

Imagining Hazard and Vulnerability of Rajiv Chowk Metro Station of Indian Capital City New Delhi

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Abstract

Hazards are omnipresent and development necessities of modern times demand an inclusive proactive safeguard of every individual as well as systems. Rajiv Chowk Metro Station is one of the busiest metro stations in Delhi as well in India. A comprehensive analysis of hazards and vulnerability of this metro station was carried out revealing its proneness to hazards like earthquake, stampede, bomb blast and fire due to ever increasing population pressure and its location in seismic zone IV. The people who are vulnerable and are having the potential to be affected by any sort of hazards are the daily users, visitors, tourists, metro staff and security personnel etc, The vulnerability is multiplied on account of commuter composition which includes elderly, children, medically disabled and women etc. which has higher susceptibility and low resilience to deal with incidents of stampede, fire etc. The analysis reveals that awareness and preparedness of metro station staff and daily commuters is at border line to tackle fire disaster. However, constant efforts in the form of mock drills are made by Central Industrial Security Force and Delhi Metro Railways Corporation to increase awareness and resilience among general public. The staff is well trained in first aid; however separate demarcated space for victims or patients is missing.

1.1 Introduction

Disaster is a single event or series of episodes giving rise to fatalities and damage or loss of property, infrastructure, essential services, means of livelihood and the environment on a scale beyond normal capacity of affected community to cope with. India is one of the vulnerable countries leading to varying degree of multiple disasters. As per Disaster Management Act 2005, “disaster” means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected

area. More than 58.6% of country’s total landmass is susceptible to earthquakes of moderate to high intensity; over 40million hectares (12%) land is prone to floods; nearly 5700 kms of 7516 kms long coastline is prone to cyclones and tsunamis; 68% of cultivated area is vulnerable to droughts; and its mountainous regions are at risk of landslide and avalanche. In addition, India is Vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and other human made disasters (NDMA).

Traditionally, disaster management was perceived in terms of emergency relief and post disaster rehabilitation process; however, this was discarded and new management focused on ensuring prevention and preparedness in anticipation to reduce the impacts of disastrous events. A

successful disaster management planning encompasses processes that operates before, during and after disasters; each aiming at reducing the risk and vulnerability. Disaster management means a continuous and integrated process of planning, organizing, coordinating and implementing measures necessary or expedient for (i) prevention of danger or threat of any disaster; (ii) mitigation or reduction of risk of any disaster or its severity or consequences; (iii) capacity-building; (iv) preparedness to deal with any disaster; (v) prompt response to any threatening disaster situation or disaster; (vi) assessing the severity or magnitude of effects of any disaster; (vii) evacuation, rescue and relief; (viii) rehabilitation and reconstruction. Disaster management works circular form know as disaster management cycle comprising of Mitigation, Preparedness Response and Recovery as shown in diagram below Mitigation, Preparedness Response and Recovery as shown in diagram below

Figure 1 DM Cycle



Mitigation- Minimizing the effects of disaster.

Examples: building codes and zoning; vulnerability analyses; public education.

Preparedness- Planning how to respond. Examples: preparedness plans; emergency exercises/training; warning systems.

Response- Efforts to minimize the hazards created by a disaster. Examples: search and rescue; emergency relief.

Recovery- Returning the community to normal.

Examples: temporary housing; grants; medical care.

A new challenge that has drawn attention of disaster managers is the crowd management. Larger urban centers and metropolitan cities are crowded with human population and are facing serious challenge in handling massive influx of commuters travelling via public transports. The seplaces are highly prone to disasters, especially incidents of fire, stampede, terrorist attacks etc. The National Capital of Delhi has come up with the effective solution to the problem of massive public commuting and traffic developed at very efficient metro system. Rajiv Chowk metro station being a junction connecting multiple routes is amongst the most crowded center located in Connaught place area of New Delhi. This paper deals with the idea of hazard, vulnerabilities and risk potential of the Rajiv Chowk metro station with an attempt to throw light on disaster preparedness of the mentioned metro station.

