International Journal of Management and Humanities (IJMH)
ISSN: 2394-0913 (Online), Volume-12 Issue-6, February 2026

Examining the Determinants of Communication Silence Among Frontline Workers and its Implications for Risk Management in Metro rail Project Execution in India

Subhadhra M D, Kranti Kumar Myneni

Abstract: ***Metro rail construction projects in India operate in a complex and risky urban environment, where early risk identification is essential to prevent accidents. Despite the availability of comprehensive safety procedures and engineering controls, accidents still occur. The results of accident analyses indicate that workers have identified early warning signs of accidents but have not been able to report them, thereby increasing accident risk formally. This research conceptualises communication silence as a behavioural factor contributing to the escalation of safety risks in metro rail construction projects. A qualitative exploratory research methodology was employed, drawing on secondary data from published literature, analyses of standard operating procedures, and two case studies of Chennai Metro Rail projects. The findings of this research indicate that hierarchical site culture, fear of attribution, low psychological safety, and variability in supervisory responses are important factors that impede worker voice. The existing safety procedures, which are technically sound, do not address behavioural factors. To overcome this limitation, this research proposes a Behavioural Safety-Integrated Communication Framework that integrates multi-channel reporting, behaviour-based safety, and supervisory accountability with existing safety procedures.***

Keywords: Behavioural Safety, Communication Silence, Metro Rail Construction, Safety Management

Nomenclature:
CBS: Compliance-Based Safety
BBS: Behaviour-Based Safety
SOPs: Standard Operating Procedures
BSICF: Behavioural Safety–Integrated Communication Framework

I. INTRODUCTION

Metro rail construction is a safety-critical activity in urban development. It occurs at ground level, involving moving girders, lifting and placing overhead structures, crane movements, and workers working above live traffic, thereby endangering both workers and the general public.

Manuscript received on 06 February 2026 | Revised Manuscript received on 10 February 2026 | Manuscript Accepted on 15 February 2026 | Manuscript published on 28 February 2026.
*Correspondence Author(s)
Subhadhra M D, Master's of Building Engineering & Management, School of Planning & Architecture, Vijayawada (A.P.), India. Email ID: subhadhaya16@gmail.com
Dr Kranti Kumar Myneni*, Assistant Professor, Master's, Building Engineering and Management, School of Planning and Architecture, Vijayawada (A.P.), India. Email ID: Kranti.myneni@spav.ac.in, ORCID ID: 0000-0002-0753-5636

Despite the presence of comprehensive safety regulations and procedures in India for metro rail construction, the frequent occurrence of accidents indicates a gap between the written and the practised.

Analysis of accidents has revealed early warning signs, such as misalignment, unstable staging, dangerous rigging, and departures from procedures, that workers are aware of but do not report to the relevant authorities. This creates a "communication silence" in which safety information is not communicated, either intentionally or due to inattention. When communication silence persists, small problems can escalate into large disasters, including injuries and deaths, project delays and damage to the project's reputation. Although we have traditionally considered escalation in terms of cost and time overruns, safety escalation has received remarkably little attention despite its roots in behavioural and communication problems during metro rail construction [1].

II. LITERATURE REVIEW

Construction safety research indicates that accidents result from interactions between technical failures and human system behaviour, particularly communication breakdowns and unsafe practices [2]. Metro rail construction, characterised by elevated work, complex lifting operations, and multi-contractor interfaces, presents heightened exposure to such risks.

A. Accident Types and Severity in Metro Rail Construction

Based on empirical evidence from Indian metro projects, several accident types have been identified, including girder collapse, crane, fall, and electrical accidents. The majority of deaths and injuries are caused by lifting and working at height, which indicates the lack of safety communication in the system. The range and severity of accidents in Indian metros are presented in Table I.

