes at the same time. Nowadays the chute devices for escaping in high rise building become important for collective escape, which is easy to use and runs at high speed without extra power. This paper presents the developments in the area of the high-rise building emergency evacuation solutions. Discussed about the need of such devices. The assembly of escape chute and disadvantages are discussed. And also, the main application. verti-scape escape chute system is briefly described. This equipment can release escape chute and bring evacuee more safety and escape efficiency. This paper shows why this system is more convenient for the evacuation. This paper highlights all the points why people can rely on this system for safety and which will give them more mental support and peace of mind. Through this paper we have tried to inform all the people about the biggest factor which we have to concern during construction is 'Safety'. This paper focuses on how one individual can use this system at the time of emergencies.

Keywords: Verti-Scape Escape, Single-Entry Escape System, Multi-Entry Escape System.

1. INTRODUCTION:

Escape Chute Systems design and manufacture Mass and Rapid Emergency Evacuation Systems for: -

1. Government Buildings
2. Petro's Chemical Plants
3. Personal Safety
4. Schools
5. Aged Care Homes
6. Fire Rescue Departments
7. Rescue Organizations
8. High Rise Buildings
9. Embassies
10. Mining Equipment
11. Air & Seaway Traffic Control Towers
12. Banks
13. General Industry Cranes, Repair Towers etc
14. Hospitals

And any other structure where a human being can be trapped with no alternative means of emergency evacuation.

Escape Chutes can be used from most high areas, where there is a possibility of being trapped by fire, terrorism, criminal attack, or industrial accident, that could result in

the loss of life or serious injury due to no alternative means of emergency egress being available.

Escape Chute System believe that the standard means of emergency egress (the internal stairway) should always be the used to egress the building in an emergency, however if that means of egress is impassable what then? Initially developed in the Sixties and Early Seventies by Gerard Zephaniah (Vertical Escape Chute) and The Eyed Escape Chutes of Japan (Spiral and Inclined Escape Chute), Escape Chutes today are becoming an accepted alternative means of emergency evacuation from high rise buildings and industrial plant.

Escape Chutes are now available in various formats, that allow evacuees to descend vertically down as in our "Verti-Scape" Escape Chute, or you can slide down at an incline as in our "Slide-Scape" both are a proven methods of emergency evacuation.

There are other formats of Escape Chutes on the market, which include an inclined nylon netting type, an inclined chute with spring reinforcement, and there are chutes that are vertical, where the user travels down in an internal spiral, and as a result of public knowledge knowing that the consequences of not having an

alternative method of emergency egress, there are more concepts and designs of systems being placed on the open market.

All escape chutes are an effective alternative method of evacuating a high location when all other means of emergency egress are blocked, the alternative to this alternative does not bare thinking about, just one Escape Chute can evacuate at the rate of 25 people per minute, or have 360 persons at ground level in 15 minutes, irrespective to the height.

1. VERTI-SCAPE ESCAPE CHUTE

"Verti-Scape", The Vertical Escape Chute is a device which aids in the mass and rapid evacuation of people from high structures, where one chute is capable of evacuating some 375 evacuees from a high-rise building in 15 to 20 minutes.

Where possible Escape Chute Systems recommend the use standard stairwells, and offer the escape chute as an alternative means of emergency egress, however should the stairwell be blocked, or full of smoke, then a fast and efficient alternative means of emergency evacuation are Escape Chutes.

The escape chute can be used by people with disabilities and after a little training blind people are more than capable of using the chute, it is also possible for a person to enter the chute, and then have an injured second person placed upon their shoulders, to assist the second person to evacuate.

The Escape Chute can be installed onto most structures, and only requires a clear drop from the evacuation point to ground level.

The Vertical Escape Chute when deployed runs parallel with the side of the structure from which it was deployed, and can used immediately after deployment.

As you travel through the escape chute you can look up, and down, no smoke can enter the chute.

To exit; your feet will touch the ground, you then crouch and extract your body from the chute and walk away.

2. CONSTRUCTION

Is manufactured from three completely separate and distinctly different fabric tubes/chutes. Each tube/chute has its own function to perform, and it is only when these three tubes/chutes are assembled together do they then become an Escape Chute.

The Outer layer of electro-fibreglass of the escape chute (Dark Grey) is there to protect the users from flame and radiated heat, it can withstand a constant temperature of between 550 & 600° C, and melts at around 810° C. Note. the gap between the outer layer and the middle/braking layer, this allows air to circulate between the two tubes, thus preventing heat transfer.

