

**SAFETY MANAGEMENT PRACTICES AND SAFETY PERFORMANCE ON ROAD
CONSTRUCTION PROJECTS IN UGANDA: A CASE OF BUSEGA- MPIGI
EXPRESSWAY (23.7KM)**

BY

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DECLARATION

I, Kawuya Ibrahim, hereby declare that this study titled Safety Management Practices and Safety Performance of Road Construction Projects Using a case of Mpigi-Busega Express Highway Road project is original and has not been published for any other degrees in any other university or institution of higher learning.

Signed



Date: 13/10/2026

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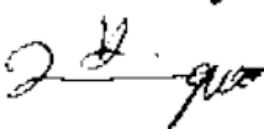
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APPROVAL

This is to certify that this dissertation has been submitted by Kawuya Ibrahim to Uganda Christian University for examination with approval.

Name of Supervisor:

Sign .

A handwritten signature in black ink, appearing to be 'J. H. J.', written over a horizontal line.

Date: 13/10/2026

DEDICATION

I dedicate this work to my family.

ACKNOWLEDGEMENT

My deepest gratitude goes to God who has provided all that was needed to complete this project and the program for which it was undertaken for. There was never lack or want. Throughout this entire study, He took care of everything that would have stopped me in my tracks and strengthened me even through my most difficult times.

I appreciate my supervisor for all the help and guidance that he rendered to me which has enabled me to put together this piece of work. I greatly appreciate. Furthermore, I appreciate the management and staff of the Mpigi Busega Express Highway road project who gave me the information I needed to complete this work.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Full Meaning
AfDB	African Development Bank
ANOVA	Analysis of Variance
CCC	China Communications Construction Company
CCECC	China Civil Engineering Construction Corporation
CVI	Content Validity Index
DV	Dependent Variable
FAC	First Aid Case
FAT	Fatality
FY	Financial Year
HoD	Head of Department
HSE	Health, Safety and Environment
ICT	Information and Computer Technology
IV	Independent Variable
JSAs	Job Safety Analyses
KAP	Knowledge, Attitude and Practice
KII	Key Informant Interview
LTI(s)	Lost Time Injury / Injuries
ML	Material Loss
MTC	Medical Treatment Case

NMI	Near Miss
NS	Not Sure
OSH	Occupational Safety and Health
PPE	Personal Protective Equipment
RWC	Restricted Workday Case
SA	Strongly Agree
SCT	Safety Climate Theory
SD	Strongly Disagree
SPSS	Statistical Package for Social Scientists
UCU	Uganda Christian University
UGX	Uganda Shillings
UK	United Kingdom
UNRA	Uganda National Roads Authority

ABSTRACT

Background and Purpose: This study examined the relationship between safety management practices and safety performance on the Mpigi-Busega Express Highway road construction project. It focused on safety compliance, safety training and safety participation.

Methodology: The study adopted a cross-sectional mixed-methods design. Data were collected from project personnel using questionnaires, interviews, focus group discussions and documentary review of Health, Safety and Environment records. Quantitative data were analysed using descriptive statistics, correlation and multiple regression, while qualitative data were analysed thematically.

Findings: The findings revealed positive and statistically significant relationships between safety performance and safety compliance ($r = .782, p < .001$), safety training ($r = .832, p < .001$) and safety participation ($r = .732, p < .001$). Together, the three practices explained 86.3% of the variation in safety performance. Safety compliance made the largest unique contribution in the combined regression model, followed by safety training and safety participation.

Conclusion: The study concluded that effective safety compliance, continuous safety training and meaningful worker participation are important for improving safety performance in road construction. However, gaps in the consistent enforcement of safety requirements, ongoing training and worker feedback remain areas requiring improvement.

Recommendations: The study recommends strengthening safety inspections and enforcement, introducing continuous refresher training and practical assessments, and establishing structured worker participation and feedback mechanisms.

Keywords: *Safety management practices, safety compliance, safety training, safety participation, safety performance, road construction.*

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Construction is one of the most hazardous industries in the world. The International Labour Organization (ILO) estimates that about 2.93 million workers died from work-related accidents and diseases in 2019, of whom about 330,000 died from occupational accidents, and that more than 395 million workers suffered a non-fatal occupational injury (ILO, 2023; ILOSTAT, 2025). Construction is among the sectors with the largest numbers of non-fatal workplace accidents (ILOSTAT, 2025). The responsibility for preventing such harm rests with employers, who are expected to put in place safety management systems that contribute to safety performance and compliance (Hofmann & Zohar, 2021). Safety management practices, that is, the policies, procedures, training and worker-involvement activities through which an organisation controls hazards, have been a focus of research since Zohar (1980) showed that the way management treats safety shapes workers' behaviour and outcomes, and the evidence from Europe, North America and Asia is that stronger safety management practices generally go with better safety performance in construction (Burke, Hofmann & Zohar, 2021; James & Zoller, 2021).

In Africa and other developing regions, work injuries and accidents have been common in the construction industry over the past two decades (Eskandari et al., 2021). Workers in Sub-Saharan Africa are exposed to biological, chemical, ergonomic and psychological hazards (Adesina & Kearney, 2019), and occupational injuries, accidents and fatalities are the usual measures of safety performance in the industry (Erdogan & Emre, 2022). Studies that link safety management practices to safety performance in African construction are, however, still few (Burke, Hofmann & Zohar, 2021).

In Uganda, maintaining safety performance on construction projects remains a challenge to many organisations (Clarke, 2020). Safety is regulated mainly by the Occupational Safety and Health Act, 2006 (Government of Uganda, 2006), which places duties on employers to provide a safe workplace and on workers to follow safety requirements, and injured workers are compensated under the Workers' Compensation Act, 2000. Studies of Ugandan construction firms nevertheless report accidents and incomplete implementation of the Act (Mpamize, 2018; Betty, 2024). Road projects are procured and supervised by the Uganda National Roads

Authority (UNRA), whose report (UNRA, 2022) recorded increases in worker accidents, employee injuries and fatalities, and property damage on its projects.

Mpigi-Busega Express Highway is a large UNRA road project financed through an African Development Bank loan and Government of Uganda counterpart funds (UNRA, 2023; Section 3.2). Its management has adopted safety compliance, safety training and safety participation practices, yet the outcomes reported by UNRA (2022) worsened (Section 1.2). The study therefore examined the relationship between these three safety management practices and safety performance on the project.

1.2 Statement of Problem

Safety management practices are critical to improving safety performance in the construction sector worldwide (Xia, Griffin, Wang & Liu, 2020). In Uganda, however, the UNRA Report (2022) records that on its road projects worker accidents on site rose from 16 percent to 28 percent, employee injuries and fatalities rose from 23 percent to 31 percent, and property damage rose from 32 percent to 41 percent, even though the project's managers had adopted safety compliance (safety rules, procedures and regulations), safety training (orientation and capacity-building programmes) and safety participation (decision-making, monitoring and communication) as interventions (UNRA, 2022). These outcomes are costly to workers and to the project: the project's own HSE records show 7 lost time injuries and 5 workers compensated between January 2021 and June 2023 and each lost time injury removes a worker from the work front (UNRA 2023) .

Three gaps in the literature explain why the problem remains unresolved. First, there is a conceptual gap: most studies treat safety management practices as one undifferentiated construct instead of testing safety compliance, training and participation as separate dimensions that may relate differently to safety performance (Gunduz & Laitinen, 2022), so it is not known which of the three matters most. Second, there is a methodological gap: many studies rely on questionnaire self-reports alone, with no independent check against recorded outcomes (Erdogan & Emre, 2022). Third, there is a contextual gap: studies in Uganda have examined general construction firms (Mpamize, 2018; Betty, 2024), and none identified by the researcher examines the relationship on a large public highway project such as Mpigi-Busega Express Highway (Jahangiri et al., 2011). The novelty of this study is that it (i) tests the three practices separately and together against the same outcome, (ii) defines safety performance as eight

recorded outcomes, separate from compliance, and (iii) checks respondents' ratings against the project's own HSE records.

It is against this background that the study investigated the relationship between safety management practices and safety performance of Mpigi-Busega Express Highway road construction project.

1.3 General objective

To investigate the relationship between safety management practices and safety performance of Mpigi-Busega Express Highway road construction project

1.3.1 Specific Objectives

The study achieved the following specific objectives

- i. To examine the relationship between safety compliance and safety performance Mpigi-Busega Express Highway road construction project
- ii. To assess the relationship between safety training and safety performance of Mpigi-Busega Express Highway road construction project
- iii. To explore the relationship between safety participation and safety performance of Mpigi-Busega Express Highway road construction project

1.3.2 Research Questions

The study answered the following research questions:

- i. What is the relationship between safety compliance and safety performance of Mpigi-Busega Express Highway road construction project?
- ii. What is the relationship between safety training and safety performance of Mpigi-Busega Express Highway road construction project?
- iii. What is the relationship between safety participation and safety performance of Mpigi-Busega Express Highway road construction project?

1.4 Hypotheses

The study tested the following hypotheses:

H₁: There is a positive and significant relationship between safety compliance and safety performance of Mpigi-Busega Express Highway road construction project

H₂: There is a positive and significant relationship between safety training and safety performance of Mpigi-Busega Express Highway road construction project

H₃: There is positive and significant relationship between safety participation and safety performance of Mpigi-Busega Express Highway road construction project.

1.5 Conceptual Framework

The conceptual framework that guided the current study is shown in Figure 1.1 below;

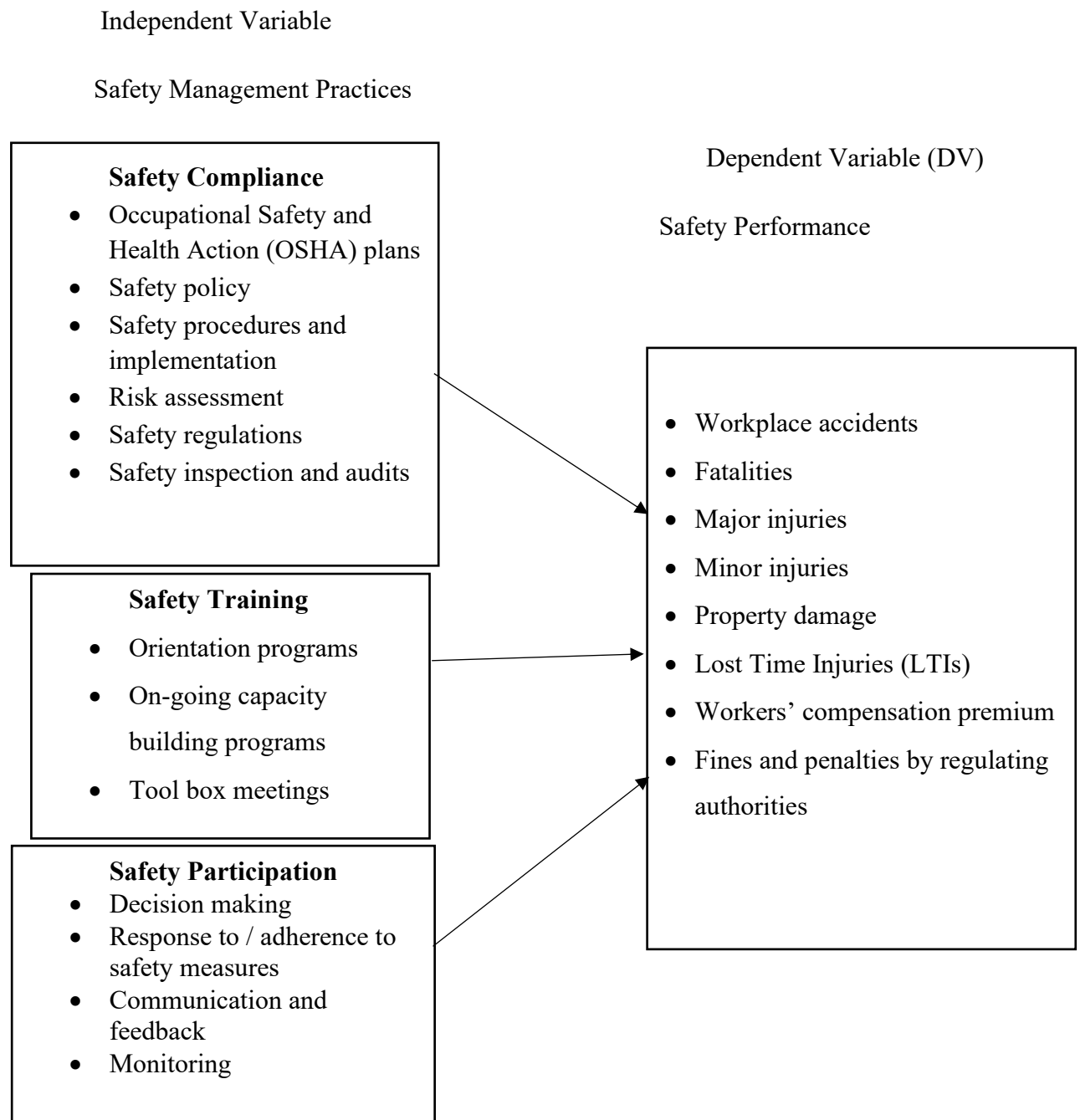


Figure 1. 1 Conceptual Framework of the study

Source: (Adopted from Zahoor, et al 2017) and modified by the researcher)

Figure 1.1 lays out the study's independent-variable/dependent-variable model, adapted from Zahoor et al. (2017) and adjusted by the researcher. On the left is the independent variable, safety management practices, broken into the three dimensions the study actually tests: Safety Compliance which was operationalized into OSHA action plans, safety policy, safety procedures and their implementation, risk assessment, safety regulations, and safety inspections and audits, safety training has the sub variables of orientation programmes, on-going capacity-building programmes, and toolbox meetings while safety participation has the sub variables of decision-making, response to and adherence to safety measures, communication and feedback, and monitoring.

On the right is the dependent variable, safety performance, measured by eight outcome indicators namely workplace accidents, fatalities, major injuries, minor injuries, property damage, Lost Time Injuries (LTIs), workers' compensation premiums, and fines and penalties imposed by regulating authorities. The arrows running from each of the three safety management practice boxes to the safety performance box represent the hypothesised relationship the study set out to test: that stronger safety compliance, more safety training, and greater safety participation are each associated with improved safety performance, that is fewer accidents and fatalities, fewer injuries, less property damage, fewer LTIs, lower compensation payouts, and fewer regulatory fines.

The framework was applied to road construction for three reasons. First, road works combine the hazards that make safety management practices most consequential: work zones beside live traffic, heavy earth-moving plant, excavations and swampy ground, and a large, changing workforce of several contractors and trades. The relationships between safety compliance, training, participation and safety performance are therefore tested under high-hazard conditions and not in a stable, fixed workplace. Second, road projects keep monthly HSE activity and event records, which made it possible to check each relationship in the framework against recorded evidence and not only against respondents' opinions (Section 3.5.3). Third, the recorded decline in UNRA's safety outcomes (Section 1.2) shows that the problem the framework addresses is present in this sub-sector, and roads are one of Uganda's largest areas of public infrastructure investment. Within the road sector the framework was applied to one project, Mpigi-Busega Express Highway, for the reasons given in Section 1.6.

The dependent variable box in Figure 1.1 shows all eight safety performance indicators. Intervening variables, which are factors outside the three practices that may also affect safety

performance, such as respondents' demographic characteristics, the contractor and subcontractor arrangements, management commitment, regulatory enforcement, and terrain and weather, were not measured as separate variables; how the study accounts for them is explained in Section 4.3.1 and shown in Figure 4.4. Factors such as the legal framework, workplace insurance arrangements, project design and financing arrangements are outside the framework.

Table 1. 1 Content of the Conceptual Framework: Variables, Indicators and How Each Was Measured

Variable	Content (indicators measured)	Measured through
Safety compliance (independent variable)	OSH action plans; safety policy; safety procedures; regular risk assessment; safety regulations; safety inspections; implementation of safety policies; safety audits (Table 4.4)	Questionnaire Section C (8 statements, composite mean); interviews; documentary review of audits, inspections, permits to work and job safety analyses (Figure 4.2)
Safety training (independent variable)	Orientation programmes; on-job training; on-going capacity-building; job rotation; toolbox meetings; periodic workshops; off-job training; coaching (Table 4.6)	Questionnaire Section D (8 statements, composite mean); interviews; documentary review of HSE training and toolbox meeting records (Figure 4.2)
Safety participation (independent variable)	Participation in safety decision-making; responsiveness to safety measures; encouragement of adherence; reporting system; periodic feedback; regular monitoring; transparent monitoring system; community participation (Table 4.8)	Questionnaire Section E (8 statements, composite mean); interviews

Variable	Content (indicators measured)	Measured through
Safety performance (dependent variable)	Workplace accidents; fatalities; major injuries; minor injuries; property damage; lost time injuries; workers' compensation; fines and penalties (Table 4.3)	Questionnaire Section B (8 statements, composite mean); documentary review of HSE event records: counts of fatalities, LTIs, injuries, property and material loss, compensation and fines (Table F.1, Figure 4.1)

Source: Researcher's compilation from the questionnaire and documentary review checklist (2024).

1.6 Justification of the Study

Empirical studies on safety management practices and safety performance have grown substantially in the construction sector, yet three specific gaps remain. Conceptually, most studies treat safety management practices as a single, undifferentiated construct rather than testing safety compliance, safety training and safety participation as distinct dimensions (Gunduz & Laitinen, 2022). Methodologically, many studies rely on questionnaire self-reports alone, with no independent, documentary check on the safety outcomes respondents report (Erdogan & Emre, 2022). Contextually and geographically, most of this evidence comes from developed economies or from general building construction, with little from the roads sub-sector and none, to the researcher's knowledge, from a large public highway project in Uganda (Jahangiri et al., 2011).

Mpigi-Busega Express Highway road construction project was purposively selected to close these gaps. As one of Uganda's largest road infrastructure investments, valued at approximately US\$132 million under a public-private partnership between the Government of Uganda and the African Development Bank (Uganda National Roads Authority [UNRA], 2023, p. 2), it generates enough routine HSE activity and event records, drawn from the project's own monthly HSE activity and event logs (Mpigi-Busega Express Highway Project, 2023, p. 7) and its safety audit files (Safety Audit Report, 2020, p. 4) help in addressing the methodological gap. Mpigi Busega Express Highway's own HSE records already show worker accidents, injuries and property damage rising despite stated safety compliance, training and participation efforts (UNRA Report, 2022, p. 21), making it a natural site for testing whether these three

practices, tested separately, are actually associated with safety performance, addressing the conceptual gap. And because Mpigi Busega Express Highway sits in the roads sub-sector, a segment underrepresented in the literature relative to general construction (Ministry of Works and Transport, 2021, p. 9; Section 2.5), studying it closes the contextual and geographical gap rather than duplicating existing site-level evidence.