Table I: Accident Patterns and Severity Levels

Year	Location	Accident Type	Severity
2013	Alandur, Chennai [3]	Girder Collapse	Fatal
2018	Delhi Metro [4]	Fall from Height	Major
2020	Bengaluru Metro [4]	Crane Accident	Major
2025	Manapakkam, Chennai [5]	Girder Slip/Collapse	Fatal

B. Hierarchy, Culture, and Communication Silence

High power-distance organisational structures common to construction sites

discourage upward safety communication. This may be due to fear of blame, job insecurity, language differences, and cultural values that do not support speaking out. If workers perceive that responses from management or supervisors are inconsistent or punitive, silence becomes a rational strategy rather than a failure [6].

C. Safety Management Approaches

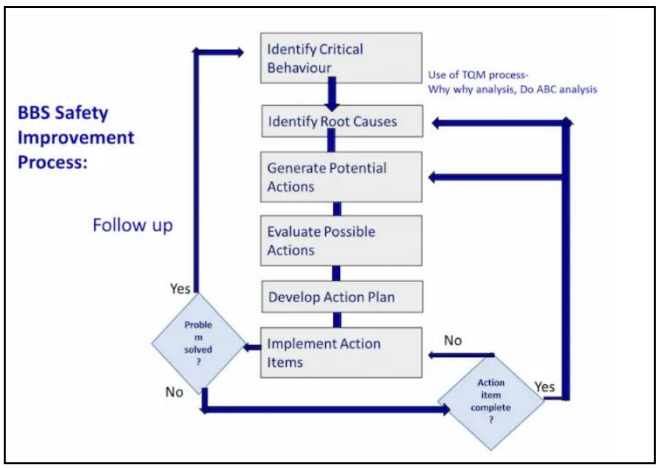
Construction safety systems generally follow engineering-based, compliance-based, or behaviour-based approaches. Engineering and compliance systems are effective at controlling known hazards but remain limited in addressing dynamic risks that depend on human behaviour and communication [7].

Table II: Comparison of Safety Management Approaches in Construction

Approach	Focus	Key Limitation
Engineering Controls	PPE, equipment, and engineering procedures	Cannot address unreported or emerging hazards
Compliance-Based Safety (CBS)	Rules, checklists, audits	Discourages proactive reporting
Behaviour-Based Safety (BBS)	Behaviour, communication, feedback	Requires cultural and managerial support

D. Behaviour-Based Safety and Global Evidence

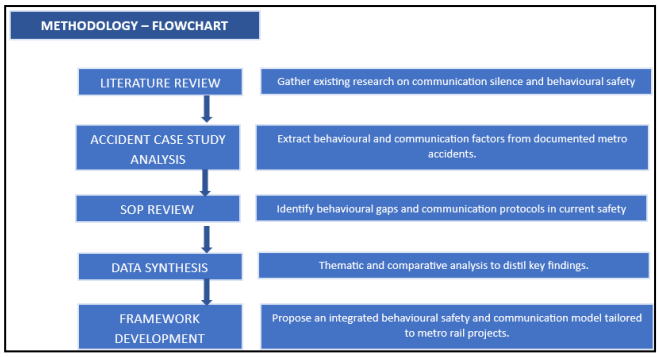
Behaviour-Based Safety (BBS) focuses on identifying and modifying unsafe behaviours through observation, feedback, and positive reinforcement. International metro and infrastructure projects demonstrate that sustained BBS interventions improve hazard reporting rates and reduce incident frequency, particularly in complex, multi-contractor environments [8]. A typical behaviour-based safety improvement process involving observation, feedback, and reinforcement cycles is illustrated in Fig. 1



[Fig.1: BBS Improvement Process]

III. RESEARCH METHODOLOGY

This study adopts a qualitative exploratory research design based exclusively on secondary data sources. Data collection included peer-reviewed literature on construction safety and communication behaviour, documented metro rail accident investigation reports, and content analysis of standard operating procedures governing safety reporting and incident investigation. Figure 2 shows the research design and analytical workflow used in this study. The study applied thematic analysis to identify behavioural drivers of communication silence and comparative evaluation to assess gaps between formal safety frameworks and observed site-level practices.