The Middle/Braking layer (Light Grey) is the layer that makes the system work, it is an elasticated tube which is approximately 300mm in diameter in its rested form, but

has the capability to expand to 600mm as the evacuee travels through, as the evacuee applies outward pressure from within the chute, the evacuee slow down, as they release pressure they speed up, the evacuee has full control of the speed at which they descend.

The inner/support chute (Beige) gives the system it's strength to hold the weight of the all chute users within the chute at any one time, this layer has loops stitched into the top, into which we insert a stainless steel rolled pipe.

The pipe is then held in place by the deployment device, or into a recess set into the floor in the case of a multi-entry system. the friction layer interlayer Para Aramid, warp and vet Vinyl chloride fibres.



Fig-1: layer of escape chute system

3. HOW A VERTICAL ESCAPE CHUTE WORKS?

To use the escape chute, the user sits on the edge at the entry point, with their feet and lower legs in the chute, at this point you will feel the escape chute grip your lower, legs, expand your legs against the chute, and you will feel considerable resistance.

While supporting your body weight with your hands, lower yourself into the chute, keeping your legs fully extended against the inside wall of the chute. Once your shoulders are into the chute, push your hands and arms against the wall of the chute, this action and the bending of your legs at the hips will bring you to a stop.

By relaxing the pressure against the wall, you will then descend.

Relax Pressure = SPEED UP
Increase Pressure = SLOW DOWN

By applying enough pressure, you can come to a complete stop, and just sit there! The evacuee has full control of the speed at which they descend.

4. SINGLE-ENTRY ESCAPE CHUTE

The Single-Entry Chute is a system that has been designed for Individual Offices, Homes or Building which do not have a vacant duct or shaft. The Single-Entry Chute can be installed on any convenient Window, Gallery or Terrace. This is also an ideal solution for providing an Evacuation System for Existing Buildings where a duct is not available and an Evacuation system is found to be necessary. The Chute could be installed quite easily on the existing Refuge Floors to provide an Evacuation Path in case of an escalation of the Emergency Situation or for the Evacuation of an Injured, Elderly, Physically Handicapped or Unconscious person.

AA Single-Entry Escape Chute means that there is only one entry point and one exit point, whereas a Multi-Entry Escape Chute can be entered at various floor levels, but still has only one exit point. Single Entry Systems are generally installed onto the roofs or through walls, windows and off balconies of buildings, and are deployed on the outside of the building.

Generally, escape chutes deployed outside of the building have a height limit of around 120 meters or 50 floors.



Fig-2: single-entry escape chute

5. MULTI- ENTRY ESCAPE CHUTE

Multi Entry Chutes are designed specifically for Medium to High Rise Buildings for immediate and quick access to the Chute in case of any emergencies. The Evacuees Can Enter the Mutli-Entry Chute from every floor of the building and reach the ground safely and quickly. However, a separate Duct or Shaft is required for the Multi-Entry Chute. The Shaft Size for a building up to 10 Floors is 4ft x 4 ft. For taller buildings, however the shaft size required is 4ft x 8ft. Hence it is usually necessary to plan the duct at the time of designing the building. It is difficult to install a Multi-Entry Chute in an existing building unless there is a vacant Duct or Shaft available in the building. When installing a multi-entry escape chute, a hole is cut in the floor, this then allows a steel plate to affixed over that hole.

The Steel place is manufactured so that the escape chute is inserted through it, up to the point where the chute reating ring because of its large diameter cannot fit through the chute plate hole.

The length of the chute is equal that of the floor height (Concrete Floor to Concrete Floor) plus an extra amount which enables the chute user to access the start of the chute on the floor below.

The vast majority of Vertical Escape Chute applications to date are described as a "Single Entry" system, this is where you have just one escape chute, that has only one entry point.

But in the case of a Multi-Entry Systems, instead of the chute going from the roof to ground level as a one-piece chute, we have chute equal to the height of each floor, where we insert a chute into the floor, this then sends the evacuee through to the floor below, and directly into the chute starting from the floor below, this is then repeated on all floors until ground level, or the designated exit point.

Entry into the chute, which has a chute feeding into it from the floor above, is just a matter of gripping the upper chute and entering the chute beside the one coming from above.

It's a similar case to a vehicle wishing to join the main stream traffic from a side road, the lower evacuees wishing to enter the system have to wait until there is a suitable gap between evacuees descending from the floors above.

Escape Chute Systems recommends the use of "Fire Marshals" one for each floor and One Chief Marshal, directing the whole evacuation.

Multi-Entry chutes can be installed, both inside and outside of the building, see METS page; Multi-Entry-Tube-System.