Safety was chosen because road construction is a high-hazard activity, in which workers work beside live traffic, heavy plant and excavations, and because the consequences of poor safety on a public project fall on workers, contractors and the taxpayer alike, in the form of injuries, compensation, project delays and industrial unrest (UNRA Report, 2020). The recorded deterioration in UNRA's safety outcomes set out in Section 1.2 shows that the problem is present in the sector studied. Safety is also the aspect of project performance in which management practices are most directly within management's control: compliance systems, training and worker participation can be chosen, resourced and changed by project management, and their effect can be seen in recorded outcomes such as accidents, injuries and property damage. In addition, employers in Uganda have a legal duty to provide a safe workplace under the Occupational Safety and Health Act, 2006, so evidence on which practices are associated with better safety outcomes is of direct use to duty-holders and regulators. The cost, time and quality performance of the project were not studied because the gap identified in Chapter Two is a safety gap.

The names "Busega-Mpigi Expressway", "Mpigi-Busega Express Highway" and "Mpigi-Busega Express Highway road construction project" are used interchangeably in this dissertation for one and the same project: the 23.7 km section of the Kampala-Masaka road corridor between Busega and Mpigi, financed through the African Development Bank loan and the Government of Uganda counterpart funding (Section 3.2). The study did not cover other expressway and highway works around Kampala, such as the Entebbe-Kampala Expressway or the separately contracted Kibuye-Busega section, which have different contractors, financing arrangements and HSE records.

One project was studied, and this one in particular, for four reasons. First, it was under active construction throughout the review period (works began in May 2020 and only about 30 percent of the civil works had been completed by November 2023), so its safety practices and outcomes were being generated month by month and could be observed and not reconstructed after the fact. Second, the project keeps its own monthly HSE activity and event records for

January 2021 to June 2023, which gave the study independent documentary evidence to place beside respondents' views. Third, its scale, at approximately US\$132 million, and its workforce of managers, supervisors and foremen made it possible to reach every respondent category within one management system. Fourth, the project management authorised the researcher's access to its staff and HSE records (Section 3.5.3). Studying a single project means that the findings are specific to it, a limitation acknowledged in Section 5.6.

1.7 Significance of the Study

The study findings may be beneficial in the following ways;

To the management of Mpigi-Busega Express Highway road construction project and of UNRA more broadly, the study may provide evidence-based information on which specific safety compliance, safety training and safety participation practices are most strongly associated with improved safety performance. This allows project management to prioritise the practices shown to have the largest association with reduced unsafe acts, unsafe conditions and recordable HSE events, for example intensifying HSE training sessions and toolbox and pre-start meetings, rather than spreading limited safety budgets evenly and untested across all practices. The documentary review findings also give management a template for using its own routine HSE records as a management and self-assessment tool, independent of what supervisors and workers report in surveys and interviews.

To policy makers in the Ministry of Works and Transport, the Uganda National Roads Authority Board, the Directorate of Occupational Safety and Health in the Ministry of Gender, Labour and Social Development, and development partners that finance road infrastructure, the study provides an empirically grounded safety performance model that can inform minimum safety compliance, training and participation standards to be written into road construction contracts and supervision consultancy terms of reference. The trend evidence additionally illustrates how routine HSE records can be used by regulators to track whether contractors are genuinely improving safety performance over the life of a project, rather than relying solely on self-reported compliance at the point of award.

To academia, the study contributes to the safety management literature by extending the application of Safety Climate Theory to a road construction context in a developing-country setting, a context in which the theory has been comparatively less tested than in manufacturing, healthcare and general construction. The study also may augment on existing knowledge on

the relationship between safety management practices and safety performance of road constructions using the context of a developing country like Uganda and also identify areas for further studies on safety management practices and safety performance in road construction and other infrastructure sub-sectors in Uganda and the wider East African region.

1.8 Scope of the Study

This section details the scope of the study;

1.8.1 Content Scope

The content of the study was confined to the relationship between safety management practices and safety performance of Mpigi-Busega Express Highway road construction project. The independent variable, safety management practices, was studied through three dimensions and the specific content under each. Safety compliance comprised OSH action plans, safety policy, safety procedures, risk assessment, safety regulations, safety inspections, implementation of safety policies and safety audits. Safety training comprised orientation programmes, on-job training, on-going capacity-building programmes, job rotation, toolbox meetings, periodic workshops, off-job training and coaching. Safety participation comprised participation in safety decision-making, management responsiveness to safety measures, encouragement of adherence to safety measures, an incident and hazard reporting system, periodic feedback, regular monitoring, a transparent monitoring system and community participation. The dependent variable, safety performance, was studied as the recorded outcomes of safety management, comprising workplace accidents, fatalities, major injuries, minor injuries, property damage, lost time injuries, workers' compensation and fines and penalties by regulating authorities. Safety performance was therefore treated as an outcome, while safety compliance, which describes adherence to safety requirements, was treated as one of the practices that influence it (Section 1.9). The content excluded from the study comprised the project's cost, time and quality performance, project design and financing arrangements, and other factors that may influence safety outcomes, such as the legal framework and workplace insurance arrangements, which were not measured. The full content is set out in Table 1.1.

1.8.2 Time Scope

The study covered the period from January 2021 to June 2023 as this was the period within which Mpigi-Busega Express Highway experienced key challenges in safety performance as a result of the safety management practices employed. This period falls within the construction

phase of the project (Section 1.8.5). The questionnaire and interviews were administered in March and April 2024 (Section 5.6), while the documentary review covered each month from January 2021 to June 2023.

1.8.3 Geographical Scope

The study was confined to Mpigi-Busega Express Highway road construction project, which runs approximately 23.7 kilometres from Busega, a neighbourhood in Rubaga Division, Kampala, through Kyengera, Nabbingo and Nsangi, to Mpigi.

1.8.4 Management Scope

The management scope of the study was the safety management system run by the project's management team, examined at the three levels at which safety management practices are decided, implemented and experienced. At the strategic level, the study covered the safety and operations managers and the project managers, who set the safety policy, allocate resources and approve safety procedures. At the tactical level, it covered the heads of department, who translate policy into departmental procedures, training and supervision. At the operational level, it covered the project supervisors, operations officers and foremen, who implement the procedures and deal with workers day to day (Table 3.1). Across these levels the study examined three management functions only: the management of safety compliance (policy, procedures, risk assessment, inspections and audits), the management of safety training, and the management of worker participation in safety. It did not examine the project's other management functions, such as financial, procurement, contract or quality management, nor the corporate governance of UNRA beyond the project. Workers who hold no supervisory role were not respondents; their experience was represented through the foremen, supervisors and officers who work directly with them.

1.8.5 Project Phase Scope

The study was carried out during the construction (implementation) phase of the project, that is, neither before nor after it. It was not a pre-construction study, since it did not examine the design, procurement, environmental and social assessment or mobilisation stages, and it was not a post-construction study, since the road had not been completed or handed over, and defects liability, operation and maintenance were outside its scope. The project's works began in May 2020 and only about 30 percent of the civil works had been completed by November 2023 (Section 3.2), so the January 2021 to June 2023 reference period lies wholly within the

construction phase. The safety management practices and safety outcomes examined were therefore those of works in progress, and the primary data were collected in March and April 2024 while construction was still under way. The findings accordingly describe how safety management practices were associated with safety outcomes as work progressed, and cannot be taken to describe the completed project.

1.9 Operational Definitions of Key Terms

The key definitions used in the study are defined as below;

Communication and Feedback: This is defined as the two-way exchange of safety-related information between management and employees, including the extent to which hazards or concerns reported by employees receive a visible response.

Decision-Making: This refers to the extent to which employees are consulted, or directly involved, in decisions relating to workplace safety on the project.

Fines and Penalties by Regulating Authorities: These refer to the monetary sanctions imposed on the organisation by government or regulatory bodies for non-compliance with safety laws, regulations or standards.

Lost Time Injury (LTI): This refers to a work-related injury or illness that results in the affected employee being unable to attend work for one or more full days beyond the day on which the incident occurred.

Monitoring: This refers to the on-going observation and tracking of safety practices and site conditions, including by workers themselves, to detect and correct unsafe acts or conditions before they result in harm.

Occupational Safety and Health (OSH) Action Plans: These are documented plans setting out an organization's specific targets, activities, responsible persons and timelines for preventing occupational accidents and injuries on a construction site (Namian, Albert, Zuluaga & Behm, 2020).

On-going Capacity-Building Programmes: These are continuous or periodic training activities, beyond initial induction, designed to update and reinforce employees' safety knowledge and skills throughout their time on the project.

Orientation Programmes: These are structured induction sessions given to new employees before they begin work, to familiarise them with the project's specific hazards, safety rules and procedures.

Property Damage: This refers to the physical harm to organizational property, plant, equipment or materials resulting from a workplace incident.

Response to/Adherence to Safety Measures: These refer to the degree to which employees comply with, and act on, the safety rules, instructions and precautions established for their work.

Risk Assessment: This refers to the systematic process of identifying workplace hazards and evaluating the likelihood and severity of the harm they could cause, so that appropriate control measures can be put in place.

Safety Compliance: This refers to the extent to which management establishes and implements the safety requirements of the project, that is, its policy, procedures, risk assessments, regulations, inspections and audits, and the extent to which workers adhere to them. It describes adherence, and is a management practice that influences safety performance, not the performance itself.

Safety Inspection and Audits: These are periodic, structured checks of the workplace, equipment and work practices, carried out to verify compliance with the project's safety policy, procedures and regulations.

Safety Performance: Safety performance is an all-inclusive set of regulations, laws and activities directed towards improving safety in organisations (Arditi & Demirkesen, 2019), which is customarily self-reported (Andersen et al., 2022) but eventually directed towards promoting the safety and health of workers (Zahoor & Zafar, 2021). In recent iterations, safety performance refers to the level of safety in an organisation as occasioned by the actions and inactions of organisational members, systems and structures (Fernández-Muñiz et al., 2021). Safety performance is therefore an outcome concept: it describes the results that are achieved, namely how many accidents, injuries, fatalities and losses occur, and not whether rules were followed. It must be distinguished from safety compliance, which describes adherence, that is, whether the safety policy, procedures, regulations and inspections of the project are put in place

and followed. Compliance is what management and workers do; performance is what results from it. In the context of this study, safety performance refers to the level of safety attained on Mpigi-Busega Express Highway road construction project, as reflected in the recorded occurrence, or avoidance, of eight workplace safety outcomes, namely workplace accidents, fatalities, major injuries, minor injuries, property damage, Lost Time Injuries (LTIs), workers' compensation and fines and penalties imposed by regulating authorities. It was measured in two complementary ways: first, through a composite score of respondents' ratings of these eight outcomes on a five-point Likert scale (Table 4.3), and second, through the counts of the same outcomes recorded in the project's own HSE records for January 2021 to June 2023 (Table 4.3, Appendix F and Figure 4.1). Statements about adherence to rules, such as the use of protective equipment or following procedures, were not used to measure safety performance, because they measure safety compliance (Table 4.4).

Safety Policy: This refers to a formal, written statement of an organization's commitment to protecting the safety and health of its employees, and the standards of behaviour expected of them.

Safety Procedures and Implementation: These are documented, step-by-step instructions for carrying out specific tasks safely, together with the extent to which those instructions are actually followed in practice on site.

Safety Regulations: These refer to the rules and standards, whether set internally by the organisation or externally by regulatory authorities, that govern acceptable safety practice on the project.

Toolbox Meetings: These refer to brief, regular safety briefings held at the job site, typically before the start of work, to discuss the specific hazards and precautions relevant to that day's tasks.

Workers' Compensation Premium: This is the cost incurred by the organisation to insure and compensate employees for injuries or illnesses sustained in the course of their work.

Workplace Accidents: These are unplanned events arising out of or in the course of work that result in injury, harm or loss (Erdogan & Emre, 2022).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on the relationship between safety management practices and safety performance from published books, journals, theses and official reports, with emphasis on road and highway construction. It begins with the status of safety in the construction industry (Section 2.2), reviews the theory underpinning the study (Section 2.3) and then presents an empirical review organised by the three specific objectives (Section 2.4), covering safety compliance, policy and regulation, the nature of safety training, and safety participation. The chapter ends with a summary of the key findings and the gaps identified (Section 2.5).

2.2 Status of Safety in the Construction Industry

Construction is one of the sectors in which the greatest numbers of non-fatal work accidents occur (ILOSTAT, 2025), and the ILO estimates that work-related accidents and diseases caused about 2.93 million deaths worldwide in 2019, about 330,000 of them from accidents (ILO, 2023). At the international level, the ILO Safety and Health in Construction Convention, 1988 (No. 167) sets out the prevention and protection measures expected on construction sites, such as planning, training and the duties of employers, contractors and workers (ILO, 1988). Research on why safety performance differs between construction sites goes back to studies of the factors affecting safety performance on construction sites (Sawacha, Naoum & Fong, 1999) and has since linked safety performance to management commitment, training, communication and worker involvement (Zohar, 1980; Griffin & Neal, 2000).

In Africa and other developing regions, work injuries and accidents have been common in construction over the last two decades (Eskandari et al., 2021), and workers face biological, chemical, ergonomic and psychological hazards (Adesina & Kearney, 2019). Fewer studies from the region have tested which safety management practices are linked with better outcomes (Burke, Hofmann & Zohar, 2021), so much of the evidence on practice-performance relationships still comes from Europe, North America, Asia and Australia, as the empirical review below shows.

The Occupational Safety and Health Act, 2006 is the principal law on safety at work in Uganda. It requires employers to provide a safe workplace, protective equipment, information and training, and to report accidents, and it requires workers to follow safety requirements (Government of Uganda, 2006). Workers injured at work are compensated under the Workers' Compensation Act, 2000. Studies of Ugandan construction nevertheless report gaps in practice. Mpmize (2018) examined how far construction firms adhered to occupational safety and health regulations and how this related to the occurrence of accidents on 30 construction sites supervised by Kampala Capital City Authority, and listed non-compliance among the causes of accidents. Betty (2024) found that, despite the Act, a construction company's sites still recorded accidents, injuries and fatalities, and that respondents rated implementation of the Act and updating of policies after incidents low (mean 2.17 on a five-point scale). A small perception survey on two Kampala construction sites, in contrast, reported favourable ratings for daily safety communication, site inspections and first aid (Gumisiriza, 2018). Taken together, these Ugandan studies come from building and general construction firms, rely largely on perceptions, and none tests the three practices of this study against safety performance on a highway project.

Road and highway works combine hazards that other construction rarely brings together: work zones beside live traffic, heavy earth-moving plant, excavations and, in Uganda, swampy ground, with a large and changing workforce of several contractors and trades. Studies of highway projects, such as Nnaji, Gambatese and Karakhan (2022) on United States highway construction, are therefore especially relevant to this study, and where the studies reviewed below were carried out on other kinds of construction, their relevance to highway projects is stated explicitly. In Uganda, road projects are procured and supervised by UNRA, whose annual safety performance reports record the outcomes of its projects (UNRA, 2020; UNRA, 2022).

2.3 Theoretical Review

The study was anchored on Safety Climate Theory, first postulated by Zohar (1980) in his seminal work on safety climate in industrial organisations, and later extended by Griffin and Neal (2000) and Neal, Griffin and Hart (2020). Zohar (1980) defined safety climate as employees' shared perceptions of the relative priority that management places on safety relative to competing organisational goals, such as production and cost, with these shared perceptions serving as a frame of reference that signals to workers which behaviours are expected, rewarded

and appropriate within the organisation. The SCT rests on three core assumptions. First, it assumes that safety climate is a group-level, shared perception rather than a purely individual attitude, formed through consistent signals from management's practices, policies and priorities (Zohar, 1980). Second, the SCT assumes that safety climate operates through two distinct behavioural pathways, safety compliance, adherence to required safety rules and procedures, and safety participation, discretionary and voluntary safety-related behaviour, which together constitute overall safety performance (Griffin & Neal, 2000). Third, it assumes that where these organisational-level signals are consistent and strong, for example through visible safety policy, training and communication, they translate into individual safety behaviour and, in turn, into safety performance outcomes (Neal, Griffin & Hart, 2020).

Various studies have employed the SCT for instance Oswald, Sherratt and Smith (2021) applied Safety Climate Theory to examine the relationship between supervisor-level safety climate and workers' safety behaviour across multiple United Kingdom (UK) construction sites. They found that supervisor safety climate was strongly and positively associated with workers' safety compliance, but only weakly associated with proactive safety participation, such as voluntary hazard reporting, suggesting that the two behavioural pathways the theory predicts do not respond equally to the same climate signals. Their study, however, was confined to UK building-construction sites with well-established safety departments, and relied entirely on self-reported behaviour with no independent, documentary check on the safety outcomes workers reported. This leaves a contextual gap, in that it is not established whether the same compliance-participation asymmetry holds in a developing-country construction setting, and a methodological gap, in that self-reported behaviour was not verified against records. The current study bridges both gaps by testing safety compliance and safety participation as separate hypotheses on a Ugandan road construction project and by adding documentary review of the project's own HSE records as an independent check on reported safety performance.

Additionally, Jiang, Zhang and Fang (2022), studying a large sample of migrant and casual construction workers on Chinese building sites, found that safety climate significantly predicted safety participation, and that this relationship was stronger among high-turnover, casually employed teams than among permanent staff, since casual workers relied more heavily on visible climate signals, such as site inductions and toolbox talks, to gauge appropriate behaviour, having no long organisational tenure to draw on instead. Their study, however,

examined safety participation only, without separately testing safety compliance or safety training as distinct predictors, leaving a conceptual gap as to how the full set of safety management practices operates in a similarly casual, high-turnover workforce. The current study bridges this gap by testing safety compliance, safety training and safety participation as three separate hypotheses on Mpigi-Busega Express Highway road construction project, a site with a comparably casual, foreman-supervised labour force, extending Jiang, Zhang and Fang's (2022) high-turnover finding from a Chinese building-construction setting to an East African highway-construction one.

Furthermore, Chen, McCabe and Hyatt (2023), extending their earlier work on safety climate and psychological stress in the Canadian construction industry, examined safety climate specifically in relation to safety compliance on highway and infrastructure projects, and found that a strong site-level safety climate was associated with significantly higher compliance with safety procedures, but that this association weakened on projects with multiple subcontractors and fragmented supervision structures, a common feature of large highway projects. This left a gap as to how safety climate operates specifically on large, multi-contractor public highway projects in a developing-country context, since their study was conducted on unionised Canadian infrastructure sites with a single main contractor. The current study bridges this gap by testing the safety-climate-derived compliance relationship on Mpigi-Busega Express Highway road construction project, a large, publicly funded highway project in Uganda, and by using documentary review to check whether reported compliance is reflected in the project's own HSE audit and inspection records.

