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Use of Magnetic Lifts in Fire Safety

Aman Singhal

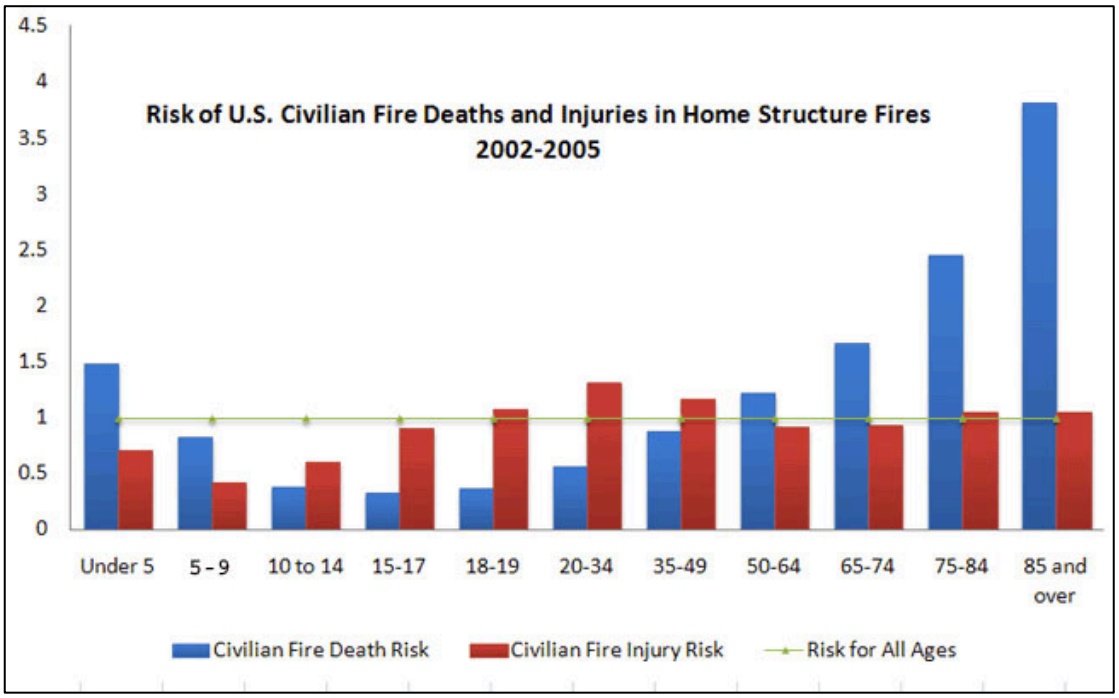
Abstract: *The deaths caused due to major fires in high rises is quite surprising. Most of the people die due to suffocation as they are unable to leave the building on time.*
The existing fire safety equipments try to put out fire by placing fire sensors and water hoses on each floor of the building. This method proves to be ineffective quite often as the most common cause of fire is electrical short-circuiting, which cannot be put out by water easily. It does not solve the purpose it was designed for. A more effective and sensible way of dealing with fire is to first try to get the people out of the building while the sprinklers put out the fire.

I. Problem:

During major fires in high rises, people lose their lives due to improper methods and procedures. About 70% of the lives could have been saved if more efficient methods of rescue were implemented.

II. Purpose:

With the construction of new high-rises, the risk of fire accidents also increases. Most of the time, people have lost their lives due to inefficient fire safety equipments which could have saved more lives. The aim is to install a lift on the top floors of the building (ensuring that none of them is above the other) which will help in saving lives of people during a major fire. The lift will be "dropped" and will fall down under the influence of gravity and at several intervals a magnetic field will retard the motion of the lift thereby ensuring that the g-force is within suitable limits. When the lift is about to reach the ground, a strong magnetic field is used to gently stop the lift. The method will reduce time to reach the ground safely by at least 75%. Thus the probability of saving lives also increases by 75%.



No. of floors of building	Floors to install lift	Approximate lives lost(earlier)	Approximate lives lost(if the lift is installed)
20	15,16,17,18,19,20	5	0
30	24,25,26,27,28,29, 30	7	1
40	33,34,35,36,37,38, 39,40	12	2
50	42,43,44,45,46,47, 48,49,50	20	4

DERIVATION:
Let us consider a lift which has a mass m' at a height of 200m above mean sea level. Let the mass of people in the on the lift be M. The acceleration due to gravity is g.

At 200m:

Potential energy = (m'+M)*g*200 joule

At H(above ground):
u = 0
Let time taken to reach a height H be t.
(200-H) = ½*g*t*t.
from the above equation we get t.

now we find the kinetic energy at that height:
from : **v = u + g*t**
v = 0+g*t.
Therefore, v = g*t.
Kinetic energy = ½*(m'+M)*v*v.

The force due to the magnetic field must be equal to the kinetic energy to stop the lift safely.
The length of the magnetic field is 'H'.
Let the Magnetic field strength be 'B'.

Force = B*H*v.

The magnetic field will be created by a current of magnitude 'I' having 'N' turns . The wire will be wound in the form of a huge solenoid.

B = u*N*I/H.

(u = 4*22/7*10^-7 .It is called the permittivity of free space)
The force must be directed vertically upwards to create retardation in the motion of the lift.

Overview of the mechanism :

A lift is placed 200m(assumed) above the ground. The lift will be made of 'ferro-magnetic' substance (preferentially Iron). The lift will be in an enclosed bracket which will run to the ground. At a particular height (say H) we install a wire which will carry a current I and will have N turns. This portion will be close to the perimeter of the bracket so as to not obstruct the lift. It will behave as a huge solenoid. When the lift is released it falls under gravity but there will be opposing magnetic fields at various positions to prevent the g-force to exceed the permissible limit. When the lift enters the solenoid the strong magnetic field will oppose the motion of the lift and the lift will come to a steady stop. This would significantly reduce the time taken during evacuation.

Systems currently used :

Systems use water hoses which malfunction frequently and are ineffective in putting out the fire. The primary step to deal with a fire is to simultaneously putout the fire and at the same time rescue people. Emergency fire exits in buildings (especially in high rises) are ineffective as it takes a lot of time for people to evacuate. There is no such way for a person to exit the building. Thus it is necessary to divert our attention towards rescuing people rather than only putting out the flames.

Benefits of this system :

The mechanism involves equipments which are very cheap and compact. It does not take up the amount of floor room fire exit staircases take. The mechanism is very simple and easy to install. It is also probably the most effective way to counter fire.

Requirements :

The system requires a lift made out of a ferromagnetic substance (like iron) while the external bracket which will run the entire height of the building will be made out of fiber glass . The bottom portion will be made of iron which will have current running in loops. This will act as a solenoid.
The estimated cost of the entire system is not expected to run beyond $1500.

Idea of this project :

The concept behind this project was facilitated when I saw a show where a person jumped from a certain height wearing a special suit and a strong magnet was placed directly below him. As he was about to strike the ground, the magnetic force caused his body to be suspended in mid-air.