Requiring a floor space of 1 X 2 Meters (39" X 78"), and the same clear space on each floor directly below.

There are no mechanical devices used to deploy chutes, they are permanently in the deployed position, it is just a case of opening the emergency chute door, taking two of three steps forward, crouching down and placing you lower legs into the chute, then push your body forward to enter the chute system.

Multi-Entry systems have no limit as to the height they can go, as each chute will only be equal to the height of each floor, somewhere between 3.5 and 4.5 meters 11'6" and 14'8", so they can be installed on each floor level for the total height of the building.

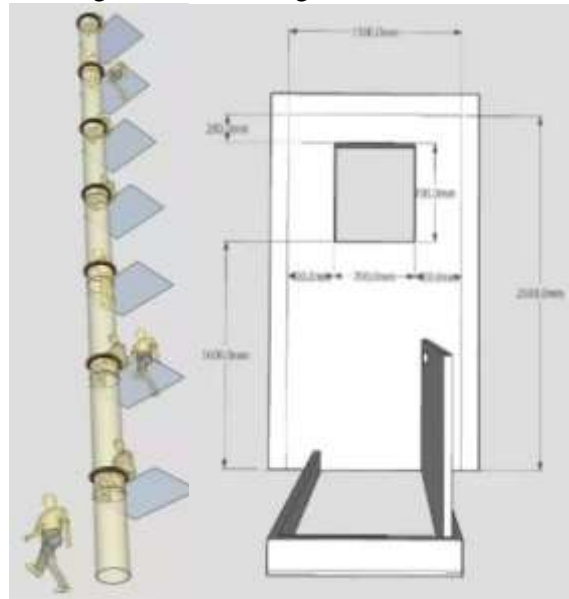


Fig-3: multi-entry escape chute

6. ADVANTAGES

1. Saves lives!
2. Protects property by facilitating a speedy response to emergencies
3. Ensures peace of mind for tenants, employers, owners and building management
4. Provides effective and guaranteed means of escape for hospital bedridden patients or people with

mobility problems, from any floor of a hospital, regardless of their mobility impairment.

7. DISADVANTAGES

1. Expensive system
2. Cannot be directly used by children less than 10 yr. old.
3. Difficult to install multi entry escape chute in existing structure.
4. Increases the economy of the construction

8. APPLICATION OF ESCAPE CHUTE

1. Escape Chute for balconies and window
2. Fire department
3. Floor mounted escape chutes
4. Low height commercial building escape chute
5. Hospital and aged care emergency evacuation from high locations
6. School class room evacuation system
7. Mining shovel and excavator escape chutes
8. Mining truck escape chutes
9. Mining loader escape chutes
10. Mobile mining equipment escape chutes
11. Multi-entry escape chute(internal)
12. Multi-entry escape chute(external)

9. CONCLUSION

This paper outlined the study on escape chute system and their uses. Discussed about eco-friendly product and safety of life. Heretofore, the only significant means of evacuation from high-rise buildings and for access of rescue forces to higher floors have been the stairwells. Recent events, such as the Sept. 11 World Trade Centre disaster and others, indicate that this is problematic and insufficient. Furthermore, it is clear that significantly improving the internal means of egress, especially in existing construction, can be prohibitively expensive and downright infeasible.

Systems for external evacuation from high-rise buildings provide verti-escape chute system and additional evacuation capacity. Escape chute systems support emergency forces in delivering personnel and equipment to upper floors of a building — an advantage that can reduce significantly the time required to access and subdue an event (such as fire) in the building and to help evacuees in stress and distress.

Systems for external evacuation challenge inventors and manufacturers, standards organizations, authorities having jurisdiction, research institutions, rescue forces, and building owners and occupants. The challenge is to devise and design the most creative and effective solutions and methods, and to ensure their effectiveness and reasonable safety through world-class standards so that these systems can provide the requisite additional, or alternate means of evacuation for occupants of high-rise buildings around the world.

ACKNOWLEDGEMENT

Thanks are due to the civil engineering department of Jawaharlal Darda college of engineering and technology. The authors are very grateful to civil engineering department. I express my warm thanks to friendly advice during the project work. We would like to thank all our friends/seniors for their comments on the earlier version of the manuscript although all the error is our own and should not tarnished the reputation of the above person's.

REFERENCES

- [1]. Wikipedia: Web site on Escape chute system
- [2]. www.risksafetysystems.com
- [3]. www.astm.org/SNEWS/MARCH_2005/shimshoni_mar05.html.