[Fig.2: Methodology Workflow]

IV. CASE STUDY ANALYSIS

A. Alandur Girder Collapse (pre 2016)

The Alandur girder collapse occurred during elevated metro construction in Chennai [3]. The investigation's findings indicate that frontline workers observed alignment instability before the collapse. However, these issues were not escalated due to pressure from the hierarchy and fear of negative repercussions. The accident led to deaths and injuries, proving that the suppression of worker voice can turn manageable risks into disasters.

B. Manapakkam Girder Collapse (2025)

In the Manapakkam accident, the unsecured structure was observed before girder placement. The absence of alternative reporting mechanisms and weak supervisory accountability allowed unsafe conditions to persist, resulting in a fatal accident [5]. Across both cases, communication silence functioned as a behavioural escalation mechanism that amplified risk severity.

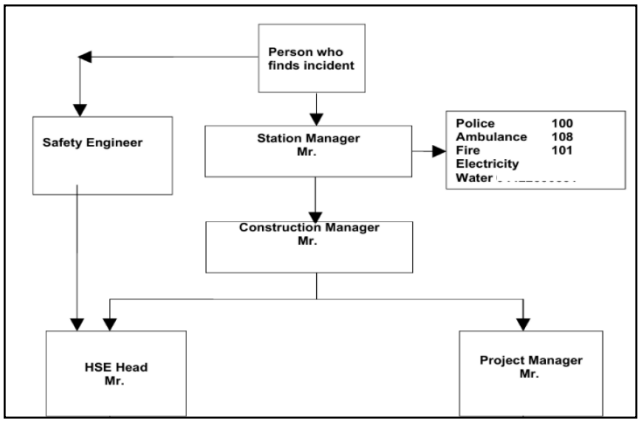
V. SOP DESIGN IN METRO RAIL CONSTRUCTION

A. Role of SOPs in Safety Governance

Standard Operating Procedures (SOPs) are a core element of safety governance in large infrastructure projects, as they define formal mechanisms for hazard reporting, incident investigation, and corrective action [9]. However, procedural completeness alone does not ensure effective risk control when behavioural and communication barriers persist.

B. Behavioural Gaps in Existing SOPs

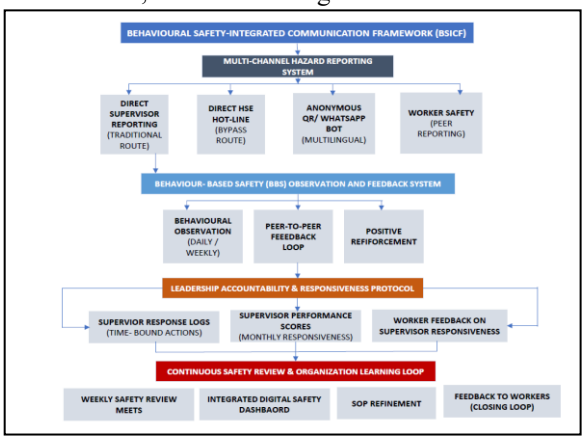
A critical review of metro rail safety SOPs indicates strong technical adequacy but limited behavioural integration. The existing procedure typically assumes uninterrupted upward communication and does not explicitly address psychological safety, anonymous reporting, or management accountability for risk escalation. The normal hierarchy of safety reporting in metro rail construction projects is shown in Fig. 3.



[Fig.3: Reporting Hierarchy CMRL]

VI. PROPOSED BEHAVIOURAL SAFETY–INTEGRATED FRAMEWORK (BSICF)

Findings from accident analysis, SOP reviews, and behavioural safety research indicate that metro rail safety systems must extend beyond technical procedures to explicitly address behavioural and communication factors that influence hazard reporting [6]. To address these limitations, this study proposes a Behavioural Safety–Integrated Communication Framework (BSICF) for metro rail construction, illustrated in Fig. 4.



