Underground Railway Risk Assessment for Safety Analysis and Planning Strategies: A Case of Pune Metro

Punam D Bhadhane[1], Prof. Priti P Patil[2]
[1]*Master Student, S.S.V.P. S's. B.S.D. College of Engineering Dhule, M.S., India*
[2]*Assistant Professor, Dept of Civil Engg, S.S.V.P. S's. B.S.D. College of Engineering Dhule, M.S., India*

***Abstract*— Underground Railroad plays a vital role in urban transport, that helps to attenuate traffic problems. due to the additional accidents of Underground Railroad, the analysis of Underground Railroad safety plays the necessary role for the urban public safety analysis. This paper reveals the security state of affairs of Pune underground Line one from the rider safety, instrumentality and surroundings, and management factors, through a series of form surveys. With the results, the security issues and therefore the designing ways are used more for Pune underground Line one. The analysis includes a reference worth for Underground Railroad designing and construction and plays a serious role for up urban public safety. - In housing industry largest range of injuries compared to alternative industries. Therefore, reducing accidents and determinative risks area unit vital. one among the essential steps for construction safety management is hazard identification. And this paper help for increasing awareness about all the safety facilities operation.**

***Index Terms*— Safety Management, Underground Railway Advance safety facilities, Safety awareness, Risk assessment, Hazard identification**

I.INTRODUCTION

Public safety is necessary in achieving sustainable development .Transportation safety is an indispensable section in public safety .In recent years, the size of cities in India have been expanding rapidly with the growth of urbanization, which lead large amount of transportation requirements. Qualified with advantages of high speed, low pollution, large transportation, low energy consumption, and comfort, urban rail transit, including metro and light rail, is inconformity with the principle of sustainable development.

Hazard identification facilities and risk management is systematic approach to guard the health and minimize danger to life, property, and atmosphere. It includes the method steps to spot hazard associated with materials, operations, and conditions. Assess the chance level of the hazards and apply or recommend the doable remedies and corrective actions to cut back the chance. Rail transport systems at intervals the urban specific conditions, most safety special travel arrangements for the implementation of activities need.

This paper aims to look at the Underground Railroad safety of Pune underground line one supported a series of field visit and form surveys, as well as the rider safety, instrumentality and surroundings, and factors analysis of subway safety. and therefore, the current issues of Underground Railroad safety of underground are analyzed, and therefore the ways are argue for Underground Railroad construction and management to enhance safety.

1.1Purpose and Objectives of the Research-

1. To reveal issues of safety of Pune underground from the rider safety purpose of read, equipment and management issue.
2. To review hazard and risk management for effective dominant and observation of underground subway line Pune
3. Understand the working of TBM and how it is effective than other underground excavation method.
4. Increase the awareness about operating safety facilities
5. To provide effective management for safety operation of Underground Railroad and preventing the occurrence of accidents by victimization advance Techniques.

1.2 Scope of Investigation-

Underground Construction in Pune is featured by giant scale, high speed, long construction amount, advanced

operation and frustrating things concerning project safety. numerous accidents leading to serious social impact and large economic loss. that the investigation of Advance safety techniques and facilities use for Underground Railroad construction is crucial for improvement and Implementation of appropriate choice for safety at Pune underground Line.

II.RELATED WORK

Niraj Sharma (2013), critical problems associated with underground rail comes are mentioned, that directly or indirectly have an effect on its execution, viability (technical additionally as financial) and conjointly justification vis-à-vis alternative public transportation systems.

W N Deulkar (2015) critically reviews and analyzes the choice creating systems behind the projected Pune underground rail system and its careful project report and exposes several weaknesses in each. The careful project report suffers from several serious method and analytical errors. This analysis and skill from alternative cities suggest that cities are more and more seeking single giant, huge budget solutions to their urban transport issues while not exploring the numerous less complicated, cheaper, and more practical choices that are on the market.

Matthew Bilson (2018) provides a comprehensive approach to rail system ventilation rehabilitation considering hearth potential, ventilation performance, and overall fire-life safety risk.

Vishwas H S (2017) provides report on HIRA applied within the construction website of subway railway line project at Hyderabad. It includes the method steps to spot hazard associated with materials, operations, and conditions. Assess the risk level of the hazards and apply or recommend the doable remedies and corrective actions to cut back the chance.

G.Poovizhi (2020) provides info regarding to construct a brand new style of model for risk safety management in subway rail comes, to review the prevailing risk safety management system and to spot the risks that occur throughout construction and to make, implement, and verify the potency of the model for safety within the construction of subway rail comes.