1.2 Background to Delhi Metro and Rajiv Chowk Metro Station

Delhi, the National Capital of India is Union Territory (NCT) that bordered the state of Haryana on three sides and by Uttar Pradesh to its east; it covers an area of 1,484 Km². One of the most populous parts of India, the NCT has a population of 1.9 million. Moreover, Delhi's urban area extend beyond the NCT boundary and having a continuum in the neighboring cities of Faridabad, Gurgaon, Noida and Ghaziabad, collectively known as the National Capital Region (NCR) with an estimated population of over 26 million people, making it the world's second largest urban area according to the United Nations. The huge population within Delhi and large flux of people commuting daily to Delhi and resultant problem of traffic and overcrowding found its solution partly in Delhi Metro project executed by a State owned company the Delhi Metro Rail Corporation Limited (DMRC) with equal equity participation from the Government of India and the Government of Delhi. This project is

world's 11th longest metro system in length and 16th largest in ridership. There are multiple junction points in the systems of which Rajiv Chowk is prominent one. This metro station is a transfer station between blue line on the upper level and yellow line on lower level. It is one of the busiest stations on the network; over 5 lakh passengers ravel through this each day. Moreover, there are corporate buildings and famous shopping centers are in close vicinity of this station which especially during festive season is flooded with people. This scenario attracts hazards and enhances vulnerability of people and infrastructure thereby warranting a comprehensive assessment of safety planning.

1.3 Methodology of the Research

Primary and secondary data were collected for assessment of vulnerability of the metro station. Primary data is collected by surveying CISF people, metro officials, daily passengers, street hawkers and shop

1.4 Hazard and Vulnerability Analysis

1.4.1 Hazard proneness:

Hazard is a potential danger produce either by natural forces or by human induced threat. Rajiv Chowk Metro Station may face following hazards on account of natural and human induced disasters. This Metro station is totally covered by Connaught Place market and Palika Bazar which make metro station vulnerable to terriost attack and bomb blast.

Hazard	Vulnerable Area	Vulnerable Population
Earthquake	Metro station and nearby areas	<ul style="list-style-type: none"> All passengers and employees
Fire	Places near eatery shops	<ul style="list-style-type: none"> People in shops, passages and open area near exit gates
Stampede	Waiting areas; station staircase	<ul style="list-style-type: none"> Large number of passengers
Chemical Emergency	Compactness of station enhance its hazardousness to deliberate chemical emergency	<ul style="list-style-type: none"> All the people present in the metro stations
Bomb Blast	The entrance of all gates and passage towards checking spot.	<ul style="list-style-type: none"> People present in passage
Storms	One side metro tunnel is open for metro arrival and departure that make vulnerable.	<ul style="list-style-type: none"> All passengers and commuters waiting inside the station
Flood	Flood is not a possibility but situated in low lying area may lead to inundation and blockade of drainage system	<ul style="list-style-type: none"> Commuters, Metro staff and CISF staff.
Terrorist Attack	Metro premises especially the entry points are at high risk.	<ul style="list-style-type: none"> People present at metro station.
Nuclear Disaster	The entire premises and surrounding areas are vulnerability	<ul style="list-style-type: none"> People inside and outside the station are equally vulnerable
Heat Waves	Entrance of the tunnel towards Station is vulnerable	<ul style="list-style-type: none"> Vulnerability to commuters is very less
Falling from	Area where ladder and escalator	<ul style="list-style-type: none"> All passengers and employees

owners. Secondary data is collected from available literature in form of books, research articles, newspapers etc.

These survey groups are identified because of following reasons:-

1. Metro Officials: All the metro operation is been governed by metro officials. Safety of passengers and metro staff is the main and primary responsibility of metro station officials.
2. CISF: Station safety is the jurisdiction of CISF force being a national force for security checking. CISF provides security to over 356 industrial units, government infrastructure projects and facilities and establishments located all over India.
3. Passengers: Passengers are part of survey because passengers face the real problems. They are also first responders, daily commuters easily identified the miscreants.