[Fig.4: BSICF Framework]

A. Framework Overview and Rationale

The BSICF is founded on four interrelated components that support one another: reporting hazards through various means; observing and providing feedback on safety-related behaviour; leaders taking responsibility for and responding to safety obligations; and a continuous safety review and learning loop.

Table III: BSICF Components and Addressed SOP Gaps

BSICF Component	SOP Limitation Addressed	Safety Enhancement
Multi-channel hazard reporting	Single supervisor-dependent reporting	Reduces fear and escalation delays
Behaviour-based safety observation and feedback	Reactive, post-incident focus	Enables proactive risk detection
Leadership accountability protocols	No monitoring of supervisory response	Ensures timely corrective action
Continuous safety review and learning	Static SOPs	Improves organisational learning

B. Multi-Channel Hazard Reporting

If a hazard is identified, there are several options for reporting it: to your supervisor, to the HSE team directly, anonymously online, or through safety representatives. This redundancy reduces fear-driven silence and bypasses supervisory bottlenecks [10].

C. Behaviour-Based Safety Mechanism

The procedure for behaviour-based safety improvement, which underpins proactive risk identification, is presented in Fig. 2. Behavioural observations, mutual feedback, and trend analysis enable proactive identification of unsafe behaviour before technical failure.

D. Leadership Accountability and Continuous Learning

Supervisor responsiveness is monitored using specific response-time and feedback criteria to ensure visible and consistent responses [11]. The continuous safety review and organisational learning process within the BSICF is presented in Fig. 5 and reinforces feedback, trust, and adaptive improvement.

Table IV: Comparison of Existing SOP and BSICF-Enhanced SOP

SOP Dimension	Existing SOP	BSICF-Enhanced SOP
Reporting pathway	Linear, supervisor-based	Multi-channel and anonymous
Psychological safety	Not explicitly addressed	Explicit non-retaliation provisions
Supervisor role	Gatekeeper	Accountable responder
Behavioural focus	Absent	Integrated BBS mechanisms

VII. INFERENCE

Evidence from accident analysis and SOP review indicates that safety escalation in metro rail construction is primarily a communication-system failure rather than a technical inadequacy. Hazards escalate into incidents when early warnings are filtered, delayed, or ignored due to behavioural constraints embedded within hierarchical safety systems.

VIII. CONCLUSION

This study confirms that, to ensure effective safety management in metro rail construction, it is necessary to incorporate principles of behaviour and communication into current processes. Although the current SOPs are highly technical, they are not effective in addressing the realities of behaviour, such as fear, hierarchy, and low psychological safety, which lead to the absence of worker voice. The Behavioural Safety-Integrated Communication Framework (BSICF) is a behaviour-based approach designed to enhance early warning systems, risk visibility, and accident prevention in the emerging metro rail construction sector in India.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been funded

by any organizations or agencies. This independence ensures that the research is conducted objectively and free from external influence.

- **Ethical Approval and Consent to Participate:** The content of this article does not necessitate ethical approval or consent to participate with supporting documentation.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed equally to all participating individuals.