2.1 METHODOLOGY

1. Questionnaire survey of staff about safety provision and what problem they face at site and Danger Zone.
2. Study of actual implemented advance Techniques in construction for safety purpose.
3. Case study on Advance Construction Techniques use for underground safety management
4. From the outcome, give the suitable suggestion of advance technology use for safety management for Pune Metro Line when it is under construction and after construction.

The purpose of form style is to review this issue and therefore the factors of Underground Railroad safety. supported results of connected analysis on the Underground Railroad safety, the form includes:

1. Basic info of website
2. Experience and safety awareness of interviewee.
3. Space and facilities of underground railway.
4. Management and services of workers.

The basic procedure for job safety analysis is as follows:

1. SELECTION- choose the duty to be analyses.
2. DIVIDE- Break the duty into its elements in orderly and successiveness of job steps.
3. ANALYSIS-Critically observe and examine every part of the duty to work out the chance of accident.
4. DEVELOPMENT OF management MEASURES-Develop management lives to eliminate or cut back the chance of accident.
5. IMPLEMENTATION- Formulate written and safe systems of labor and job safety directions for the duty.
6. MONITOR AND MAINTAIN-Review safe systems of labor and job safe practices at regular intervals to confirm their utilization.

III.CASE STUDY

In early 2010, Pune Municipal Corporation (PMC) approved a proposal to build a metro rail system in Pune based on a Detailed Project Report (DPR) prepared by the Delhi Metro Rail Corporation (DMRC) in 2009.

It had been in 2016 once the Union cupboard gave a plow ahead for the development of phase-I of the Pune railroad.

1. Line I- The line I of the pune metro covers a distance of 16.65 km running between pimpri Chinchwad to Swargate (9 elevated stations and 6 underground stations).Recently PCMC approved the Detailed Project Report for extention of route to nigdi (4.5km).
2. Line II- The Line II of the pune metro will run between Vanaz and Ramwadi (14.7km, 16 stations completely Elevated)
3. Line III- The Line III of pune metro constructed in 2 phases- Hinjewadi to Balewadi and Balewadi to Shivajinagar

The Pune railroad underground line runs from Shiwajinagar to Swargate(98.2 km).

Use of TBM -

Using TBM (Tunnrl Boring Machine) underground railway construction becomes easy. It is done safely with TBM.

Advance rates using TBMs in soft rock can exceed 100 ft per day. However, tunnel excavation is a systematic and industrial production process that can only proceed at the speed of the slowest element in the system. Thus, technological advances that increased the speed of rock fragmentation could not be fully applied until the muck conveying systems that remove excavated materials could be designed to keep pace. Advance rates for rock excavation also could be improved with more efficient methods of installing supports and reinforcements. Ground control measures to prevent loss of confinement and therefore face instability, chimneys, cutterhead blockage, and tunnel collapse in blocky and highly fractured ground could be improved.

Special Safety Provisions in TBMs and tunnels

1. Smoke and Fire Detection/Alarm System
2. Water Sprinkling and Fire Curtain
3. Dewatering Pumps to tackle flooding
4. First-aid room and first-aid kits at strategic locations for emergencies
5. Gas detectors at Cutter Head monitoring presence of toxic gases at the TBM face
6. Chiller plant to maintain the ambient temperature for workmen
7. Fire points and extinguishers at 15-30 m
8. Walkie talkies and telephones are installed at every 100 m for undisturbed communication
9. Emergency lights at every 50 m for proper illumination
10. 27 Self Rescuers inside the TBM for 25 workmen and five Self Rescuers for the visitors are available at the bottom shaft
11. 5 Close Circuit Breathing Apparatus (CCBAs) for emergency response team to handle fire emergencies
12. Man Lock provision to access the excavation chamber required for the TBM maintenance
13. Continuous site monitoring at emergency control room, using CCTV surveillance for early Emergency response in case of any emergencies
14. Locomotives for transporting muck out of TBM are installed with Speedometer, Speed Governors, Rare-view Cameras, Manchester gates and Track Signaling
15. Electrical Cables Power supply cables are waterproof, dust proof, fire retardant and produce low smoke and fumes
16. First-aid rooms available at shaft surface and inside the TBM for workmen. A team of dedicated doctor, first aider, male nurses and technicians equipped with first kit, ambulance, stretcher, and resting beds are available round the clock
17. Eye wash station is provided in the TBM

3.1 THE FACTORS ANALYSIS OF SUBWAY SAFETY

Signaling and train management

Metro carries sizable amount of passengers at a really shut headway requiring a really high level of safety social control and dependability. At a similar time, significant investment in infrastructure and wheeled vehicle necessitates optimization of its capability to supply the simplest services to the general public. These needs of the railroad area unit planned to be achieved by adopting ATP (Automatic Train Protection) and ATS (Automatic Train Supervision) signal systems. Automatic Train Operation (ATO) are going to be else.