Notwithstanding its wide use, Safety Climate Theory has general limitations that this study takes into account. First, because safety climate is a shared perceptual construct, Beus, Dhanani and McCord (2019), in a meta-analysis of personality and workplace safety, found that individual differences in conscientiousness and risk propensity moderate how strongly a given climate perception translates into safe behaviour, meaning the climate-to-behaviour link is not uniform across individuals. Second, Griffin and Curcuruto (2020), reviewing safety climate research broadly, note that climate measures can be sensitive to the level at which they are referenced, organisational, group or supervisor level, and that studies using different referents are not always directly comparable. Third, because safety climate is a perceptual, attitudinal construct, it is better suited to explaining ongoing, voluntary safety behaviours, such as participation and reporting, than to explaining single, low-frequency events such as fatalities,

which may be driven as much by physical hazards and engineering controls as by workers' climate perceptions (Guldenmund, 2000). The current study addresses this last limitation by not relying on Safety Climate Theory alone, but by complementing the SCT with other theories such as Heinrich's domino theory and Reason's organisational accident model both of which give more direct attention to the physical and organisational causal chain leading to accidents.

Heinrich's Domino Theory, developed by H. W. Heinrich in the 1930s, models an accident as the last in a predictable, repeated sequence of five factors: ancestry and social environment, fault of a person, an unsafe act or mechanical or physical hazard, the accident itself, and the resulting injury (Heinrich, 1931). The Heinrich's Domino's Theory further assumes that removing any one domino in the sequence, most practically the unsafe act or condition, prevents the accident and injury that would otherwise follow, and it assumes that the great majority of accidents, 88 percent on Heinrich's original estimate, are caused by unsafe acts of persons rather than unsafe conditions or chance occurrence (Abdelhamid & Everett, 2020). The theory has since been revised to place greater emphasis on management practices as the root cause standing behind unsafe acts (Liska, Goodloe & Sen, 2019), and Bird and Loftus (1976) reformulated it to show management as accountable for workers' safety, arguing that if unsafe acts are prevented through management practice, the resulting chain of events, and the injury, can be avoided. This theory is applicable to the current study because it supplies the causal logic for why safety compliance, safety training and safety participation, all of which are management-driven practices aimed at removing unsafe acts and conditions, should be expected to reduce workplace accidents, injuries and fatalities, the very indicators used to measure safety performance in this study.

Additionally, Reason's organisational accident model, also known as the Swiss Cheese Model, conceptualises organisational defences against accidents as a series of layered barriers, each of which contains unintended weaknesses or gaps; an accident occurs only when the gaps in successive layers momentarily align, allowing a hazard to pass through all of them (Reason, 1997). The model assumes that accidents are rarely caused by a single unsafe act but result from the combination of active failures at the point of the incident and latent conditions, such as weak supervision, inadequate training, or poor safety procedures, that have existed in the organisation for some time before the incident (Reason, 2000). This model is applicable to the current study because it explains why safety performance should be understood as depending on multiple, simultaneous management practices rather than any single practice in isolation, reinforcing the study's decision to test safety compliance, safety training and safety

participation as three separate but jointly examined dimensions, and because it supports the use of documentary review of incident records as a way of tracing the latent organisational conditions, for example gaps in inspection or training coverage, that stand behind recorded accidents, rather than treating each accident as an isolated, unrelated event.

2.4 Empirical Review

This section reviews empirical studies organised by the study's three specific objectives.

2.4.1 Safety Compliance and Safety Performance

Safety compliance refers to the extent to which an organisation establishes a clear safety policy, rules, procedures, risk assessment and standards of behaviour for employees, and sets up a safety system to correct workers' safety behaviours (Namian, Albert, Zuluaga & Behm, 2020). Cox and Cheyne (2019), examining the effectiveness of occupational safety and health management systems in offshore oil and gas activities, found that the implementation of safety procedures and rules caused a measurable shift in employees' behaviour toward greater safety performance, and developed a Safety Climate Assessment Toolkit for evaluating compliance with safety rules and procedures. Their study, however, was confined to a highly regulated, capital-intensive offshore industry with dedicated safety departments, a very different institutional setting from a Ugandan road construction project, leaving a contextual gap that the current study bridges by testing the same relationship in a labour-intensive, lower-resource construction setting.

Safety compliance is anchored in law, policy and contract. At the national level the law sets the minimum duties of employers and workers (Government of Uganda, 2006); at the international level, Convention No. 167 sets the expected prevention measures on construction sites (ILO, 1988); and at the project level the contractor's written safety policy, procedures and regulations turn these duties into site rules. On projects such as the one studied, compliance is currently carried out mainly through a documented safety policy and OSH action plan, risk assessments before major activities, written safe-work procedures, enforcement of site rules such as the use of personal protective equipment, routine inspections by supervisors and HSE officers, periodic audits, and incident reporting and corrective action (Table 1.1). The literature distinguishes this formal compliance from the behaviour of following the rules in daily work: Griffin and Neal (2000) and Neal and Griffin (2006) describe safety compliance as the core activities workers carry out to maintain workplace safety, such as following procedures and

wearing protective equipment, and separate it from safety participation, which is voluntary involvement in safety activities. Having a policy on paper is therefore not the same as compliance, and the studies below ask whether the policy is enforced.

Durdyev, Mohamed, Lay and Ismail (2021), studying key factors affecting construction safety performance in Cambodia, found that regulatory compliance and risk assessment practices were significant predictors of safety performance on construction sites in a developing economy comparable to Uganda, lending direct support to testing safety compliance, including risk assessment specifically, as a predictor of safety performance in the current study. These findings are similar to Ghasemi and Mohammadfam (2020) who in a study of 42 construction sites in Iran, found that sites with an actively implemented safety policy and formal safety procedures recorded 34 percent fewer workplace accidents than sites where a policy existed on paper but was not implemented. However, the study measured safety policy and safety procedures and implementation as one combined variable, leaving a conceptual gap as to which of the two actually drove the reduction. The current study bridges this by measuring safety policy and safety procedures and implementation as two separate sub-indicators, so their individual associations with workplace accidents can be tested independently.

Furthermore, Winge and Albrechtsen (2021), studying Norwegian construction firms, found that the strength of the link between safety regulations and reduced Lost Time Injuries (LTIs) depended on day-to-day adherence to procedures rather than regulatory content itself. The study, however, was confined to a single developed-country, unionised construction sector, leaving a contextual gap as to whether the same pattern holds on a large public highway project in a developing country with a different regulatory and labour environment. The current study bridges this gap by testing the same relationship on Mpigi-Busega Express Highway in Uganda.

Also, other scholars like Kim, Park and Lee (2022), in a study of 68 Korean building sites, found that the frequency of safety inspection and audits was the strongest predictor of reduced property damage among six compliance sub-indicators tested, more so than risk assessment alone. The study relied entirely on supervisor-reported inspection frequency with no independent verification against inspection logs, leaving a methodological gap. The current study bridges this by cross-checking respondents' reported safety inspection and audit frequency against the project's own HSE audit records through documentary review.

Nnaji, Gambatese and Karakhan (2022) in their study examining highway construction projects in the United States, found that OSH action plans assigning inspection responsibility to a named site officer were associated with fewer fines and penalties by regulating authorities than generic plans. The study was however limited to highway projects in a high-resource regulatory environment, leaving a contextual gap regarding whether the same OSH-action-plan-to-fines-and-penalties link holds where regulatory enforcement capacity and resourcing differ, as in Uganda. The current study addresses this by testing the OSH action plans indicator against the fines and penalties indicator on a Ugandan public highway project.

Other scholars such as Chan, Wong and Lam (2022) conducted their study in Hong Kong and found a significant negative association between the comprehensiveness of documented risk assessment and workers' compensation premiums. The study however did not examine whether this association held once safety inspection and audit frequency was controlled for, leaving a conceptual gap as to whether risk assessment has an independent effect on compensation premiums or whether it operates through inspection. The current study bridges this by measuring risk assessment and safety inspection and audits as distinct indicators and testing each against workers' compensation premiums separately.

Furthermore, Alkaissy, Arashpour, Ashuri, Bai and Hosseini (2022), studying large infrastructure projects in Australia, found no significant association between the mere presence of written safety regulations and workplace accidents once inspection and audit frequency was controlled for. The study however did not extend this test to other safety performance indicators such as property damage or fines and penalties, leaving a conceptual gap regarding whether the same null finding holds across all five safety performance indicators used in this study. The current study bridges this gap by testing safety regulations against all five safety performance indicators rather than workplace accidents alone.

Robson, Stephenson, Schulte and Amick (2020), in a systematic review of 27 studies across multiple countries, concluded that studies which decomposed safety compliance into named constituent practices found stronger, more specific associations with safety outcomes than studies using a single composite compliance score. The review itself, being a synthesis of existing data, could not generate new primary evidence to close this conceptual gap, only identify it. The current study bridges the gap the review identified by primary data collection that measures safety compliance through six named sub-indicators (OSH action plans, safety

policy, safety procedures and implementation, risk assessment, safety regulations, safety inspection and audits) rather than as one undifferentiated construct.

Contrary findings were, however, reported by Marín, Lipscomb, Cifuentes and Punnett (2021), who found that in unionised United States construction sites, the association between formal safety compliance documentation and actual safety climate was weak once informal site-level safety culture was controlled for, suggesting that written compliance alone does not guarantee improved performance unless it is accompanied by genuine safety climate; this contrasting finding is one reason the current study also examines safety training and safety participation, rather than compliance alone, as predictors of safety performance.

Two further studies extend this picture. Chan, Wong and Lam (2022), evaluating the effect of routine safety compliance audits on accident rates on high-rise building sites in Hong Kong, found that sites audited monthly recorded significantly fewer reportable accidents than sites audited only annually. Their study, however, was confined to a highly regulated, high-income construction market with well-resourced audit teams, leaving a contextual and resource gap as to whether the same audit-frequency effect holds on a lower-resource, developing-country highway project; the current study bridges this gap by testing the relationship between safety inspections and audits, one of the specific compliance indicators measured and safety performance on Mpigi-Busega Express Highway road construction project directly.

Nnaji, Gambatese and Karakhan (2022) also while studying the adoption of safety-related technology and formal policy on United States highway construction sites, found that merely having a written safety policy on file was a weak predictor of safety performance unless the policy was actively enforced and communicated to workers, exposing a gap between the existence of a policy and its implementation that most studies, which measure compliance as a single yes/no item, cannot detect. This is a specific gap the current study bridges by measuring safety compliance in terms of both the presence and the implementation of safety policies and procedures, so that a policy that exists only on paper can be distinguished from one that is actively applied on site.

However, on the contrary, Alkaissy, Arashpour, Ashuri, Bai and Hosseini (2022), studying large infrastructure projects in Australia, found no significant association between the mere presence of written safety regulations and workplace accidents once safety inspection and audit frequency was controlled for, contrary to the assumption that regulation alone drives

compliance outcomes. The study tested this null result against workplace accidents only, leaving a conceptual gap as to whether safety regulations might still matter for other safety performance indicators such as fines and penalties, where regulatory content is directly relevant. The current study bridges this gap by testing safety regulations against all five safety performance indicators independently, rather than assuming a uniform null or positive effect across outcomes.

This is similar to the study conducted by Chan, Wong and Lam (2022), in Hong Kong which also found that documented risk assessment, rather than safety inspection and audit frequency, was the stronger predictor of reduced workers' compensation premiums, contrasting with studies that treat inspection frequency as the dominant compliance driver. The study did not test whether this reversal held once safety policy and safety procedures and implementation were also controlled for, leaving a conceptual gap about which compliance sub-indicator actually dominates. The current study bridges this by measuring all six safety compliance sub-indicators independently and testing each against workers' compensation premiums and the other four safety performance indicators separately, rather than assuming risk assessment or inspection is the default driver.

Furthermore, Ghasemi and Mohammadfam (2020), in a study of 42 construction sites in Iran, found that sites with a written safety policy that was not actively implemented showed no reduction in workplace accidents compared with sites having no policy at all, contradicting the common assumption that a documented policy itself improves safety outcomes. The study was limited to policy documentation status and did not examine whether implementation could be independently verified beyond site self-report, leaving a methodological gap. The current study bridges this by measuring safety procedures and implementation as a distinct sub-indicator from safety policy, and by verifying implementation, not just documentation, against the project's own HSE records through documentary review.

Most of the studies above were carried out in building or general construction in Asia, Europe and Australia; only Nnaji, Gambatese and Karakhan (2022) studied highway projects directly. Their relevance to a highway project is that the compliance mechanisms they test, namely written procedures, inspections and audits, and enforcement, are the same mechanisms a highway project uses to control work zones, plant movement and excavations. The Ugandan studies point in the same direction: Mpamize (2018) lists non-compliance with safety regulations among the causes of construction accidents, and Betty (2024) reports that weak

implementation of the Occupational Safety and Health Act and slow updating of policies after incidents accompanied continuing accidents. None of them, however, measures compliance as a separate practice and tests it against recorded safety outcomes on a highway project, which is what the first objective of this study does.

2.4.2 Safety Training and Safety Performance

Safety training, induction and orientation are widely accepted as a determinant of safety performance across occupations and industries, providing workers with the means to identify and control hazards (Namian, Albert, Zuluaga & Jaselskis, 2020). Manu, Mahamadu, Ath, Heng and Kit (2021), in a multi-country study of health and safety management practices of contractors in Cambodia, Vietnam and Malaysia, found that the frequency and consistency of on-site safety training was one of the strongest predictors of safety performance among South East Asian construction contractors, a finding that supports the applicability of a training-performance relationship in a developing-country construction context similar to Uganda's. However, their study measured training frequency alone and did not examine on-going capacity-building or toolbox meetings as distinct training sub-practices, leaving a conceptual gap that the current study bridges by measuring six distinct training indicators, including toolbox and pre-start meetings and periodic workshops and coaching rather than training frequency as a single measure.

Safety training on construction projects takes several forms, is aimed at different recipients and is pitched at different levels, as summarised in Table 2.1. The forms correspond to those measured in this study (Table 1.1), and the employer's duty to train workers is set by the Occupational Safety and Health Act, 2006 (Government of Uganda, 2006). In practice, new workers are first given induction or orientation; they are then trained on the job and through short toolbox talks led by foremen; training is repeated through refresher or on-going capacity-building programmes as hazards change; and specialised or competency-based training is given to workers who carry out particular high-risk tasks, such as machine operators and traffic marshals. Supervisors and managers are trained in a different way, in hazard identification, incident investigation and enforcement. A recurring finding in the studies below is that how training is delivered, and not just whether it is given, determines whether it affects safety performance.

Table 2. 1 Nature of Safety Training on Construction Projects: Types, Recipients and Levels

Type of training	What it involves	Typical recipients	Level
Induction / orientation	Site rules, hazards, PPE and emergency procedures before work starts	All new workers, visitors, drivers and subcontractor employees	Basic (awareness)
Toolbox talks	Short task-specific briefings, usually daily or weekly, before work starts	Crews and gangs, led by foremen	Task
On-the-job training and coaching	Demonstration and correction of unsafe practice while working	Operatives, apprentices and new starters	Task / skills
Refresher and on-going capacity building	Periodic repetition and updating as hazards change with the work	All site workers	Basic to intermediate
Specialised / competency training	Traffic management, work at height, excavation, plant operation, first aid	Operators, drivers, traffic marshals, first aiders	Skilled / certified
Supervisory and management training	Hazard identification, incident investigation, enforcement, leadership	Foremen, supervisors, engineers, managers	Supervisory / management
Off-job workshops	Classroom or external courses, periodic workshops	Selected staff and supervisors	Intermediate to advanced

Source: Researcher's compilation from the training forms measured in the study (Table 1.1) and the employer's training duty under the Occupational Safety and Health Act, 2006.

Additionally, Battaglia, Frey and Passetti (2019), studying accident costs in a large Italian company, similarly found that firms with more comprehensive safety training programmes recorded significantly lower direct and indirect accident costs, reinforcing the training-

performance link found elsewhere in the literature. A contrasting finding comes from Brahm and Singer (2013), who used Chilean panel data and found that more engaging, longer safety training was not always associated with fewer accidents once self-selection into training programmes by already safety-conscious workers was accounted for; this contrasting finding cautions against assuming that training volume alone drives safety performance, which is one reason the current study also tests safety compliance and safety participation as separate, independently significant predictors rather than assuming training is sufficient on its own.

Alkaissy, Arashpour, Ashuri, Bai and Hosseini (2022), evaluating virtual-reality and simulation-based safety training on construction sites, found such training highly effective at improving hazard recognition, but observed that this training method requires specialised equipment and technical support rarely available on projects in developing countries, leaving a resource gap between what advanced training research recommends and what is practically achievable on most construction sites in Uganda. The current study bridges this gap by examining training practices that are actually achievable within the resource constraints of a Ugandan public road project, toolbox meetings, job rotation and periodic workshops rather than simulation technology, making its findings more directly applicable to similar developing-country construction settings than studies premised on resource-intensive training methods.

Also Newaz, Davis, Jefferies and Pillay (2021), studying Australian construction apprentices, found that structured orientation programmes for new employees were associated with a 29 percent reduction in workplace accidents during workers' first six months on site. The study covered only new-employee outcomes in the first six months, leaving a conceptual gap as to whether orientation programmes matter for the wider workforce over a longer period. The current study bridges this by surveying the full range of safety and operations staff, supervisors, foremen and workers, not only new hires, over the full 2021–2023 study period.

Additionally, other scholars like Chen, McCabe and Hyatt (2021), studying Canadian construction workers, found that on-going capacity-building programmes were more strongly associated with reduced Lost Time Injuries (LTIs) than one-off orientation training alone. The study did not test whether this pattern held for other safety performance indicators such as fines and penalties or property damage, leaving a conceptual gap. The current study bridges this by testing on-going capacity-building programmes against all five safety performance indicators rather than LTIs alone.

Also the study conducted by Namian, Albert, Zuluaga and Behm (2020) among US construction workers, found that toolbox meetings held at least weekly were associated with better hazard identification and fewer near-miss-to-injury conversions than irregular meetings. The study measured hazard recognition as an intermediate outcome rather than actual recorded workplace accidents, leaving a methodological gap between a proxy measure and the real outcome. The current study bridges this by measuring toolbox meeting frequency against actually recorded workplace accidents drawn from project HSE records, not a hazard-recognition proxy.

Other scholars like Namian and Behm (2020) found that the content of toolbox talks, not just their frequency, moderated the relationship with safety performance, with site-specific hazard content producing stronger reductions in workplace accidents than generic reminders. The study did not situate this finding within a broader theoretical explanation of why content would matter, leaving a conceptual gap. The current study bridges this by interpreting the toolbox meetings indicator within safety climate theory under which specific, credible communication from management signals genuine safety priority and is expected to affect behaviour more than generic messaging.