Ladders and escalator		
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1.4.2 Vulnerability Analysis

Vulnerability Level					
Disaster →	Earthquake	Fire	Bomb-blast	Stampede	Chemical hazards
Probability of Occurrence	H	H	H	H	L
Severity	H	H	H	H	L
H-High, L- Low					

As per data, it seems eatery shops are more vulnerable to fire because there are maximum chances of fire breakdown, reason being congested working area and gas cylinder used for cooking. Table 2 shows probability of hazard whereas severity shows level of impact the station has to bear on its occurrence. Earthquake has a high probability of occurrence in Rajiv Chowk Metro Station because it falls in zone IV of earthquake, also underground tunnels makes it more sensitive towards earthquake and its occurrence will have high impact on loss of human life, infrastructure, property etc. Rajiv Chowk Metro Station is also vulnerable to bomb blast due to presence of Café Coffee Day shops.

1.4.3 Vulnerability of Metro Station for Different Disasters

Stampede is possible in situations when there is sudden increase in density of the population at a place at same time. People travelling from different location at Rajiv Chowk Metro Station are accumulated in same area, any kind of false alarm or loud voice can lead to huge stampede. Other factor can be the high quality mirrors at barricading point; in case of stampede, they can worsen the situation.

Any gas leakage can be havoc for this station, it may also lead to stampede. All these factors can give terrorist or other miscreants opportunity to create mess, presence of underground tunnels increases vulnerability.

Being the busiest station, and also its presence in heart of city makes it vulnerable to bomb blast. Gaps in security checking point and passage of any person with

explosives material can threaten the station safety. Other possibility to target the metro station is its location and nearby commercial market around station which is always crowded.

An epidemic is the rapid spread of infectious disease to large number of people in a given population within short period, in a week or so. The conditions which governs the outbreak of epidemics include infected food supplies, contaminated drinking water and the migration of populations of certain animals, like rats or mosquitoes, which can act as disease vector. For e.g. Malaria, Dengue, Chikungunya, etc. whooping cough occurs in spring, whereas Measles produces two epidemics one in winter and other in beginning of summer. Influenza, the common cold, and other infections of the upper respiratory tract, such as sore throat, occur predominantly in winter.

Fire is having the potential to be the most vulnerable and the deadliest disaster in crowded places with high density of population. This station is most crowded during office hours, availability of eatery shops make it more vulnerable to fire disaster due to use of gas cylinders and induction plates. Any accidental spark in metro rail panels can also lead to fire. Insufficient fire extinguishers and sand buckets, sand bags can also be responsible for slow mitigation of a disaster.

1.5 Preparedness and Capacity Analysis

Preparedness refers to measures taken to prepare for and to reduce the effects of the disaster. To predict the possibility, e, to prevent disasters and mitigate their impacts on vulnerable populations and respond to

and effectively cope with their consequences. Disaster preparedness provide a platform to design effective, realistic and coordinated planning.

Disaster preparedness is continuous and integrated process, which can reduce the impact of disasters because of its proactive approach. It requires contribution in many different areas- ranging from training, logistic, to health care recovery, livelihood to institutional development. Preparedness involves lot of planning like the formulation of viable emergency plans, the development of warning systems, maintenance of inventories, public awareness and most importantly education and training of staff personnel in prevention as well as handling of emergency situations. It encompasses search and rescue measures as well as evacuation plans. All preparedness planning needs to be supported by appropriate rule and regulations, with clear allocations of responsibilities and budgetary provisions.

Station in terms of security has a good source of man power (CISF) teams and there are lots of CCTVs installed at different places. CISF is always proactive to tackle any security issues at metro station and not only at Rajiv chowk but, at all the metro stations. CCTVs camera are being actively working in or outside the metro premises to observe the activities of each and every one coming or exit from metro station. Regardless having the better alarming system in Delhi metro it has been observed that in few cases information transfer got delayed. For example, in year 2016, on occurrence of earthquake, train drivers were informed 4 to 5 minutes late as a consequence trains crossed two stations.