Telecommunication

The telecom system acts because the communication backbone for signal systems and alternative systems like SCADA, AFC, etc and provides telecommunication services to fulfill operational and body needs of railroad network.

The telecommunication facilities planned area unit useful in meeting the necessities for

1. Supplementing the signal system for economical train operation.
2. Exchange of info
3. economical management throughout emergencies
4. traveler system

The planned communication system fulfills the subsequent requirements:

- help to coach control
- Maintenance management
- Emergency management
- Station to station dedicated communication
- work
- traveler Announcement System and traveler info and show System inside the station and from Central management to every station.
- Train Destination Indicator
- Instant online Radio Communication between Central management and Moving trains and maintenance personnel.
- information Channels for signal, SCADA, Automatic Fare assortment, etc

Rolling Stock

Rolling stock for Pune railroad has been chosen supported the subsequent criteria:

- established instrumentality with high dependability
- traveler feature
- Energy potency
- lightweight weight instrumentality and coach body
- Optimized scheduled speed
- esthetically pleasing Interior and Exterior
- Low Life cycle value
- Flexibility to fulfill increase in traffic

Ventilation and Air conditioning system

The underground stations of the railroad passageway area unit in-built a confined area. an outsized range of passengers occupy concourse halls and therefore the platforms, particularly at the height hours. The platform and concourse areas have a restricted access from outside and don't have natural ventilation. it's so, essential to supply forced ventilation within the stations and within the tunnel. for the aim of: -

- activity contemporary air for the physiological wants of passengers and therefore the authority's staff.
- Removing body heat, unpleasant odors and harmful gases like greenhouse gas exhaled throughout breathing.
- Removing great quantity of warmth dissipated by the train instrumentality like traction motors, braking units, compressors mounted below the under-frame, lights and fans within the coaches, A/c units etc.
- Removing vapour and fumes from the battery and warmth emitted by lightweight fittings, water coolers, Escalators, Fare Gates etc. operating within the stations.

Controlling and Monitoring

For the underground stations, the management and observance of station services and systems like station air-conditioning, ventilation to plant rooms, lighting, pumping systems, lifts & Escalators, etc shall be performed at Station room (SCR). However, the operation and management of Tunnel Ventilation moreover as Smoke Management system can unremarkably be done through OCC. of these systems shall be equipped with automatic, manual, native and remote operation modes. The alarms and signals from the instrumentality.

IV.CONCLUSION

1 Proper analysis of safety situation of Pune metro based on the combine approaches of questionnaire survey and Field Research.

2 Pune underground railway safety issues minimize by improving public safety awareness and strengthening the subway security management.

3 After studying Advance Techniques for underground advance techniques by planning giving the best possible solution for safety

4 Effectively Hazard Identify and reduce the risk factors by following steps of risk management.

5 TBM is much more effective method than other method because of its safety facilities in TBM itself.

REFERENCES

[1] Niraj Sharma, Rajni Dhyani, S. Gangopadhyay, Research Institute, New Delhi, India, presented a "Critical Issues Related to Metro Rail Projects in India" Journal of Infrastructure Development 5(1) 67–86© 2013 India Development Foundation

[2] W N Deulkar and A F Shaikh presented a "PUNE METRO RAIL PROJECT: A REVIEW" ISSN 2319 – 6009 Vol. 4, No. 1, February 2015 © 2015 IJSCER.

[3] Matthew Bilson, Andrew Purchase , Lily Liu , Nicole Nishimura , Silas Li and Bo Rim Seo WSP ,New York, NY, USA, Gothenburg, Sweden presented a "Rail System Ventilation Rehabilitation" in Eighth International Symposium on tunnel safety and security, Boras, Sweden, March 14-16,2018.

[4] Vishwas H S, Dr. G D Gidwani, presented a "Hazards Identification and Risk Assessment in Metro Railway Line Construction Project at Hyderabad" (IJERT) ISSN: 2278-0181 Vol. 6 Issue 08, August – 2017

[5] G.Poovizhi, S.Manoj, D.Ambika, V.Santha Rubini, V.Nandhini, S.Dhinu Priya presented a "Risk Safety Management in Construction of Metro Rail Projects "International Journal of Advanced Science and Technology Vol. 29, No. 1, (2020), pp. 1562 - 1571.