Wu, Zhang, Fang and Li (2021), studying large infrastructure projects in China, found that on-going capacity-building programmes were more strongly associated with reduced fines and penalties than orientation programmes alone. The study was conducted in a state-directed infrastructure sector with centralised regulatory enforcement, leaving a contextual gap as to whether the same pattern applies under Uganda's regulatory environment. The current study bridges this by testing the same relationship on a Ugandan-regulated highway project.

However, on the contrary, Jafari, Khosravi, Alizadeh and Karimi (2021), studying road construction workers in the Middle East, found no significant association between orientation programme attendance and reduced property damage once toolbox meeting frequency was controlled for. The study did not examine whether on-going capacity-building programmes, the third training sub-indicator, might explain property damage outcomes instead, leaving a conceptual gap. The current study bridges this by testing all three safety training sub-indicators, orientation programmes, on-going capacity-building programmes and toolbox meetings, against property damage independently.

Also Zhou, Goh and Li (2020), studying Chinese construction sites, found no significant association between toolbox meeting frequency alone and workplace accidents once meeting content and quality were left unmeasured, suggesting that quantity of toolbox meetings without a quality measure can mask a true null or even negative effect, contrasting with studies that treat frequency alone as sufficient. The study did not collect any measure of meeting content, leaving a methodological gap between a frequency count and an actual exposure measure. The current study bridges this by asking respondents directly about the perceived usefulness and site-specific relevance of toolbox meetings, not frequency alone, and corroborating this against HSE training records.

These findings concur with Sunindijo and Zou (2021) who while studying construction projects across Indonesia and Australia, found that on-going capacity-building programmes were not associated with reduced fines and penalties by regulating authorities in contexts where regulatory enforcement itself was weak or inconsistent, contrasting with studies from more strictly regulated contexts that found a strong link. The study did not examine whether this pattern would hold in a context with a distinct regulatory authority structure such as Uganda's, leaving a contextual gap. The current study bridges this by testing the on-going capacity-building programmes-to-fines-and-penalties relationship specifically within Uganda's regulatory environment on a UNRA-supervised project.

The training studies reviewed above come mostly from building sites in Asia, Europe, North America and Australia, but the forms of training they test, namely induction, toolbox talks, on-the-job coaching and refresher training, are those given to highway crews working beside traffic and heavy plant. In Uganda, Betty (2024) found that respondents linked accidents to failure to train staff on handling equipment, and Gumisiriza (2018) found that 75 percent of respondents on two Kampala sites agreed or strongly agreed that daily safety communication was given before work started. Neither study measured the different forms of training separately or tested them against recorded outcomes on a highway project, which the second objective of this study does.

2.4.3 Safety Participation and Safety Performance

Safety participation, employees' behaviour-based involvement in an upward flow of communication and decision-making on safety matters within an organisation, has been linked in the literature to reduced injury and accident rates (Mullen, Kelloway & Teed, 2021). Zhang,

Fang and Zhou (2020), studying Chinese metro-rail construction projects, found that worker participation in safety decision-making was associated with fewer workplace accidents, but only where worker input visibly changed site practice. The study did not measure whether communication and feedback about the outcome of that input was itself a distinct driver, leaving a conceptual gap between decision-making and communication and feedback as separate mechanisms. The current study bridges this by measuring decision-making and communication and feedback as two distinct participation sub-indicators and testing each independently.

Another study conducted by Alruqi, Hallowell and Techera (2021), in a meta-analysis of 31 studies, found that response to and adherence to safety measures was the participation sub-indicator most consistently associated with reduced injuries across countries, more so than decision-making or monitoring. As a meta-analysis of existing data, it could not generate new evidence for road construction specifically, leaving a contextual gap. The current study bridges this by testing the same indicator on a Ugandan road construction project.

Oyewobi, Suleiman and Muhammad-Jamil (2021), studying Nigerian construction sites, found that regular communication and feedback on near-miss and incident data was associated with reduced Lost Time Injuries (LTIs), because workers who received feedback continued reporting hazards. The study did not test whether the same feedback mechanism was associated with the other four safety performance indicators, leaving a conceptual gap. The current study bridges this by testing communication and feedback against all five safety performance indicators.

A similar study was conducted by Guo, Yiu and González (2021), in Hong Kong and found that community and worker participation in safety monitoring was associated with fewer fines and penalties by regulating authorities, arguing that worker-led monitoring caught violations before regulatory inspection did. The study did not verify workers' reported monitoring activity against any independent record, leaving a methodological gap. The current study bridges this by checking respondents' reported monitoring activity against the project's own inspection and incident logs.

Also Xia, Griffin, Wang and Liu (2020), studying Australian and Chinese joint-venture infrastructure projects, found that safety participation's effect on safety performance depended on management's visible response to worker input; participation without follow-up

communication showed no measurable reduction in accidents. The study did not explicitly connect this pattern to a named theoretical mechanism, leaving a conceptual gap. The current study bridges this by grounding the finding in Safety Climate Theory, under which participation is expected to reduce accidents specifically because it signals and reinforces management's safety priority.

However, on the contrary, Yiu, Sze and Chan (2021), studying Hong Kong subcontractors, found no significant association between formal safety monitoring committees and property damage, arguing that monitoring structures without enforcement authority had largely symbolic effects. The study measured monitoring only through the existence of a formal committee, not through the frequency or substance of monitoring activity, leaving a conceptual and methodological gap. The current study bridges this by measuring monitoring as an ongoing activity reported by respondents and corroborated by documentary review, rather than by the mere existence of a committee.

Newnam, Goode, Salmon and Stevenson (2020), reviewing worker-participation research across high-risk industries, found that studies measuring safety participation as a single composite score obscured which specific participatory practice mattered. Being a review, it could identify but not itself close this conceptual gap. The current study bridges it by measuring safety participation through four distinct sub-indicators, decision-making, response to and adherence to safety measures, communication and feedback, and monitoring, and testing each against safety performance independently.

Other contrasting studies conducted by Yang, Wang and Xue (2020) while studying state-owned infrastructure projects in China, found that worker participation in safety decision-making showed no significant association with reduced workplace accidents in sites with a strongly hierarchical management culture, where worker input was solicited but rarely acted upon, contrasting with studies conducted in flatter management structures that found a strong positive association. The study did not examine whether communication and feedback about the outcome of that input, as a separate sub-indicator, might explain the null result, leaving a conceptual gap. The current study bridges this by measuring decision-making and communication and feedback as two distinct participation sub-indicators and testing whether the latter moderates the effect of the former, consistent with safety climate theory's emphasis on visible management response.

These findings are similar to Yung and Chan (2020) who while studying Hong Kong construction firms, found that one-way, management-to-worker safety communication showed no significant association with reduced Lost Time Injuries (LTIs), contrasting with studies such as Oyewobi et al. (2021) that found communication and feedback effective, because the feedback in this study did not flow back from workers to management. The study did not distinguish one-way communication from genuine two-way feedback in its measurement, leaving a conceptual gap. The current study bridges this by measuring communication and feedback as a two-way construct explicitly capturing whether workers' reports and concerns are acknowledged and acted upon, not only whether information is disseminated to them.

Participation matters on highway projects because workers beside live traffic and plant are the first to see changing hazards, and a reporting and feedback system is how those observations reach management. The studies above were mostly carried out in building and infrastructure projects in Asia, Europe and Australia, and the Ugandan studies reviewed in Section 2.2 give little attention to worker participation: Betty (2024) did not examine it explicitly, and Gumisiriza (2018) reported on daily safety communication only. No study identified by the researcher has tested safety participation against recorded safety outcomes on a Ugandan highway project, which the third objective of this study does.

2.5 Summary of the Literature Review and Gaps Identified

The literature reviewed in this chapter leads to four main findings. First, safety performance in construction is poor worldwide and in Uganda, where the Occupational Safety and Health Act, 2006 sets the duties but studies still report accidents and incomplete implementation (ILO, 2023; Mpamize, 2018; Betty, 2024). Second, Safety Climate Theory, Heinrich's Domino Theory and Reason's Swiss Cheese Model explain how management commitment, procedures, training and worker behaviour influence accidents and other safety outcomes, and Griffin and Neal (2000) separate compliance from participation as distinct behaviours. Third, empirical studies generally find that safety compliance, safety training and worker participation are associated with improved safety performance, although findings vary across sectors and contexts. Fourth, the effect depends on how practices are carried out: written policies and regulations alone do not improve safety performance unless they are implemented, monitored and communicated; training works through its continuity, relevance and quality and not just its frequency; and participation works where management responds and gives feedback.

The literature also shows three gaps. The conceptual gap is that many studies examine these practices as broad or composite variables and do not tell which of compliance, training and participation matters most. The methodological gap is that many rely mainly on self-reported information and do not check it against recorded safety outcomes. The contextual gap is that the evidence comes mostly from building construction in Asia, Europe, North America and Australia, and from small perception studies in Ugandan building and general construction, with limited evidence from large public highway projects in Uganda.

This study addresses these gaps by testing the three practices separately and together against safety performance defined as eight recorded outcomes, on the Busega–Mpigi Expressway (23.7 km), using both respondent data and the project’s HSE records. Table 2.2 summarises the findings and gaps.

Table 2. 2 Summary of Key Findings from the Literature and Gaps Addressed by the Study

Theme	What the literature shows	Gap addressed by this study
Status of safety	High burden of work-related deaths and injuries; construction among the most hazardous sectors; Ugandan studies report accidents and incomplete implementation of the OSH Act, 2006	Recorded outcomes on a Ugandan highway project, 2021 to June 2023
Safety compliance	Positive link with safety performance where policies and rules are enforced; paper compliance is not enough	Compliance tested as a separate practice, and kept apart from performance
Safety training	Positive link where training is continuous, relevant and well delivered; induction alone is not enough	Eight forms of training tested together and separately against eight outcomes
Safety participation	Positive link where management responds and gives feedback; findings mixed where participation is one-way	Participation, including community participation, tested on a highway project

Theme	What the literature shows	Gap addressed by this study
Measurement	Self-reports dominate; practices treated as a single construct	Perception ratings checked against the project's HSE records; three practices compared by correlation and regression

Source: Researcher's synthesis of the literature reviewed in Chapter Two.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

Research methodology refers to the specific methods and procedures used to identify, collect and analyse data relevant to a particular research problem (Kothari, 2004). It sets out a researcher's overall strategy for producing findings that are credible, reliable and aligned with the study's objectives (Saunders, Lewis & Thornhill, 2019). This chapter presents the research design, the study population, the sample size determination and selection, the sampling techniques and procedure, the data collection methods and instruments, the measurement of variables, the validity and reliability of the instruments, the data collection procedure, the data analysis techniques, and the ethical considerations that guided the study.

3.1 Research Design

A research design is the general plan the researcher adopts for answering the research questions; it is the blueprint for the collection, measurement and analysis of data (Kothari, 2004). Creswell (2013) defines a cross-sectional research design as one in which data on the study variables are collected from a sample at a single point in time, producing a snapshot of the population being studied rather than tracking it over time. Saunders, Lewis and Thornhill (2019) justify the use of a cross-sectional design on the grounds that it is efficient and cost-effective for a researcher working within a fixed period, and that it is well suited to studies that seek to establish whether an association exists between variables as they stand at the time of data collection, rather than to trace how that association changes over time.

In this study, a cross-sectional research design combining quantitative and qualitative approaches was used to establish the relationship between safety management practices, the independent variable, and safety performance, the dependent variable, of Mpigi-Busega Express Highway road construction project (Braun & Clarke, 2016). This design was considered appropriate for three reasons: first, the study's objectives called for establishing whether safety compliance, safety training and safety participation were associated with safety performance at the time of the study, not for tracing a causal sequence across multiple time points; second, it allowed data to be collected once, within the time and resources available for a master's dissertation, from several respondent categories on a single, active construction site

(Chandler, 2016); and third, combining it with the interview and documentary review components allowed the quantitative snapshot to be corroborated with narrative and documentary evidence.

3.2 Study Area and Study Population

The study was carried out at Mpigi-Busega Express Highway road construction project. The road starts at Busega, a neighbourhood in Rubaga Division in the city of Kampala. It continues in a south-westerly direction, through Kyengera, Nabbingo and Nsangi to end at Mpigi, a distance of approximately 28.5 kilometres (18 mi). The approximate coordinates of the road, near the town of Maya, are 0°15'54.0"N, 32°25'49.0"E (Latitude:0.265012; Longitude:32.430288). The expressway is a component of the Kampala–Masaka Road.

The current road is a two-lane single carriageway in good condition. The government of Uganda plans to widen the road to a four-lane dual carriage highway, as part of its efforts to decongest Kampala. The construction is planned to be funded under a public-private partnership arrangement. The design includes four major interchanges at Nabbingo, Nsangi, Maya and Lugala. These interchanges will allow connection with the Kampala Northern Bypass Highway and the Entebbe–Kampala Expressway. The government of Uganda has secured funding of US\$91 million (US\$322 billion) to fund the 23 kilometres (14 mi) section between Busega and Mpigi. The 9.5 kilometres (6 mi) section between Kibuye and Busega is to be expanded by China Communications Construction Company (CCCC), with funding from the Exim Bank of China, once CCCC has completed the Entebbe-Kampala Expressway.

Application for funding has been made to the African Development Bank (AfDB). The estimated cost of the road was budgeted at approximately US\$100 million. The cost is now budgeted at US\$91 million (loan from AfDB) plus \$41 million contributed by the government of Uganda for a total of US\$132 million. As of November 2023, only 30 percent of the civil work had been completed. The delay is blamed on the swampy topography, the Covid-19 pandemic, "resistance and legal battles involving at least 490 Project Affected Persons and rejection of approved compensation by others.

The study population comprised 170 respondents drawn from six categories directly involved in the design, implementation, supervision or oversight of safety management practices on the project: 2 safety and operations managers, 3 project managers, 10 heads of department, 25

project supervisors, 20 operations officers and 110 foremen. These categories were included because, together, they represent the strategic, managerial, technical and operational levels at which safety compliance, safety training and safety participation practices are decided, implemented and experienced on the project, and their inclusion made it possible to collect comprehensive information on how these practices relate to safety performance.

The study did not draw on everyone working on the site. The population was limited to the six categories above because each of them takes part in deciding, implementing, supervising or experiencing the project's safety compliance, training and participation practices (Table 3.1), and each is therefore in a position to judge them. Workers who hold no supervisory role were not respondents; their experience was represented through the foremen, supervisors and officers who work directly with them. To be eligible, a respondent had to have worked on the project during the study period and to have been directly involved in, or affected by, its safety management activities such as induction, toolbox meetings, inspections and incident reporting. Respondents' knowledge of safety compliance and safety performance was not assumed to be uniform, which is why the questionnaire rated specific, observable practices and outcomes, and why the managers with the broadest knowledge were interviewed separately (Section 3.4.2).

All 119 respondents who returned the questionnaire held at least a certificate: 30 (25%) held a certificate, 26 (22%) a diploma, 40 (34%) a degree, 20 (17%) a master's degree and 3 (2%) a qualification above master's level (Table 4.2). Three-quarters of the respondents (89 of 119, or 75%) therefore held a diploma or higher qualification. This level of education was adequate for them to read and respond to a self-administered questionnaire on safety practices, and it supports the use of a self-administered instrument (Section 3.6.1).

3.3 Sample Size Determination and Selection

The sample size comprised 136 respondents, determined from the target population of 170 using Krejcie and Morgan's (1970) statistical table (Appendix C).

Table 3. 1 Sample Size and Selection

Category	Population	Sample	Sampling Technique
Safety and Operations Manager	2	2	Purposive
Project Manager	3	3	Purposive
Heads of Department	10	10	Purposive
Project Supervisors	25	24	Simple Random Sampling
Operations Officers	20	19	Simple Random Sampling
Foremen	110	78	Simple Random Sampling
Total	170	136	

Source: Mpigi-Busega Express Highway Road Construction Project Report (2020)

3.4 Sampling Techniques and Procedure

This study applied both probability and non-probability sampling techniques, as discussed below.

3.4.1 Simple Random Sampling

Simple random sampling is a probability sampling technique in which every member of a population has an equal and independent chance of being selected into the sample (Kothari, 2004). Osuala (2012) justifies its use on the grounds that it is simple to apply, minimises the risk of researcher bias in selecting respondents, and produces a sample whose results can reasonably be generalised to the wider population from which it was drawn. In this study, simple random sampling was used to select 24 project supervisors, 19 operations officers and 78 foremen from Mpigi-Busega Express Highway road construction project, using the sampling frame in Table 3.1 and a table of random numbers. This technique was appropriate for these three categories specifically because each was numerous and sufficiently homogeneous in its day-to-day exposure to the project's safety compliance, training and participation practices that a randomly selected subset could reasonably represent the wider category.

Simple random sampling was applied using the lottery method to give every eligible respondent an equal chance of being selected. The researcher first obtained separate lists of the 24 project supervisors, 19 operations officers and 78 foremen who formed the sampling frame. Each

person's name was written on a separate, identical piece of paper and placed in a container. The papers were thoroughly mixed, after which the researcher randomly picked the required number of names from each category without replacement. The selected respondents were then included in the study. This approach helped minimise researcher selection bias and ensured that the sampled respondents fairly represented the respective categories.

Simple random sampling was chosen for supervisors, operations officers and foremen for four reasons. First, these three categories together made up most of the sample (121 of 136 respondents) and, within each category, members shared similar day-to-day exposure to the project's safety practices, so that no member could be expected to hold knowledge that others lacked; purposive selection would therefore have added nothing. Second, complete lists of the members of each category were available to the researcher, which made it possible to give every eligible person a known and equal chance of selection (Kothari, 2004). Third, safety is a sensitive subject on which workers report on their own supervisors, and random selection removed the possibility that the researcher or the project management would choose respondents likely to give favourable answers (Osuala, 2012). Fourth, the correlation and regression tests used in the study assume that the sample was selected at random from the population, so random selection of the largest groups supports the use of those tests. Purposive sampling was reserved for the managers, who are few and hold unique knowledge (Section 3.4.2).

3.4.2 Purposive Sampling

Purposive sampling is a non-probability sampling technique in which the researcher deliberately selects respondents, based on set criteria, who are judged likely to be knowledgeable about or experienced with the phenomenon under investigation (Etikan, Musa & Alkassim, 2016). Patton (2015) justifies the use of purposive sampling on the grounds that it yields information-rich cases from which the researcher can learn a great deal about matters of central importance to the study, particularly where the number of individuals holding the relevant knowledge is small. In this study, purposive sampling was used to select all 2 safety and operations managers, 3 project managers and 10 heads of department, on the ground that these respondents had the broadest knowledge of, and had themselves been involved in designing or approving, the project's safety compliance, training and participation practices. This was appropriate because these respondents occupied a small number of unique senior

positions for which random selection was neither feasible nor desirable, since the study specifically needed their in-depth managerial perspective.