1.6 Infrastructure Preparedness Capacity:

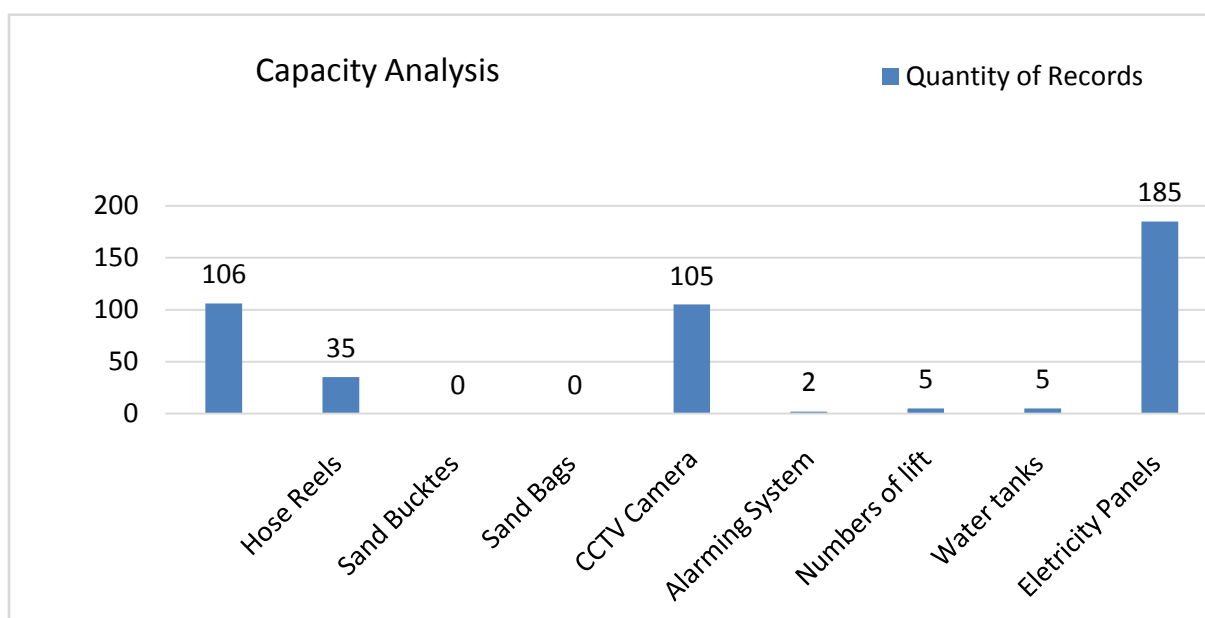
“Preparedness” means the state of readiness to deal with a threatening disaster situation or disaster. Preparedness is based on a sound analysis of disaster risks and good linkages with early warning systems, and

includes such activities as contingency planning, the stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation, and public information, and associated training and field exercises. In case of any disaster event at Rajiv Chowk Metro Station the capacity needed to respond to such an incident as per the capacity analysis is reasonable. A rapid and effective response is expected on the basis of findings as highlighted in the graph and table below. The resources/equipment are adequate to prepare for, mitigate, and respond to such a situation. Metro Station is fully prepared to face any kind of disaster said by the metro officials. They have a different mechanism to control the crowd at metro station, they block all the route towards the yellow line because yellow line has only platform space. Space available near to the blue line platform may be utilized for mock drills and display of precautionary video related to hazards, which may help daily passengers to enhances their capacities.

Table 1 Capacities of Rajiv Chowk Metro Station:

Preventive Tolls	Quantity in Records
Fire Extinguishers	106
Hose Reels	35
Sand buckets	00
Sand Bags	00
CCTV Camera	105
Alarming System	02
Number of lifts	05
Water tanks	05
Electricity Panels	185
Escalator	14

In Japan metro stop immediately after occurrence of any disaster. Similar type of technology for earthquake alarm is placed at Patel Chowk metro station of Delhi metro. Patel Chowk metro stations pass it to other stations, it takes much time.



Metro premises has adequate resources in terms of preventative tolls but in terms of human capacities only Central Industrial Security Force (CISF) staff is well trained to face any catastrophe. There is high need of trained the metro official and daily passengers.