REFERENCES

1. P. E. D. Love, P. Teo, M. Davidson, S. Cumming, and J. Morrison, "Building absorptive capacity in construction organisations: The role of risk, uncertainty and learning," Journal of Construction Engineering and Management, vol. 145, no. 5, Art. no. 04019020, 2019, DOI: https://doi.org/10.1016/j.ijproman.2016.05.010
2. W. M. Alruqi and M. R. Hallowell, "Critical success factors for construction safety: A literature review and future research directions," Safety Science, vol. 129, Art. no. 104832, 2020, DOI: https://doi.org/10.1061/(ASCE)CO.1943-7862.0001626
3. Chennai Metro Rail Limited, Annual Reports and Project Updates, Chennai, India. Available: https://chennaimetrorail.org/annual-report/
4. Ministry of Labour and Employment, Government of India, Annual Report on Industrial and Construction Accidents, New Delhi, India, 2019. https://labour.gov.in/annual-reports
5. Chennai Metro Rail Limited (CMRL), Incident Investigation Report: Manapakkam Girder Slip/Collapse, Internal Incident Investigation Report, Chennai, India, 2025. https://chennaimetrorail.org/annual-report/
6. A. C. Edmondson and Z. Lei, "Psychological safety: The history, renaissance, and future of an interpersonal construct," Annual Review of Organisational Psychology and Organisational Behaviour, vol. 5, pp. 23–43, 2018. https://www.annualreviews.org/doi/10.1146/annurev-orgpsych-031016-113235
7. M. Knoll and R. van Dick, "International differences in employee silence motives: Scale validation, prevalence, and relationships with culture characteristics across 33 countries," European Journal of Work and Organizational Psychology, 2021. DOI: https://doi.org/10.1002/job.2512
8. DNV-GL, Behaviour-Based Safety Outcomes in Major Transport Infrastructure Projects: A Global Review, DNV-GL Technical Report, 2020. Available: https://www.dnv.com/training/behaviour-based-safety-51521/
9. B. H. W. Guo, T. W. Yiu, and V. A. González, "Predicting safety behaviour in construction: Meta-analytic evaluation of the theory of planned behaviour," Journal of Construction Engineering and Management, vol. 144, no. 8, Art. no. 04018068, 2018, DOI: https://doi.org/10.1016/j.ssci.2015.11.020
10. Poudel, O., Assaad, R. H., and Awada, M., "Integrating Large Language Models (LLMs) with Autonomous Aerial Drone Robotics and Computer Vision for Contextual Adaptive Construction Site Safety Management and Risk Assessment," ResearchGate Preprint, 2024. Available: https://www.researchgate.net/publication/400168772
11. A. Newman, R. Donohue, and N. Eva, "Psychological safety: A systematic review of the literature," Human Resource Management Review, vol. 30, no. 1, Art. no. 100724, 2020 DOI: https://doi.org/10.1016/j.hrmr.2017.01.001

AUTHOR'S PROFILE

Subhadhra M D is a postgraduate student pursuing the Master's degree in Building Engineering and Management (MBEM) at the School of Planning and Architecture, Vijayawada, India. The author's academic background integrates engineering fundamentals with management principles, with a strong focus on understanding and improving performance in complex construction environments. The author's primary research interests include construction safety management, behavioural safety, communication dynamics in high-risk worksites, metro rail infrastructure projects, and risk management in urban construction systems. Through postgraduate coursework, analytical assignments, and independent research, the author has developed a keen interest in examining how organisational structure, hierarchy, and human behaviour influence safety outcomes in large infrastructure projects. The author's current research focuses on communication silence among frontline workers and its role in the escalation of safety risks in metro rail construction projects in India. This work adopts a behavioural and systems-oriented perspective to analyse gaps between formal safety procedures and actual site practices, with particular emphasis on early hazard identification, worker voice, and supervisory responsiveness. Although the author has not yet published in journals, there is active engagement in academic research and scholarly writing on construction safety and infrastructure risk governance. The author aspires to contribute to future research and professional practice by advancing behaviour-centred, communication-focused safety frameworks suited to Indian urban infrastructure projects.

Dr Kranti Kumar Myneni received B. Arch degree from JNTU, Hyderabad, Telangana, India in 2001, pursued Master's (M.Sc. - Construction Management) from South Bank University, London in 2003 and received a doctorate from the School of Planning and Architecture, Vijayawada. Currently working as an Assistant Professor in the School of Planning and Architecture, Vijayawada. Member of the Council of Architecture and a Fellow member of the Indian Institute of Architects. Published nearly 40 articles and presented papers at 5 international conferences.3 chapters.