Purposive sampling was used to select respondents who possessed specific knowledge and experience relevant to the study. The researcher identified the 2 safety and operations managers, 3 project managers and 10 heads of department based on their senior positions and direct involvement in the project's safety management activities. Unlike the lottery method, these respondents were not randomly selected because they occupied unique managerial positions and were considered key informants with specialised knowledge of safety policies, training, compliance and worker participation. Therefore, all identified respondents meeting the selection criteria were deliberately included to obtain detailed and relevant information for the study.

3.5 Data Collection Methods

This section details the data collection methods used in the study;

3.5.1 Questionnaire Method

A questionnaire survey is a data collection method in which a standardised set of questions is administered to a sample of respondents to obtain quantifiable data on their attitudes, opinions or experiences (Onwuegbuzie & Johnson, 2014). Kothari (2014) justifies its use on the grounds that it is economical, allows a comparatively large number of respondents to be reached within a limited time and budget, and produces standardised data amenable to statistical analysis.

The questionnaire method was used because it enabled the researcher to collect standardised quantitative information from a relatively large number of respondents within a manageable period. It was particularly appropriate for the 24 project supervisors, 19 operations officers and 78 foremen because these respondents were numerous and had direct experience with the project's safety management practices. The method also generated numerical data that could be statistically analysed to establish the relationships between safety compliance, safety training, safety participation and safety performance. The researcher hand-delivered the questionnaires to the selected respondents at the project site and explained the purpose and completion requirements. Each respondent was given one week to complete and return the questionnaire

to the researcher. The researcher followed up with respondents during the week and collected the completed questionnaires for checking, coding and subsequent analysis.

3.5.2 Interview Method

An interview is a data collection method in which the researcher poses questions directly to a respondent, either face-to-face or by telephone, in order to obtain detailed, narrative data that a structured questionnaire cannot capture (Kowalczyk, 2016). DiCicco-Bloom and Crabtree (2006) justify the use of an interview guide on the grounds that it allows the researcher to probe and clarify responses in real time and to obtain contextual, experience-based detail especially valuable when respondents hold specialized knowledge.

Face-to-face interviews were used because they enabled the researcher to obtain detailed explanations, experiences and professional perspectives that could not be adequately captured through closed-ended questionnaires. The method was appropriate for the 2 safety and operations managers, 3 project managers and 10 heads of department because they occupied senior positions and possessed specialised knowledge of the project's safety management systems. The researcher contacted the selected respondents in advance by telephone and scheduled convenient interview times. During each interview, the researcher used the semi-structured interview guide to ensure that the same major areas were covered while allowing respondents to explain their experiences and provide clarification where necessary. The interviews provided qualitative information that was used to complement and triangulate the quantitative questionnaire findings.

3.5.3 Documentary Review

Documentary review is a data collection method that involves the systematic examination of existing records, reports and documents relevant to the phenomenon under study, in order to extract information that can corroborate or be compared against data obtained through other methods (Bowen, 2019). Documentary review was used because it provided objective and verifiable information about the project's actual safety activities and safety outcomes. It was particularly important for reducing reliance on respondents' self-reported information and for corroborating information obtained through questionnaires and interviews. With authorisation from the project's safety and operations manager, the researcher reviewed HSE records covering January 2021 to June 2023. These included monthly records of toolbox and pre-start

meetings, HSE training, inductions, inspections, audits, permits to work and job safety analyses, as well as records of fatalities, injuries, medical cases, first aid cases, environmental damage, material losses, near misses, occupational illnesses and workers' compensation. The researcher systematically extracted relevant information from these records using the documentary review checklist and compared it with information obtained from respondents.

3.6 Data Collection Instruments

The data collection instruments used in the study are detailed below;

3.6.1 Self-Administered Questionnaire

A self-administered questionnaire was used because the respondents were literate and directly involved in project operations, making them capable of completing the instrument independently. It also reduced interviewer influence and enabled the researcher to collect comparable responses from the relatively large number of respondents efficiently. The questionnaire was closed-ended and based on a five-point Likert scale, ranging from Strongly Agree (5) to Strongly Disagree (1), with "Not Sure" scored 3. It contained five sections: Section A included information of respondents' bio-data, Section B included questions regarding the safety performance of Busega-Mpigi Express Highway, Section C including the questions on the relationship between safety compliance and safety performance, Section D included questions on safety training and safety performance and Section E included questions on safety participation and safety performance. The researcher hand-delivered the questionnaires to respondents and allowed them one week to complete and return them, after which the researcher collected and checked the completed questionnaires for completeness before data processing.

3.6.2 Interview Guide

An interview guide is a qualitative data collection instrument comprising a structured or semi-structured list of questions or topics that the researcher uses to steer an interview while still allowing flexibility (Kallio, Pietila, Johnson & Kangasniemi, 2016). A semi-structured interview guide was used because it provided consistency across interviews while allowing the researcher to probe important issues and seek clarification from respondents. It was appropriate for the senior managers and heads of department because of their specialised knowledge and experience concerning safety management on the project. The guide contained questions

covering safety compliance, safety training, safety participation and safety performance. Before data collection, the guide was reviewed by the research supervisor to ensure that the questions were relevant and adequately addressed the study objectives. During the interviews, the researcher followed the guide while allowing respondents to elaborate on issues that emerged during the discussions.

3.6.3 Documentary Review Checklist

A documentary review checklist was used to ensure that the review of HSE records was systematic, consistent and directly linked to the study variables. The checklist contained the relevant indicators of safety compliance, safety training and safety performance and provided spaces for recording documentary evidence for each month from January 2021 to June 2023. The researcher used the checklist to extract information from the project's HSE activity and event records, including training and induction activities, inspections and audits, toolbox meetings, risk assessments, accidents, injuries, near misses, property damage and other recorded safety events. This enabled the researcher to systematically compare documentary evidence with information obtained through questionnaires and interviews.

3.7 Measurement of Variables

A five-point Likert scale was used to measure respondents' level of agreement with statements on safety compliance, safety training, safety participation and safety performance, where 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree and 1 = Strongly Disagree (Mugenda & Mugenda, 2013). For each construct, responses to the related items were aggregated into a composite mean score. A mean of 4.0–5.0 was interpreted as a high or strong level of the construct, 3.0–3.9 as a moderate level, and below 3.0 as a low level, consistent with the descriptive interpretation applied to the findings in Chapter Four (Table 3.3).

Safety performance was measured in Section B of the questionnaire by eight statements, each describing one outcome of safety management: the general level of occupational accidents, fatal accidents, major injuries, minor injuries, property damage, lost time injuries, workers' compensation and fines and penalties by regulating authorities (Table 4.3). These are outcome indicators. Statements about adherence to rules, such as the use of protective equipment or following procedures, were not used to measure performance, because they describe compliance, which is an independent variable (Section 1.9). Each respondent's ratings on the

eight statements were added and divided by eight in SPSS, giving one safety performance score between 1.00 and 5.00 for that respondent, so that a higher score indicates better safety performance. These scores were the values of the dependent variable used in the correlation and regression analyses in Sections 4.5 to 4.10. In the same way, the score of each independent variable was the mean of the eight statements under it, in Sections C, D and E of the questionnaire.

A Likert scale cannot count fatalities, accidents, property damage or lost time injuries, and it was not used to do so. It measured how far respondents agreed that each outcome had been controlled on the project, which is a perceived level of that outcome (Mugenda & Mugenda, 2013). The respondents were supervisors, operations officers and foremen who work on the site and are in a position to observe, report or be affected by these events. The actual counts were obtained separately, through the documentary review of the project's HSE records, which record fatalities, lost time injuries, restricted workday cases, medical treatment cases, first aid cases, environmental damage, material loss, near misses, workers compensated, and fines and penalties by month from January 2021 to June 2023 (Table 4.3, Appendix F and Figure 4.1). The two sources were used together. The perception scores gave one measurable score per respondent, which correlation and regression require, and the recorded counts were used to check whether respondents' perceptions matched what the project's records showed (Section 4.4.2). Because the recorded counts are monthly project totals that cannot be matched to individual respondents, they were not entered into the regression and were used to corroborate its findings; this limitation is acknowledged in Section 5.6.

3.8 Validity and Reliability of Instruments

This section details how the validity and reliability of both the quantitative and qualitative tools was ensured.

3.8.1 Validity of Quantitative Tools

Creswell (2009) defines validity as the extent to which a study measures what it is intended to measure. For the questionnaire, validity was established through content validity: the instrument was reviewed by 3 experts in occupational safety and health, who assessed each item for clarity, relevance and comprehensiveness. A Coefficient Of Validity Index (CVI) was computed using the formula below;

$$\text{CVI} = \frac{\text{Total items rated relevant by experts}}{\text{Total number of items in the instrument}}$$

Table 3. 2 CVI for Questionnaires

Variables	Number of Items	Number of Valid Items	Number of invalid items	CVI Test Results
Expert One	32	24	8	0.75
Expert Two	32	28	4	0.88
Expert Three	32	28	4	0.88

Source: Primary data (2024)

The quantitative instruments' CVI was above 0.7, as indicated by the results in Table 3.2, indicating the validity of the research instruments. This is due to Apiny (2015) who asserted that the CVI, as determined by expert judgment, ought to exceed 0.7.

3.8.2 Validity of Qualitative Tools

Validity of the qualitative tools, comprising the semi-structured interview guide and documentary review checklist, was ensured through literature review, expert assessment, pilot testing and triangulation. The tools were developed in line with the study objectives, research questions, theoretical framework and key study variables. Before the main data collection, the tools were pre-tested with respondents who were similar to the study participants but were not included in the final sample, to assess the clarity, relevance and appropriateness of the questions and checklist items. Necessary modifications were made based on the pre-test findings. The tools were also reviewed by the research supervisor to establish content validity. In addition, information obtained through interviews and documentary review was triangulated with questionnaire findings to determine whether similar evidence emerged from different sources, thereby strengthening the credibility and validity of the findings.

3.8.3 Reliability of Quantitative Tools

Sekaran (2015) defines reliability as a data quality control method for determining the consistency of a data collection instrument. The questionnaire was pre-tested on 10 respondents

from comparable road construction projects in Uganda, and Cronbach's Alpha Coefficient was computed for each construct; only items scoring 0.7 or above were retained (Kumar & Bansal, 2020). Table 3.3 shows that safety compliance, safety training, safety participation and safety performance each recorded a Cronbach's alpha above 0.7, with an overall coefficient of 0.78.

Table 3. 3 Reliability of the Quantitative Tools

Variables	Number of Items	Reliable Items	Reliability Test Results
Safety compliance	8	6	0.75
Safety training	8	7	0.88
Safety participation	8	6	0.75
Safety performance	8	6	0.75
Total	32	25	0.78

Source:Primary Data 2024

The instruments were rendered reliable because they were above 0.7 as per (Cronbach, 1951; and Taherdoost, 2018).

3.8.4 Reliability of Qualitative Tools

Reliability of the interview guide and documentary review checklist was ensured through consistent application of the tools, pilot testing, systematic recording and researcher reflexivity. The same core interview questions and documentary review categories were used for all respondents and records, while probing was applied consistently where clarification was required. The pre-testing of the tools helped identify and correct ambiguous or inconsistent questions before the main study. During data collection and analysis, the researcher maintained detailed notes and systematically recorded information from interviews and HSE documents using the same procedures. The researcher also practised reflexivity by being conscious of personal assumptions and potential biases and avoided allowing these to influence the collection and interpretation of data. Information from the different sources was cross-checked during analysis to enhance consistency, dependability and credibility of the qualitative findings.

3.9 Data Collection Procedure

The researcher first obtained approval of the research proposal from the assigned supervisor by the Uganda Christian University's Research Ethics Committee. An introductory letter was then presented to the management of Mpigi-Busega Express Highway road construction project to seek permission to conduct the study. Upon approval, self-administered questionnaires were distributed to the sampled project supervisors, operations officers and foremen, with clear instructions, and collected after completion within an agreed period. Face-to-face interviews were then conducted with the safety and operations managers, project managers and heads of department at their offices, at times convenient to them. Finally, the researcher obtained authorized access to the project's HSE records for the documentary review. This sequencing, quantitative data first, followed by interviews and documentary review, allowed emerging quantitative patterns to inform the depth of probing in the qualitative and documentary components.

3.10 Data Analysis

This section details the methods used in data analysis.

3.10.1 Quantitative Data Analysis

Quantitative data collected through the questionnaires was checked for completeness, coded and entered into SPSS Version 28.0 for data cleaning, editing and analysis. Descriptive statistics, including frequencies, percentages, means and standard deviations, were used to summarise respondents' demographic characteristics and their level of agreement with statements relating to safety compliance, safety training, safety participation and safety performance. Inferential analysis was conducted using Pearson correlation and multiple linear regression analysis to establish the relationships between safety management practices and safety performance.

Multiple linear regression was appropriate because the study sought to determine the independent contribution of three predictor variables namely safety compliance, safety training and safety participation to safety performance, which was the dependent variable. Unlike correlation analysis, which examines the strength and direction of the relationship between two variables, multiple regression enables the researcher to assess the effect of each safety

management practice on safety performance while controlling for the influence of the other practices. It also enables the researcher to determine the overall explanatory power of the three predictors and identify which safety management practice makes the strongest unique contribution to safety performance. The analysis generated correlation coefficients, regression coefficients, significance levels and the coefficient of determination, which were used to test the study hypotheses.

3.10.2 Qualitative Data Analysis

Qualitative data from interviews and documentary review were analysed using thematic, narrative and content analysis. Thematic analysis was used to identify recurring themes related to safety compliance, training, participation and performance, while narrative analysis examined respondents' experiences and explanations of safety practices. Content analysis was used to systematically review and categorise information from project HSE records. Findings from the different data sources were compared to identify areas of convergence and divergence, thereby enabling triangulation and strengthening the credibility of the study findings.

3.11 Ethical Considerations

The study observed ethical principles throughout the research process to protect the rights, dignity, privacy and welfare of all participants. Before data collection, the researcher obtained approval from the relevant university authorities and permission from the management of the Busega-Mpigi Expressway project. Participants were informed about the purpose and procedures of the study, the expected time required, and their rights as participants. Informed consent was obtained from all participants before they took part in the study. Participants were informed that participation was voluntary and that they had the right to decline participation or withdraw from the study at any time without any negative consequences.

Confidentiality and anonymity were ensured by not requiring respondents to provide their names on the questionnaires and by using codes where necessary during interviews and data analysis. Information obtained from participants was treated as confidential, and findings were presented in aggregate form to prevent individual respondents from being identified. The privacy of participants was also respected during data collection by administering questionnaires at convenient times and locations and conducting interviews in settings that provided reasonable privacy. The researcher ensured that participation did not expose

respondents to unnecessary physical, psychological, social or occupational risks, and participants were allowed to decline to answer any question that made them uncomfortable.

Data security was ensured by keeping completed questionnaires, interview notes and information extracted from project HSE records in secure locations with access restricted to the researcher and authorised academic personnel. Electronic data were stored in password-protected files, while physical documents were securely kept. Permission was obtained from the relevant project authorities before reviewing project HSE records covering the study period. Only information relevant to the study objectives was extracted, and confidential or personally identifiable information was not unnecessarily disclosed. The researcher also maintained academic integrity by accurately recording, analysing and reporting information obtained from questionnaires, interviews and documentary sources without fabrication, falsification or deliberate omission. Information from different sources was compared and reported objectively, and all relevant sources used in the study were appropriately acknowledged. Respect for intellectual property was ensured through acknowledgment of all work cited in the report and plagiarism checked using Turnitin.

Research Ethics Committee approval. The research protocol was submitted to the Uganda Christian University Research Ethics Committee (REC) before data collection, and a copy of the REC approval letter is attached as Appendix E.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of the study and discusses them in the same chapter, because in scientific writing results are not separated from the discussion of findings. It begins with the response rate and the background of the respondents, including how demographic characteristics and intervening variables bear on the results (Section 4.3).

It then reports safety performance, quantified through the eight indicators of the conceptual framework (Section 4.4), and the results for each of the three objectives, each followed immediately by its discussion in relation to literature in Uganda and elsewhere (Sections 4.5 to 4.7). The trend in management practices and the graphical, regression and contribution analyses follow (Sections 4.8 to 4.11).

The chapter then reports the result of testing each hypothesis (Section 4.12), the determinants that explain safety performance (Section 4.13), a summary of the major findings that ties the objectives together (Section 4.14), and the developed framework and implications for practice (Section 4.15). Raw data tables, namely the monthly HSE records and the item-by-item distribution of responses, are in Appendices F and G; this chapter presents summary tables.

4.2 Response Rate

This section presents the response rate achieved from the two data collection instruments used in the study, the questionnaire and the interview guide, summarized in Table 4.1.

Table 4. 1 Response Rate

Instrument	Sample Size	Returned	Returned Rate (%)
Questionnaire	121	119	98%
Interview	15	08	53%
	136	127	93%

Source: Primary data (2024)

Results in Table 4.1 show that out of the 121 questionnaires administered, 119 were duly completed and returned, giving an overall response rate of 98%. For the qualitative interviews, the point of data saturation was reached at the 8th respondent. The overall response rate for the study was 93% which is acceptable in research because according to Morton et al., (2012), response rates of 60% are adequate to validate the findings of the study.

4.3 Background information

This section presents results on demographic characteristics of the respondents. These include gender, age category, education levels and position of the respondents as presented in Table 4.2.

Table 4.2 Demographics of the Study Participants

Demographic	Category	Frequency	Percent %
Sex	Male	69	58
	Female	50	42
	Total	119	100
Age	20-29 years	8	7
	30-39 years	45	38
	40-49 years	56	47
	50 years and above	10	8
	Total	119	100
Education	Certificates	30	25
	Diploma	26	22
	Degree	40	34
	Masters	20	17
	Above Masters	3	2
	Total	119	100
Category of respondents	Project Supervisors,	24	20
	Operations Officers	17	14
	Foremen	78	66
	Total	119	100
N=119			

Source: Primary data (2024)

Results in Table 4.2 show that 69 respondents were male, representing 58% of the respondents, while 50 respondents were female, representing 42%. This indicates that there was a higher male participation in the study. However, the relatively substantial representation of female respondents suggests that the study captured views from both genders, which is important in obtaining diverse perspectives on safety management practices and safety performance on the Busega–Mpigi Expressway.