1.7 Capacity analysis for different disasters:

This station is maintaining good resources to tackle any emergency and well prepared to face any minor or major disaster in metro station premises. CISF is very actively working in security checking and commanding on the CCTV surveillances. Metro station have different capacities listed below to tackle disasters.

a) Capacity for Earthquake

- Earthquake sensor to predict the intensity and magnitude of the earthquake.
- Loud hailers to generate warning.
- CFA staff which help the people in panic.
- Local announcements.
- Group mode information transfer.

b) Capacity for fire

- Fire alarm control panel
- Smoke detector
- Fire extinguishers of different types
- Hose heels
- Sprinkler system
- Under frame sprinkler system
- Emergency exits
- Fire Hydrants

c) Capacity for Terrorist Attack and Bomb Blast

- 106 CCTV camera
- CISF (89 personal per day)
- Metal detectors
- Checking points

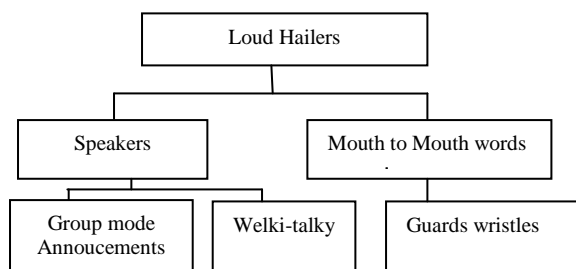
d) Capacity for Stampede

- Emergency gates
- Loud hailers
- Big ropes
- CISF staff
- Automatic entry permission without use of card at AFS gate

1.8 First Aid

First Aid facility is also available to at the station. The station staff also arrange ambulance if it is required.

1.9 Alerting measures at metro station



Loud hailers are used at the time of any disaster at metro station, while there is unmaintained crowd gathered at metro station premises then officials announced the announcement on loud hailers. Using Radio System, the information about earthquake is passed to all the operators as well as to the station controller in the group mode. The metro officials including trains operators and the staff get information immediately and train take automatic brakes, whole the scenario take only 5-10 seconds. Delhi Metro maintained and installed earthquake sensors at different place according to the zonation of the earthquake. Smoke dedicator are well maintained by the Rajiv Chowk Metro station in case of any smoke, dedicator immediately start working and generate warnings.

1.10 Summary

This metro station is one of the busiest metro station of Delhi metro network. A detailed analysis of hazards and vulnerabilities assessment of Rajiv Chowk Metro Station was conducted. The following points were observed.

Hazard Assessment- The metro station is prone to Earthquake, Stampede, Fire, and Bomb Blast. There are other hazards which may affect the metro station like nuclear explosion, chemical disaster and heat waves etc.

Vulnerability Analysis – In case any disaster everyone present in the station is vulnerable. However, elderly people, women and children are more vulnerable.

References

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1.11 Recommendations

1. **Increase passage security:** There is a massive gap between checking point of CISF and main entrance of the Rajiv Chowk Metro Station. A possibility of terrorist attack or a bomb blast in this identified gap can result in loss of life and injuries to many.
2. **Increase in number of the CCTV Camera:** There is need to increase the CCTV Surveillance in the passage by which commuter travel after crossing the AFS gate.
3. **Advanced First Aid Facility:** Though the first aid facility is available at the station but it is suggested that advanced First Aid facility with trained paramedical staff may be created which may save the lives in case of any disaster.
4. **Evacuation Map:** Evacuation Routes must be mentioned at different places in bilingual.
5. **Safety Video:** For creation of safety awareness among the masses safety video may be displayed at different points.
6. **Biological Disasters:** Awareness banners/ posters may be displayed for prevention of communicable disease.
7. **Deputation of more Customer Facilitation Agent (CFAs):** The space at yellow line platform is limited, to avoid any stampede like situation more CFAs may be deputed.
8. Coordination with District Administration and outer agencies need to be strengthen.
9. Regular mock drill may be conducted to enhance the skill of officials for tackle any catastrophe.
10. Emergency number may be displayed at various places in metro station premises.
11. Information sharing system between station official and drivers may be established in any case of medical emergency in the train.

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