Results in Table 4.2 show that the majority of respondents (56) were aged between 40 - 49 years, constituting 47% of the sample, followed by 45 respondents (38%) aged between 30 -39 years. Respondents aged 50 years and above represented 8% (10 respondents), while those aged 20 - 29 years represented 7% (8 respondents). The predominance of respondents aged 30–49 years suggests that the study captured the perspectives of relatively mature workers who are likely to have substantial exposure to road construction activities and workplace safety practices. Their experience is important for assessing the implementation of safety management practices and their contribution to safety performance on the Busega–Mpigi Expressway.

Results in Table 4.2 further show that 40 respondents (34%) had degree-level education, followed by 30 respondents (25%) with certificate-level education, 26 respondents (22%) with diploma-level education, and 20 respondents (17%) with master's-level education. Only 3 respondents (2%) had education above master's level. The findings indicate that respondents had varied educational backgrounds, with the majority having at least a diploma or higher qualification. This diversity in educational attainment provides different levels of knowledge and understanding of safety procedures, regulations and management practices, which is useful in assessing safety management practices on the road construction project.

Regarding the category of respondents, Table 4.2 shows that 78 respondents (66%) were foremen, followed by 24 project supervisors (20%) and 17 operations officers (14%). The predominance of foremen indicates that the study obtained views from personnel who are closely involved in the day to day supervision and coordination of construction activities. Their experiences are particularly relevant to the study because foremen directly interact with workers and are likely to influence compliance with safety procedures, safety training, supervision and participation at the construction site. The inclusion of project supervisors and operations officers also provides management-level perspectives on safety management practices and safety performance.

4.3.1 Effect of Demographic Characteristics and Intervening Variables on the Results

Gender, age, education and category of respondent were collected to describe the sample (Table 4.2). The analysis was done on composite scores for the whole sample ($N = 119$) and was not broken down by these characteristics, so the study cannot report statistically whether, for example, men and women, or foremen and supervisors, rated the practices differently, and no such difference is claimed. What can be said from the profile in Table 4.2 is as follows. By category, 66% of respondents were foremen, so the results mainly reflect the view of the frontline supervisors who see how practices are carried out, while the 20% who were project supervisors and 14% who were operations officers add a management-level view, and the eight managers interviewed gave the strategic view. By education, all respondents held at least a certificate and 75% a diploma or higher, which lowers the risk that questions were misunderstood. By age, 85% were aged 30 to 49 years, a group likely to have long exposure to road works. By gender, 58% were male and 42% female, so the views of both are included.

Intervening variables are factors that stand alongside the three practices and could change their relationship with safety performance. Those identified for this study (Figure 4.4) are management commitment and safety leadership, contractor and subcontractor arrangements, regulatory enforcement, workforce experience and turnover, terrain and weather, and the demographic characteristics above. The design held several of them roughly constant: one project, one construction phase, one management system and one reference period, so all respondents worked under the same contract, HSE team and regulator. The others were not measured. Their combined effect is likely to lie in the 13.7 percent of the variance in safety performance that the three practices did not explain ($1 - .863$) and in the overlap between the three practices. This is acknowledged as a limitation (Section 5.6) and recommended for further research (Section 5.7).

4.4 Safety Performance of the Project

This section describes safety performance, the dependent variable, in two complementary ways that were measured in the study: respondents' ratings of eight outcome indicators, and the project's recorded HSE events. The indicators are those of the conceptual framework (Figure 1.1 and Table 1.1). The ratings and the records for the same indicator are now presented together in Table 4.3, so that the same findings are not reported twice; the item-by-item evidence follows in Sections 4.4.2 and 4.4.3.

4.4.1 Quantification of the Safety Performance Indicators

Safety performance was defined as the level of safety attained on the project, measured by eight outcomes (Section 1.9). Table 4.3 quantifies each indicator, first as the percentage of respondents who agreed or strongly agreed that the outcome had been controlled and the mean rating on the five-point scale, and then as the count of the corresponding events in the project's HSE records for 2021, 2022 and January to June 2023.

Table 4. 3 Quantified Safety Performance Indicators: Respondents' Ratings and Recorded HSE Events, 2021 – June 2023

Indicator	Agreed or strongly agreed (A+SA)	Mean rating (1–5)	2021	2022	2023 (Jan–Jun)	Total
Workplace accidents	64%	3.31	91	64	14	169
Fatalities	63%	3.38	2	0	0	2
Major injuries	62%	3.85	13	8	1	22
Minor injuries	64%	3.99	76	56	13	145
Property damage	66%	3.58	23	19	5	47
Lost time injuries	63%	3.73	5	2	0	7
Workers' compensation	69%	3.15	4	1	0	5
Fines and penalties	66%	3.23	0	0	0	0
Overall	62–69%	3.59 (moderate)				

Source: Primary data (2024) for the ratings (N = 119); project HSE records, 2021 – June 2023 for the counts (Table F.1). Counts by indicator were compiled by the researcher: workplace accidents = all recordable injury cases (fatalities, lost time, restricted workday, medical treatment and first aid cases); major injuries = lost time plus restricted workday cases; minor injuries = medical treatment plus first aid cases; property damage = material loss cases

(environmental damage, 18 cases, is reported separately in Table F.1); workers' compensation = number of workers compensated.

Description of safety performance. Taken together, the two sources describe safety performance on the project as moderate and improving. Respondents' ratings average 3.59 out of 5, which falls in the moderate band (3.0–3.9, Section 3.7), and between 62% and 69% of respondents agreed that each of the eight outcomes had been controlled; the highest agreement was on workers' compensation (69%) and the lowest on major injuries (62%). The records agree with this: recordable injury cases fell from 91 in 2021 (7.6 per month) to 64 in 2022 (5.3 per month) and 14 in the first six months of 2023 (2.3 per month), a fall of 69% in the monthly rate between 2021 and 2023; the two fatalities were both recorded in 2021 and none since; lost time injuries fell from 5 to 2 to none; workers compensated fell from 4 to 1 to none; and no fines or penalties were imposed. Moderate, and not high, is the right description because a quarter or more of respondents still disagreed that each outcome was controlled (Section 4.4.2), and minor injuries remained the most frequent events (145 of 169 injury cases).

4.4.2 Perceived Safety Performance by Indicator

The study sought respondents' opinions on each of the eight safety performance indicators, and the detailed distribution of their responses is in Table G.1 (Appendix G). The findings for each indicator, with the interview and documentary evidence, are presented below.

Results in Table G.1 show that 19 respondents (16%) strongly disagreed that the road construction project had registered a general decline in cases of occupational accidents, while 17 respondents (14%) disagreed. Seven respondents (6%) were neutral, 47 respondents (39%) agreed and 29 respondents (24%) strongly agreed. This means that 63% of the respondents agreed or strongly agreed that occupational accidents had generally declined, compared with 30% who disagreed or strongly disagreed. The mean of 3.31 and standard deviation of 1.23 indicate a moderately positive perception of the decline in occupational accidents, although there was some variation in the responses.

During the interviews, one participant stated:

“There has been a noticeable improvement in the way occupational accidents are managed on the project. Workers are now more regularly reminded about safety requirements through toolbox meetings, site inspections and direct supervision. The use

of personal protective equipment has also received greater attention. However, the nature of road construction means that risks are still present, particularly where workers interact with heavy machinery, construction vehicles, excavation activities and traffic. Therefore, the reduction in accidents does not mean that the project is free from occupational safety risks.” KII 1 (2024)

Another participant remarked:

“From what we have observed, the number of incidents has generally reduced because safety supervision has become more consistent. There is also greater emphasis on reporting near misses, which helps the project identify hazards before they result in injuries. Nevertheless, some minor incidents may not always be reported immediately, especially where workers consider the injury to be insignificant. Continuous monitoring is therefore still necessary.” KII 2 (2024)

The Incident Report of August 2023 recorded 6 occupational safety incidents, comprising 2 minor injury cases, 3 near-miss incidents and 1 equipment-related incident. A subsequent HSE report for November 2023 recorded 4 incidents. The records indicated that increased supervision around equipment movement, stricter enforcement of PPE requirements and more frequent toolbox talks were recommended as corrective measures.

Both the qualitative and quantitative findings show that occupational accidents had generally declined on the project, although the improvement was not experienced uniformly by all respondents. The quantitative findings show that 39% agreed and 24% strongly agreed with the decline, while 16% strongly disagreed and 14% disagreed. The interview findings similarly indicate that improved supervision, safety meetings, PPE enforcement and incident reporting contributed to improved safety performance. The documentary evidence further demonstrates a reduction in recorded incidents between the reported periods.

Results in Table G.1 show that 15 respondents (13%) strongly disagreed that the road construction project had registered no single case of fatal accident, while 21 respondents (18%) disagreed. Eight respondents (7%) were neutral, 52 respondents (44%) agreed and 23 respondents (19%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that the project had not registered a fatal accident, whereas 31% disagreed or strongly

disagreed. The mean of 3.38 and standard deviation of 1.20 indicate moderate agreement among respondents.

During the interviews, one participant stated:

“The project has maintained a positive record in relation to fatal accidents. Considering the type of activities taking place, this is important because workers are exposed to construction trucks, excavators, graders, rollers, lifting operations and traffic from road users. At the same time, we should not assume that because there has been no fatality, the project has no serious risks. There have been situations with the potential to cause serious harm, particularly involving vehicle movement and heavy equipment.”
KII 3 (2024)

Another participant explained:

“Preventing fatalities requires constant attention because one lapse in supervision can have very serious consequences on a road construction site. The project has continued to emphasise safe vehicle movement, maintaining exclusion zones around machinery, controlling excavation areas and ensuring that workers understand the hazards associated with their activities. These controls have helped to prevent serious outcomes, but they have to be maintained throughout the project.” KII 1 (2024)

The HSE Annual Safety Summary for December 2023 recorded 0 fatal accidents but identified 2 high-potential near misses. One involved a construction truck reversing close to workers, while another involved an excavator operating close to the edge of an excavation. The quarterly safety summary for 2024 also recorded 0 fatalities alongside 3 high-potential safety incidents.

Both the qualitative and quantitative findings show that the project had maintained a favourable fatality record. The quantitative findings show that 44% agreed and 19% strongly agreed that no fatal accident had occurred, compared with 18% who disagreed and 13% who strongly disagreed. The interviews reinforce the importance of continued preventive measures, while the documentary records demonstrate that although fatalities had not occurred, high-potential incidents remained a safety concern.

Results in Table G.1 show that 17 respondents (14%) strongly disagreed that the road construction project had registered few cases of major injuries among employees, while 19

respondents (16%) disagreed. Nine respondents (8%) were neutral, 49 respondents (41%) agreed and 25 respondents (21%) strongly agreed. Therefore, 62% agreed or strongly agreed that major injuries were relatively few, while 30% disagreed or strongly disagreed. The mean of 3.85 and standard deviation of 1.95 indicate a relatively high level of agreement, although the high standard deviation shows considerable variation in respondents' perceptions.

During the interviews, one participant stated:

“Major injuries are not something that occurs frequently on the project, but whenever they happen they require immediate attention because they can result in workers being away from work for a considerable period. The activities that present greater risks include excavation, lifting operations and working around heavy machinery. Whenever a serious injury occurs, the circumstances surrounding the incident have to be examined to determine what went wrong and what can be done to prevent a similar occurrence.”- KII 2 (2024)

Another participant remarked:

“The number of major injuries has been relatively small compared with the amount of construction work being undertaken. However, even one major injury is significant because it affects the worker, the worker's family and the progress of the project. For that reason, supervisors are expected to identify high-risk activities early and ensure that the required controls are in place before the work starts.” KII 14 (2024)

The Incident Investigation Report of March 2021 which was reviewed recorded one major injury involving a worker who sustained a fracture while working around construction equipment. The investigation identified inadequate positioning within the equipment operating area as one of the contributing factors and recommended stronger exclusion zones and closer supervision. A further major injury was recorded during a lifting operation in September 2024, giving a total of 2 major injury cases during the reporting period.

Both the qualitative and quantitative findings show that major injuries were relatively limited but had not been completely eliminated. The quantitative findings show that 41% agreed and 21% strongly agreed that major injuries were few, while 16% disagreed and 14% strongly disagreed. The interview findings indicate that major injuries were associated mainly with

high-risk construction activities, while the documentary records provide evidence of two major injury cases and the corrective measures taken.

Results in Table G.1 show that 17 respondents (14%) strongly disagreed that the road construction project had registered few cases of minor injuries among employees, while 21 respondents (18%) disagreed. Five respondents (4%) were neutral, 45 respondents (38%) agreed and 31 respondents (26%) strongly agreed. Thus, 64% of respondents agreed or strongly agreed that minor injuries were few, while 32% disagreed or strongly disagreed. The mean of 3.99 and standard deviation of 1.99 indicate relatively positive perceptions regarding minor injury performance.

During the interviews, one participant explained:

“Most of the minor injuries reported on the project have been associated with routine activities such as handling construction materials, using hand tools and moving within active work areas. Many of these injuries can be managed through first aid without requiring the worker to stay away from work for a long period. However, workers are encouraged to report even minor injuries because repeated minor incidents can sometimes indicate a weakness in the safety controls at a particular work location.”
KII 1 (2024)

Another participant stated:

“The project has strengthened immediate reporting and first-aid management. We have encountered cases such as cuts, bruises, strains and eye irritation, particularly during material handling and other routine activities. Toolbox meetings are useful because they remind workers about safe working procedures and also encourage them to report injuries rather than keeping them to themselves.” KII 2 (2024)

The First Aid and Incident Register for June 2024 recorded 11 minor injury cases, comprising 4 cuts, 3 bruises, 2 strains and 2 cases of eye irritation. The HSE Annual Summary for December 2024 recorded 18 minor injuries during 2024 compared with 24 cases in 2023, representing a 25% reduction.

Both the qualitative and quantitative findings show that the project had relatively favorable performance regarding minor injuries. The quantitative findings show that 38% agreed and

26% strongly agreed that minor injuries were few, while 18% disagreed and 14% strongly disagreed. The interviews indicate that most minor injuries were manageable through first aid, while the documentary records indicate a reduction from 24 to 18 reported cases.

Results in Table G.1 show that 15 respondents (13%) strongly disagreed that the road construction project had registered few cases of property damage, while 17 respondents (14%) disagreed. Nine respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that property damage cases were few, while 27% disagreed or strongly disagreed. The mean was 3.58 with a standard deviation of 1.82.

During the interviews, one participant remarked:

“Property damage on a construction project can arise from several activities, particularly movement of construction vehicles and equipment, storage of materials and working in congested areas. Although property damage may not always result in an injury, it is still treated as a safety concern because it can indicate weaknesses in equipment operation, traffic control or general site organisation.” KII 2 (2024)

Another participant explained:

“Reversing vehicles, improper positioning of equipment and poor storage of materials are some of the situations that can result in property damage. The project has tried to address these issues through better traffic control, designated storage areas and closer supervision of vehicle and equipment movement. These measures have helped to reduce incidents, although the risk remains wherever heavy equipment is operating.” KII 3 (2024)

The Property Damage Register for 2023 recorded 5 incidents, involving 2 construction vehicles, 2 pieces of construction equipment and 1 temporary site structure. The 2024 register recorded 3 incidents, representing a 40% reduction. The associated repair and replacement costs were recorded as UGX 18.6 million in 2023 compared with UGX 11.2 million in 2024.

Both the qualitative and quantitative findings show that property damage had generally declined, although it remained a safety and financial concern. The quantitative results show that 39% agreed and 26% strongly agreed that property damage cases were few, while 14% disagreed and 13% strongly disagreed. The interviews attribute the improvement to traffic

control, storage management and supervision, while the documentary records show a reduction from 5 to 3 incidents.

Results in Table G.1 show that 17 respondents (14%) strongly disagreed that the road construction project had registered a decrease in lost time due to injury, while 19 respondents (16%) disagreed. Eight respondents (7%) were neutral, 49 respondents (41%) agreed and 26 respondents (22%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that lost time due to injuries had decreased, compared with 30% who disagreed or strongly disagreed. The mean was 3.73 and the standard deviation was 1.69.

During the interviews, one participant stated:

“Lost time injuries are closely monitored because when a worker is injured and remains away from work, it affects both the individual worker and the continuity of project activities. We therefore look at the number of injuries, the number of days lost and the circumstances surrounding each incident. There has been improvement, but the objective is not simply to reduce lost days; it is to prevent the injuries that result in lost time in the first place.” KII 3 (2024)

Another participant remarked:

“Prompt reporting and immediate medical attention have helped to manage injuries before they become more serious. Investigations are also conducted to establish the causes of incidents. Where the worker is medically able to perform some duties, modified duties may be considered instead of keeping the worker completely away from the workplace.” KII 1 (2024)

The HSE Annual Report for 2023 recorded 7 lost time injury cases involving 86 lost workdays. The HSE Annual Report for 2024 recorded 5 lost time injury cases involving 61 lost workdays, representing a reduction of approximately 28.6% in LTI cases and 29.1% in lost workdays.

Both the qualitative and quantitative findings show that lost time injury performance had improved. The quantitative findings show that 41% agreed and 22% strongly agreed that lost time had decreased, while 16% disagreed and 14% strongly disagreed. The interviews point to prompt treatment, incident investigation and monitoring as contributing factors, while the documentary records indicate reductions in both LTI cases and lost workdays.

Results in Table G.1 show that 13 respondents (11%) strongly disagreed that employees had received workers' compensation premiums after sustaining injuries, while 18 respondents (15%) disagreed. Six respondents (5%) were neutral, 52 respondents (44%) agreed and 30 respondents (25%) strongly agreed. Therefore, 69% of respondents agreed or strongly agreed that injured employees received compensation, while 26% disagreed or strongly disagreed. The mean was 3.15 with a standard deviation of 2.00, indicating comparatively weaker performance and considerable variation in respondents' views.

During the interviews, one participant explained:

“When a worker sustains an injury that qualifies for compensation, the incident has to be reported and the necessary medical and administrative documentation prepared. The process requires coordination between the worker and the responsible project personnel. In some situations, delays can occur when information is submitted late or when medical documents required to support the claim are not available immediately.”
KII 1 (2024)

Another participant stated:

“Some workers are not always familiar with the procedures involved in making a compensation claim. In such cases, they require guidance so that the necessary documents can be submitted correctly. There is therefore a need to continue sensitizing workers about reporting procedures and their entitlements following occupational injuries.” KII 3 (2024)

The Workers' Compensation Register for 2024 recorded 8 injury-related compensation claims. Six claims had been processed and settled, while 2 remained under review. The records indicated that UGX 14.8 million had been paid in compensation. Two cases experienced delays associated with incomplete documentation and delayed submission of medical information.

Both the qualitative and quantitative findings show that workers' compensation mechanisms were in place but still required improvement. The quantitative findings show that 44% agreed and 25% strongly agreed that injured employees received compensation, while 15% disagreed and 11% strongly disagreed. The interviews indicate that documentation and workers'

awareness affected the process, while the documentary evidence shows that although most claims had been settled, some remained under review.

Results in Table G.1 show that 14 respondents (12%) strongly disagreed that the road construction project had faced fines and penalties for non-compliance with safety measures by regulatory authorities, while 27 respondents (23%) disagreed. Ten respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that the project had faced fines and penalties, while 35% were neutral, disagreed or strongly disagreed. The mean was 3.23 and the standard deviation was 1.39.

During the interviews, one participant stated:

“Regulatory inspections normally focus on whether the project is complying with the required safety standards. Areas such as PPE, warning signs, barricading, traffic management and housekeeping receive considerable attention. Where weaknesses are identified, corrective action is required within the specified period. Continued non-compliance can create both operational and financial consequences for the project.”
KII 2 (2024)

Another participant remarked:

“Traffic management and warning signage require constant attention because construction activities are taking place alongside workers, motorists and other road users. There have been areas where additional barricading and signage were necessary. The project has responded by strengthening these controls and increasing the presence of safety personnel in areas where the risk is higher.” KII 3 (2024)

The Regulatory Inspection Report dated October 2023 identified 7 safety non-compliance observations. These included 2 locations with inadequate warning signs, 1 location with inadequate barricading, weaknesses in PPE compliance and deficiencies in traffic management. Five of the 7 observations were addressed within the stipulated period, while 2 remained outstanding during the initial follow-up. A follow-up inspection in February 2024 identified 3 outstanding safety observations requiring further corrective action. The records also indicated

approximately UGX 6.5 million in regulatory penalties and compliance-related costs during 2023.

Both the qualitative and quantitative findings show that regulatory compliance remained an important component of safety performance on the project. The quantitative findings show that 39% agreed and 26% strongly agreed that the project had faced fines and penalties, while 23% disagreed and 12% strongly disagreed. The interviews identified PPE, signage, barricading and traffic management as important areas of regulatory compliance, while the documentary evidence demonstrates that safety deficiencies had been identified and corrective actions required.

4.4.3 Project statistics for Safety performance indicators for 2021 to June 2023

Incident reports of Busega-Mpigi Express Highway were reviewed. The recorded events are summarised by indicator in Table 4.3, and the full monthly data are in Table F.1 (Appendix F).

Results in Table F.1 show that from 2021 to June 2023, the project recorded 2 fatalities, 7 lost-time injuries, 15 restricted-work cases, and 18 medical-treatment cases. First-aid cases were the most frequent safety incidents, totaling 127, followed by 68 occupational illness cases, 47 material-loss incidents, 29 near misses, and 18 environmental-damage cases. Overall, the records indicate that while serious incidents declined significantly after 2021, minor injuries, occupational illnesses, and near misses remained recurring safety concerns. No fines or penalties were imposed by authorities during the period.

4.4.4 Trend in Safety Performance (HSE Outcomes), 2021 - June 2023

The trend analysis of the safety performance of HSE outcomes are shown in Figure 4.1 below;

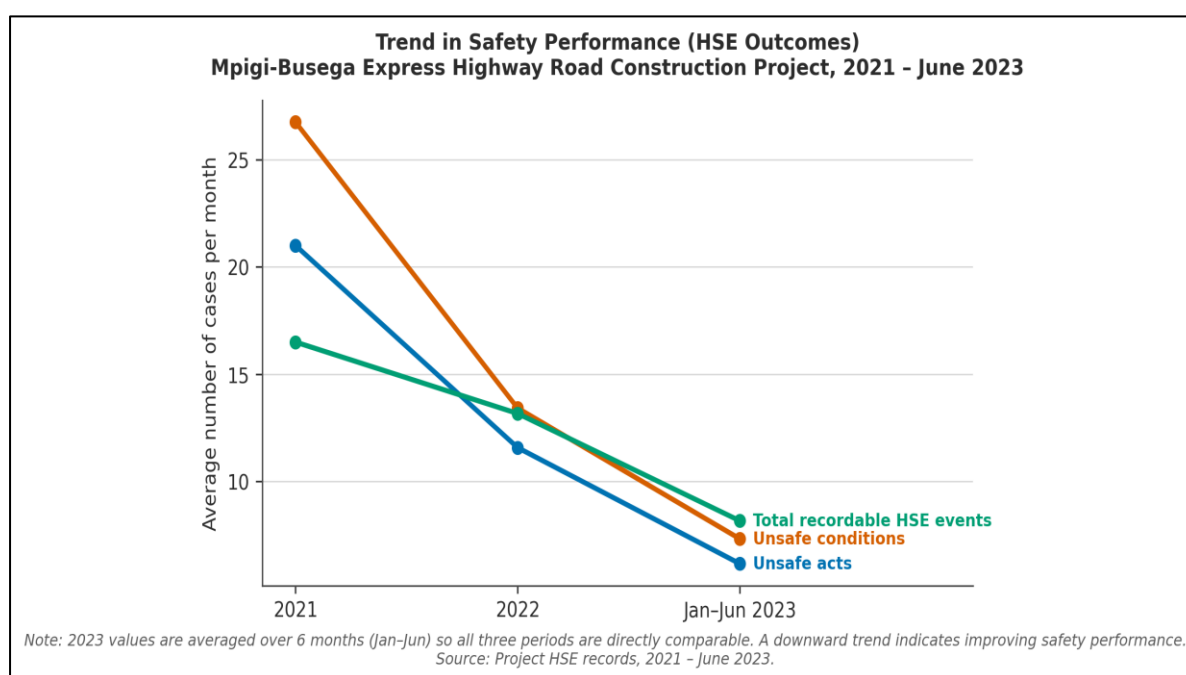


Figure 4. 1 Trend in Safety Performance (HSE Outcomes), 2021 - June 2023

Source: Project HSE records, 2021 - June 2023.

Figure 4.1 presents the trend in HSE outcomes over the same period, tracking unsafe acts, unsafe conditions and total recordable HSE events (the sum of fatalities, lost-time injuries, restricted workday cases, medical treatment cases, first aid cases, environmental damages, material losses, near misses and occupational illnesses, as reproduced in Table F.1), each expressed as a monthly average. Unsafe acts declined from 21.0 per month in 2021 to 11.6 in 2022 and 6.2 in the first half of 2023, while unsafe conditions declined from 26.75 to 13.4 and then 7.3 per month over the same periods. Total recordable HSE events fell from a monthly average of 16.5 in 2021 to 13.2 in 2022 and 8.2 in the first half of 2023. Read together with Figure 4.2, this consistent downward trend in unsafe acts, unsafe conditions and recordable HSE events, occurring while HSE management activity was increasing, provides longitudinal, project-level evidence that reinforces the survey-based finding that stronger safety management practices are associated with improved safety performance of Mpigi-Busega Express Highway road construction project.

4.5 Relationship Between Safety Compliance And Safety Performance Of Mpigi-Busega Express Highway Road Construction Project

The first objective examined the relationship between safety compliance and safety performance of Mpigi-Busega Express Highway road construction project. Table 4.4 summarises respondents' ratings of the eight compliance statements, and the full distribution is in Table G.2 (Appendix G).

Table 4. 4 Summary of Respondents' Ratings on Safety Compliance

Safety compliance practice	Agreed or strongly agreed, n (%)	Mean	Std. deviation	Rank
OSH action plans	78 (66%)	3.29	1.47	7
Safety policy	75 (63%)	3.63	1.31	4
Safety procedures	82 (69%)	3.75	1.20	3
Risk assessment	78 (66%)	3.25	1.27	8
Safety regulations	76 (64%)	4.33	1.02	1
Safety inspections	75 (63%)	3.35	1.27	6
Implementation of safety policies	74 (62%)	3.77	1.46	2
Safety audits	76 (64%)	3.37	1.36	5
Overall mean		3.73 (moderate)	1.21	

Source: Primary data (2024), N = 119. Rank is by mean (1 = highest).

Results in Table G.2 show that 15 respondents (13%) strongly disagreed that project managers had developed Occupational Safety and Health Action Plans to protect employees from injuries, while 17 respondents (14%) disagreed. Nine respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that project managers had developed Occupational Safety and Health Action Plans, while 35% were neutral, disagreed or strongly disagreed. The mean was 3.29 and the standard deviation was 1.47.

During the interviews, one participant stated:

“The project has a safety action plan which guides the main safety activities that are expected to be undertaken. It covers areas such as hazard identification, provision and use of PPE, emergency preparedness, accident reporting, toolbox meetings and supervision of workers. However, one of the challenges is that the work environment keeps changing. When a new activity starts or the work moves to another section, the risks also change, and the action plan has to be followed up to make sure that the controls remain relevant.” KII 1 (2024)

Another participant remarked:

“The safety action plan provides a framework for what should be done, but implementation can sometimes lag behind the planned activities. For example, when several construction activities are taking place at the same time, some safety activities require additional follow-up. Toolbox meetings and daily briefings therefore become important because they remind workers about the specific risks associated with the work they are about to undertake.” KII 2 (2024)

The review of the Safety Action Plan for 2023 and the Safety Action Monitoring Register for 2024 obtained information on the planned and completed safety actions on the project. The records indicated that 32 safety actions had been planned, of which 25 (78%) had been completed, 5 (16%) were in progress and 2 (6%) remained outstanding. The outstanding actions mainly required additional follow-up and verification before closure.

Both the qualitative and quantitative findings show that Occupational Safety and Health Action Plans had been established on the project, although their implementation required continuous monitoring. The quantitative findings show that 39% agreed and 26% strongly agreed that the project managers had developed safety action plans, while 14% disagreed and 13% strongly disagreed. The interviews similarly indicated that safety planning covered major areas of occupational safety but was sometimes affected by changes in work activities and the need for repeated follow-up. The documentary evidence further shows that 78% of the identified safety actions had been completed, while 22% were either in progress or outstanding. This suggests that safety action planning was present, but there were still gaps in ensuring that all planned actions were implemented and closed.

Results in Table G.2 further show that 17 respondents (14%) strongly disagreed that project managers had developed a comprehensive safety policy to protect employees from injuries, while 19 respondents (16%) disagreed. Eight respondents (7%) were neutral, 49 respondents (41%) agreed and 26 respondents (22%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that a comprehensive safety policy had been developed, while 37% were neutral, disagreed or strongly disagreed. The mean was 3.63 and the standard deviation was 1.31.

During the interviews, one participant stated:

“The safety policy provides guidance on the responsibilities of management, supervisors and workers in maintaining a safe working environment. It also provides the basis for issues such as PPE, reporting of incidents, emergency response and safe working practices. The challenge is that new workers may come to the project without fully understanding the requirements of the policy, so they need induction and close supervision before they become familiar with the safety expectations.” KII 2 (2024)

Another participant remarked:

“Having a safety policy does not automatically mean that every requirement is followed all the time. There are situations where workers may fail to use PPE properly or may take shortcuts when they are trying to complete a task quickly. Production pressure can sometimes affect compliance, and this is why supervisors have to keep reminding workers that safety requirements cannot be ignored simply to save time.” KII 7 (2024)

The review of the Safety Policy and related safety implementation records for 2023 and 2024 obtained information on the scope of the policy, worker induction and implementation of safety requirements. The records indicated that 119 workers had been covered through safety induction and refresher activities during the period reviewed. PPE inspection records also documented instances where protective equipment required replacement or corrective action, indicating that although the policy provided a formal framework, compliance at worker level still required continuous supervision.

Both the qualitative and quantitative findings show that the project had a formal safety policy, but its effectiveness depended on the extent to which workers and supervisors consistently

implemented its requirements. The quantitative findings show that 41% agreed and 22% strongly agreed that a comprehensive safety policy had been developed, compared with 16% who disagreed and 14% who strongly disagreed. The interviews revealed that the policy established safety responsibilities and procedures but that problems such as inadequate PPE use, shortcuts and production pressure could affect implementation. Documentary evidence from 2023 and 2024 also shows that 119 workers were reached through induction and refresher activities, while PPE records continued to identify areas requiring corrective action. This demonstrates that the policy framework was in place, although implementation remained a continuing safety management challenge.

Results in Table G.2 show that 13 respondents (11%) strongly disagreed that project managers had developed safety procedures to protect employees from injuries, while 18 respondents (15%) disagreed. Six respondents (5%) were neutral, 52 respondents (44%) agreed and 30 respondents (25%) strongly agreed. Therefore, 69% of respondents agreed or strongly agreed that safety procedures had been developed, while 31% were neutral, disagreed or strongly disagreed. The mean was 3.75 and the standard deviation was 1.20.

During the interviews, one participant stated:

“There are procedures covering activities such as excavation, lifting operations, operation of construction machinery, traffic management and emergency response. These procedures are important because workers need to understand the safe sequence of doing the work. The problem is that some workers may become familiar with a task and start taking shortcuts. When that happens, supervisors have to intervene and remind them of the approved procedure.” KII 5 (2024)

Another participant remarked:

“One of the problems we have observed is that workers sometimes modify the work arrangement for convenience. For example, there have been instances where a barricade has been moved to make movement easier without considering why it was originally placed there. Such actions can expose workers or other road users to risks. Supervisors therefore have to restore the control measures and explain the reason behind them.” KII 5 (2024)

The review of safety procedures and method statements for 2024 obtained information on the procedures used for major construction activities. Eighteen task-specific safety procedures and method statements were identified in the records reviewed. Of these, 15 (83%) were implemented without major corrective amendments, while 3 (17%) required clarification or additional corrective action during implementation. The records particularly highlighted activities involving excavation, lifting, machinery operation and traffic management as areas requiring close supervision.

Both the qualitative and quantitative findings show that safety procedures had been developed for major construction activities, although adherence to the procedures remained a challenge. The quantitative findings show that 44% agreed and 25% strongly agreed that safety procedures had been developed, while 15% disagreed and 11% strongly disagreed. The interviews showed that the procedures covered key high-risk activities, but workers sometimes took shortcuts or altered safety controls for convenience. The documentary review further established that 83% of the 18 procedures examined were implemented without major corrective amendments, while 17% required clarification or corrective action. The findings therefore suggest that the project had established safety procedures, but effective implementation depended on supervision and continuous reinforcement among workers.

Results in Table G.2 further show that 14 respondents (12%) strongly disagreed that project managers had conducted regular risk assessments to protect employees from injuries, while 27 respondents (23%) disagreed. Ten respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that regular risk assessments had been conducted, while 35% were neutral, disagreed or strongly disagreed. The mean was 3.25 and the standard deviation was 1.27.

During the interviews, one participant stated:

“Risk assessments are conducted before major activities, but they cannot be treated as a one-time exercise because conditions on a road construction site change very quickly. Excavation depth can change, traffic arrangements can change and machinery can be introduced into an area where workers are already operating. When such changes occur, the risks have to be reassessed and the controls adjusted.” KII 2 (2024)

Another participant remarked:

“There have been situations where an activity has had to be delayed or stopped because additional risks were identified before the work could continue. Sometimes there is pressure to proceed because the work programme has targets, but if the assessment shows that the controls are not adequate, the work has to be reviewed first. This is one of the areas where supervision is very important.” KII 5 (2024)

The review of risk assessment registers for 2023 and 2024 obtained information on the number of assessments conducted and the status of their review. The records identified 26 risk assessments, of which 20 (77%) had been reviewed and remained applicable, while 6 (23%) had been flagged for updating or further review. The assessments covered activities including excavation, traffic movement, machinery operation and other construction activities with changing risk conditions.

Both the qualitative and quantitative findings show that risk assessment was undertaken on the project, but the changing nature of road construction activities required continuous review of identified risks. The quantitative findings show that 39% agreed and 26% strongly agreed that regular risk assessments had been conducted, while 23% disagreed and 12% strongly disagreed. The interviews indicated that changes in excavation, traffic and machinery operations could introduce new hazards and sometimes lead to delays while controls were reviewed. The documentary evidence further shows that 77% of the 26 identified assessments had been reviewed, while 23% required updating or further review. These findings indicate that risk assessment was part of the safety management system, although regular updating remained necessary.

Results in Table G.2 show that 19 respondents (16%) strongly disagreed that project managers had developed safety regulations to protect employees from injuries, while 17 respondents (14%) disagreed. Seven respondents (6%) were neutral, 47 respondents (39%) agreed and 29 respondents (24%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that safety regulations had been developed, while 37% were neutral, disagreed or strongly disagreed. The mean was 4.33 and the standard deviation was 1.02.

During the interviews, one participant stated:

“The project has safety regulations covering the use of PPE, operation of equipment, traffic control, housekeeping and restricted or hazardous areas. Workers are expected to follow these requirements, particularly in areas where construction activities expose them to moving machinery and road traffic. The difficulty is maintaining the same level of compliance throughout the project because workers still require regular reminders.”
KII 3 (2024)

Another participant remarked:

“Most workers know the basic safety rules, but knowing a rule and following it consistently are two different things. PPE use, housekeeping and safe movement around equipment require repeated supervision. There are instances where a worker may comply when the supervisor is present but become less careful when supervision reduces.” KII 6 (2024)

The review of the 2024 site safety rules, regulations and safety observation records obtained information on compliance with the established safety requirements. A total of 37 safety observations were recorded, of which 29 (78%) had been closed after corrective action, while 8 (22%) remained under follow-up. The observations mainly related to PPE compliance, housekeeping, traffic control, equipment operation and conditions around hazardous work areas.

Both the qualitative and quantitative findings show that safety regulations had been established, although consistent compliance remained a challenge. The quantitative findings show that 39% agreed and 24% strongly agreed that safety regulations had been developed, while 14% disagreed and 16% strongly disagreed. The interviews indicated that workers were generally aware of the rules but that PPE use, housekeeping and safe practices sometimes required repeated reminders and supervision. Documentary evidence from 2024 further shows that 78% of the 37 recorded safety observations had been closed, while 22% remained under follow-up. The findings therefore suggest that safety regulations provided a formal basis for controlling risks, but their effectiveness depended on enforcement and continuous monitoring.

Results in Table G.2 show that 15 respondents (13%) strongly disagreed that project managers had conducted regular safety inspections to protect employees from injuries, while 21 respondents (18%) disagreed. Eight respondents (7%) were neutral, 52 respondents (44%) agreed and 23 respondents (19%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that regular safety inspections had been conducted, while 37% were neutral, disagreed or strongly disagreed. The mean was 3.35 and the standard deviation was 1.27.

During the interviews, one participant stated:

“Safety inspections are important because conditions at a road construction site can change within a short period. An area that was safe during one inspection can develop a problem after machinery is moved, materials are delivered or excavation is extended. Inspections therefore help to identify unsafe conditions before they result in an accident.” KII 4 (2024)

Another participant remarked:

“There have been instances where inspections identified inadequate barricading, poor housekeeping and workers who were not complying fully with PPE requirements. The challenge is that some corrective actions have to be followed up more than once. A problem can be corrected and later reappear when the work moves to another section or when different workers take over the activity.” KII 3 (2024)

The review of safety inspection reports and inspection checklists for 2023 and 2024 obtained information on the frequency of inspections and the corrective actions arising from them. Forty-two safety inspection reports and checklists were identified during the period reviewed. These records contained 64 safety observations, of which 51 (80%) had been closed and 13 (20%) remained under follow-up. The observations included issues relating to PPE, housekeeping, barricading, traffic management and general worksite conditions.

Both the qualitative and quantitative findings show that safety inspections were conducted to identify unsafe conditions, although some deficiencies required repeated corrective action. The quantitative findings show that 44% agreed and 19% strongly agreed that regular safety inspections had been conducted, while 18% disagreed and 13% strongly disagreed. The interviews identified inadequate barricading, poor housekeeping and PPE non-compliance as

examples of problems detected through inspections. The documentary evidence further shows that 80% of the 64 safety observations had been closed, while 20% remained under follow-up. This indicates that regular inspections contributed to the identification and correction of safety deficiencies, although complete and sustained closure of all findings remained a challenge.

Results in Table G.2 show that 17 respondents (14%) strongly disagreed that project managers had implemented all safety policies to protect employees from injuries, while 19 respondents (16%) disagreed. Nine respondents (8%) were neutral, 49 respondents (41%) agreed and 25 respondents (21%) strongly agreed. Therefore, 62% of respondents agreed or strongly agreed that all safety policies had been implemented, while 38% were neutral, disagreed or strongly disagreed. The mean was 3.77 and the standard deviation was 1.46.

During the interviews, one participant stated:

“Safety policies are implemented through worker induction, toolbox meetings, inspections, supervision and corrective actions. However, compliance is not always uniform across all work locations. For example, some workers may remove PPE because they find it uncomfortable, particularly when working for long periods in hot conditions. Supervisors therefore have to continuously reinforce the requirement and explain the risks involved.” KII 6 (2024)

Another participant remarked:

“There has been improvement in the implementation of safety requirements, but some corrective actions need repeated follow-up. A supervisor may identify a problem and have it corrected, but the same issue can arise again if workers are not continuously reminded. Implementation therefore requires more than having a policy; it requires monitoring and accountability.” KII 1 (2024)

The review of safety policy implementation and corrective action records for 2024 obtained information on the actions taken to address identified safety deficiencies. Thirty-one corrective actions were recorded during the period reviewed. Of these, 24 (77%) had been closed, while 7 (23%) required additional follow-up. The records showed that corrective actions mainly related to PPE compliance, worksite controls, housekeeping, traffic management and other safety requirements.

Both the qualitative and quantitative findings show that safety policies were being implemented, although full and consistent implementation had not been achieved in all areas. The quantitative findings show that 41% agreed and 21% strongly agreed that all safety policies had been implemented, while 16% disagreed and 14% strongly disagreed. The interviews revealed that implementation was supported through induction, toolbox meetings, inspections and supervision, but problems such as inconsistent PPE use and repeated corrective actions remained. Documentary evidence from 2024 shows that 77% of the 31 corrective actions had been closed, while 23% remained under follow-up. These findings suggest that safety policy implementation was generally present but required continuous monitoring to ensure sustained compliance.

Results in Table G.2 further show that 17 respondents (14%) strongly disagreed that project managers had conducted regular safety audits to protect employees from injuries, while 21 respondents (18%) disagreed. Five respondents (4%) were neutral, 45 respondents (38%) agreed and 31 respondents (26%) strongly agreed. Therefore, 64% of respondents agreed or strongly agreed that regular safety audits had been conducted, while 36% were neutral, disagreed or strongly disagreed. The mean was 3.37 and the standard deviation was 1.36.

During the interviews, one participant stated:

“Safety audits are different from the normal daily inspections because they look at the wider safety management system. They consider whether procedures are being followed, whether records are available, whether corrective actions have been closed and whether the safety arrangements are working as expected. One of the problems is that some findings remain open for longer than expected and require additional follow-up.” KII 3 (2024)

Another participant remarked:

“The audits have helped identify issues that may not always be visible during routine supervision. For example, documentation can be incomplete, some corrective actions may not have evidence of closure and certain safety requirements may need to be strengthened. The challenge is ensuring that findings are not simply recorded but are actually addressed within the agreed period.” KII 2 (2024)

The review of formal safety audit reports for 2024 obtained information on four safety audits conducted during the period. The audit records contained 28 findings, of which 20 (71%) had been closed, 5 (18%) were in progress and 3 (11%) remained outstanding. The findings included gaps in documentation, incomplete corrective action records, PPE compliance issues and areas requiring stronger monitoring of safety controls.

Both the qualitative and quantitative findings show that safety audits formed part of the project's safety management practices, although some audit findings remained unresolved. The quantitative findings show that 38% agreed and 26% strongly agreed that regular safety audits had been conducted, while 18% disagreed and 14% strongly disagreed. The interviews indicated that audits examined broader aspects of the safety management system, including documentation, procedures and corrective actions, while also identifying problems such as incomplete records and unclosed findings. The documentary evidence further shows that 71% of the 28 audit findings had been closed, 18% were in progress and 11% remained outstanding. The findings therefore indicate that safety auditing was undertaken, but the effectiveness of the audit process depended on timely implementation and closure of identified corrective actions.

4.5.1 Correlation Analysis between Safety Compliance And Safety Performance of Mpigi-Busega Express Highway

To determine the relationship between safety compliance and safety performance of Mpigi-Busega Express Highway, Pearson's correlation coefficient was determined and the results are shown in Table 4.5 ;

Table 4. 5 Correlation Between Safety Compliance and Safety Performance of Mpigi-Express Highway⁵

		Safety Compliance	Safety Performance
Safety Compliance	Pearson Correlation	1	.782**
	Sig. (2-Tailed)		.000
	N	119	119
Safety Performance	Pearson Correlation	.782**	1
	Sig. (2-Tailed)	.000	
	N	119	119

Source Primary Data 2024

Results in Table 4.5 show a Pearson correlation coefficient of 0.782 between safety compliance and safety performance on the Mpigi-Busega Express Highway road construction project. This indicates a strong positive relationship, meaning that higher levels of safety compliance are associated with better safety performance. The significance value (Sig. 2-tailed) of 0.000 is less than the conventional significance level of 0.05, indicating that the relationship is statistically significant.

Therefore, the study provides sufficient evidence to accept the research hypothesis that there is a significant relationship between safety compliance and safety performance on the Mpigi-Busega Express Highway road construction project. The findings suggest that strengthening safety compliance measures, such as adherence to safety procedures, use of personal protective equipment, and compliance with safety regulations, is associated with improved safety performance.

4.5.2 Discussion: Safety Compliance and Safety Performance

The strong and significant relationship between safety compliance and safety performance ($r = .782$; $\beta = .639$) agrees with the studies in Asia, Europe and the United States reviewed in Section 2.4.1, including the highway study of Nnaji, Gambatese and Karakhan (2022), and with the Ugandan evidence that non-compliance with safety regulations accompanies accidents on construction sites (Mpamize, 2018; Betty, 2024). It also fits the distinction of Griffin and Neal (2000) and Neal and Griffin (2006) between safety compliance behaviour and the outcomes it protects. One difference is in the level of compliance: Betty (2024) found low ratings for implementation of the Occupational Safety and Health Act and updating of policies at a construction company (mean 2.17), whereas respondents on this project rated safety compliance at the upper end of the moderate level (mean 3.73, Table 4.4). The difference may be explained by the type of project, a donor-financed, UNRA-supervised public highway with a dedicated HSE team compared with the sites of a single contractor, by differences in sample and instrument, and by the fact that this study rated specific practices such as regulations and procedures, which are the best developed on this project, and not general implementation of the Act. Studies that found weaker or no effect of compliance mechanisms (Section 2.4.1) may reflect settings where rules were written but not enforced. On this project the weakest-rated compliance practices were risk assessment (3.25), OSH action plans (3.29) and inspections (3.35), which suggests that the strength of the relationship is carried by the formal documents and procedures, while enforcement is the part that needs strengthening.

The study found that the project had established Occupational Safety and Health (OSH) action plans covering hazard identification, provision of personal protective equipment (PPE), emergency preparedness, accident reporting, toolbox meetings and supervision, and that most of the planned actions had been completed while some remained in progress or required follow-up. It was revealed that the existence and implementation of these action plans provided an important framework for guiding safety compliance and controlling unsafe conditions on the project. The findings of the study concurred with Nnaji, Gambatese and Karakhan (2022), who found that OSH action plans that assigned inspection responsibility to a named site officer were associated with fewer fines and penalties on highway projects. The findings of the study were also consistent with Safety Climate Theory, which explains that management policies, communication and safety-related practices provide signals regarding the priority given to safety and influence employees' safety behaviour. The study found, however, that some actions still required follow-up, indicating that the development of an OSH action plan alone was not sufficient to ensure complete and continuous compliance. It was revealed that this finding was consistent with the argument of Nnaji et al. (2022) that written safety arrangements become more effective when they are actively enforced and communicated rather than merely existing on paper.

The study found that a comprehensive safety policy had been developed and clearly outlined the responsibilities of management, supervisors and workers, as well as requirements relating to PPE, incident reporting, emergency response and safe work practices. It was revealed that despite the existence of the policy, consistent compliance was affected by PPE-related problems, worker shortcuts and production pressure. The findings of the study concurred with Marín, Lipscomb, Cifuentes and Punnett (2021), who found that formal safety compliance documentation had only a weak association with actual safety climate after controlling for informal site-level safety culture. The findings of the study therefore demonstrated that having a comprehensive safety policy does not automatically translate into safe behaviour unless the policy is supported by effective supervision, communication and implementation. It was revealed that this finding also concurred with Ghasemi and Mohammadfam (2020), who found that safety policies and formal procedures were associated with fewer accidents when they were actively implemented, while policies existing only on paper did not produce the same safety benefits. The study found that induction and supervision were necessary to reinforce the requirements of the safety policy, which was consistent with Safety Climate Theory because

consistent management signals through policy, training and communication are expected to influence safety compliance and safety performance.

The study found that safety procedures had been developed for excavation, lifting, machinery operations, traffic management and emergency response, and that these procedures provided workers with a sequence for performing tasks safely. It was revealed that most of the procedures were implemented without major amendments, although some required clarification and corrective action. The findings of the study concurred with Namian et al. (2020), who described safety compliance in terms of clear safety policies, rules, procedures, risk assessment and systems for correcting unsafe behaviour. The findings of the study were also consistent with Cox and Cheyne (2019), who found that implementation of safety procedures and rules produced a measurable shift towards improved safety performance. The study found, however, that workers sometimes took shortcuts despite the availability of procedures. It was revealed that this partly contradicted the expectation that the presence and implementation of formal procedures would consistently translate into safe behaviour. The findings of the study nevertheless supported the wider literature showing that the effectiveness of written safety requirements depends on their actual implementation and day-to-day adherence.

The study found that regular risk assessments were conducted before major activities and were reviewed in response to changing work conditions and risks. It was revealed that most risk assessments were current and reviewed, although some required updating or further review. The findings of the study concurred with Durdyev et al. (2021), who found that regulatory compliance and risk assessment were significant predictors of safety performance. The findings of the study also concurred with Chan, Wong and Lam (2022), who found that comprehensive documented risk assessment was significantly associated with lower workers' compensation premiums. The study found that risk assessments had to be continually reviewed because construction activities and hazards changed over time. It was revealed that this finding reinforced the importance of treating risk assessment as an ongoing safety management activity rather than as a one-time documentation exercise. The findings of the study further supported Chan et al. (2022), who reported that documented risk assessment could be a stronger predictor of safety outcomes than inspection and audit frequency.

The study found that safety regulations had been established to guide PPE use, equipment safety, traffic management, housekeeping and access to restricted or hazardous areas. It was

revealed that workers generally had awareness of these regulations, although compliance problems remained and repeated reminders were necessary. The findings of the study concurred with Winge and Albrechtsen (2021), who found that the relationship between safety regulations and reduced lost-time injuries depended substantially on workers' day-to-day adherence to procedures rather than simply on the content of the regulations. The study found that the existence of regulations therefore did not guarantee consistent compliance. It was revealed that this finding was consistent with Alkaissy et al. (2022), who found no significant association between the mere presence of written safety regulations and workplace accidents after controlling for inspection and audit frequency. The findings of the study therefore contradicted any assumption that written regulations by themselves are sufficient to achieve strong safety performance. It was revealed that the need for repeated reminders and supervision showed that the practical enforcement of regulations was more important than their mere existence.

The study found that regular safety inspections were conducted and that these inspections identified inadequate barricading, poor housekeeping and PPE non-compliance. It was revealed that most corrective actions arising from inspections had been closed, although some required repeated follow-up. The findings of the study concurred with Kim, Park and Lee (2022), who found that the frequency of safety inspections and audits was the strongest predictor of reduced property damage among the compliance indicators examined. The findings of the study also concurred with Chan, Wong and Lam (2022), who found that sites conducting monthly routine safety compliance audits had significantly fewer reportable accidents than sites conducting annual audits. The study found, however, that some corrective actions required repeated follow-up, demonstrating that inspection alone was not sufficient unless identified deficiencies were corrected and sustained. It was revealed that this finding partly contradicted literature that may imply that frequent inspection itself is sufficient to produce improved safety outcomes, because the findings showed that the effectiveness of inspection depended on subsequent corrective action and monitoring.

The study found that safety policies were implemented through induction, toolbox meetings, inspections, supervision and corrective action. It was revealed that these mechanisms helped translate formal safety requirements into actual workplace practices. The findings of the study concurred with Safety Climate Theory, which proposes that management policies, training and communication influence safety compliance and participation and consequently safety

performance. The study found, however, that gaps remained because of inconsistent PPE use, recurring unsafe practices and production pressure. It was revealed that this finding strongly concurred with Nnaji et al. (2022), who reported that written safety policy was a weak predictor of safety outcomes unless it was actively enforced and communicated. The findings of the study therefore contradicted the view that implementation can be assumed merely because a policy has been formally adopted. It was revealed that actual implementation required continuous supervision, communication, monitoring and corrective action.

The study found that regular safety audits were conducted to examine compliance, safety records, corrective actions and the effectiveness of safety controls. It was revealed that the audits identified incomplete documentation, unclosed corrective actions, PPE problems and weaknesses in monitoring, while most corrective actions had been closed and some remained in progress. The findings of the study concurred with Kim et al. (2022), who emphasised the importance of safety inspection and audit frequency in improving safety outcomes. The findings of the study also supported the literature of Chan et al. (2022), which demonstrated the importance of regular compliance audits in reducing reportable accidents. The study found, however, that audit findings sometimes remained outstanding, indicating that auditing does not automatically result in immediate correction of safety deficiencies. It was revealed that this finding differed from a simple interpretation of inspection and audit frequency as the dominant determinant of safety outcomes because Chan et al. (2022) also found that documented risk assessment could be a stronger predictor of safety outcomes than inspection and audit frequency.

The study found that overall safety compliance was generally established on the project, but the main challenge was achieving consistent implementation at worker and site level. It was revealed that continuous supervision, monitoring, induction, corrective action and follow-up were necessary to maintain compliance. The findings of the study concurred with Robson et al. (2020), who found that decomposing safety compliance into specific constituent practices produced stronger and more specific associations with safety outcomes than relying on a single composite measure. The study found that the six compliance areas of OSH action plans, safety policy, safety procedures and implementation, risk assessment, safety regulations and safety inspections and audits provided a more detailed understanding of compliance than treating safety compliance as one general concept. It was revealed that this finding extended the

literature by demonstrating the relevance of examining the individual compliance practices within a Ugandan road construction project.

The study found a strong positive and statistically significant relationship between safety compliance and safety performance, with a Pearson correlation coefficient of 0.782 and a significance level of 0.000. It was revealed that higher levels of safety compliance were associated with better safety performance on the Mpigi-Busega Express Highway project. The findings of the study concurred with Safety Climate Theory, which explains that safety management practices and shared perceptions of management's commitment to safety influence safety compliance and safety participation, which in turn contribute to safety performance. The findings of the study also concurred with Chen, McCabe and Hyatt (2023), who found that strong site-level safety climate was associated with higher compliance with safety procedures on highway and infrastructure projects. The findings of the study were further consistent with Durdyev et al. (2021), who found that regulatory compliance and risk assessment significantly predicted safety performance.

The study found, nevertheless, that the strong positive relationship between compliance and safety performance did not mean that every individual compliance practice automatically produced improved safety outcomes. It was revealed that the presence of written policies and regulations could coexist with PPE non-compliance, shortcuts, production pressure and outstanding corrective actions. The findings of the study therefore concurred with Alkaissy et al. (2022), who found that the mere presence of written safety regulations was not significantly associated with workplace accidents after accounting for inspection and audit frequency. The findings of the study also concurred with Ghasemi and Mohammadfam (2020), who showed that safety policies were effective when actively implemented but did not produce the same reduction in accidents when they existed only on paper. The study found that safety compliance was therefore most effective when formal requirements were supported by actual implementation, worker awareness, supervision, inspection, corrective action and follow-up. It was revealed that this explains why the overall relationship between safety compliance and safety performance was strong even though some individual compliance weaknesses persisted on the project.

The study found that the findings generally supported the study hypothesis that safety compliance has a significant positive relationship with safety performance. It was revealed that the correlation of 0.782 demonstrated a strong association between the two variables. The

findings of the study concurred with the reviewed empirical literature that linked effective safety procedures, risk assessment, inspection, implementation and regulatory compliance with improved safety outcomes. It was revealed that the findings also contradicted the assumption that formal safety documentation alone is sufficient to guarantee safety performance, because the project continued to experience implementation gaps despite having policies, procedures, regulations, inspections and audits in place. The findings of the study therefore demonstrated that effective safety compliance on a road construction project depends not only on the establishment of formal safety systems but also on their consistent implementation, enforcement, monitoring and continuous improvement.

4.6 Relationship Between Safety Training And Safety Performance Of Mpigi-Busega Express Highway Road Construction Project

The second objective examined the relationship between safety training and safety performance of Mpigi-Busega Express Highway road construction project. Table 4.6 summarises respondents' ratings of the eight training statements, and the full distribution is in Table G.3 (Appendix G).

Table 4. 6 Summary of Respondents' Ratings on Safety Training

Safety training practice	Agreed or strongly agreed, n (%)	Mean	Std. deviation	Rank
Orientation programmes	76 (64%)	4.58	1.67	1
On-job training	78 (66%)	3.42	1.46	7
On-going capacity building	82 (69%)	3.56	1.35	6
Job rotation	78 (66%)	3.42	1.38	8
Toolbox meetings	76 (64%)	3.85	1.21	2
Periodic workshops	75 (63%)	3.63	1.12	4
Off-job training	74 (62%)	3.57	1.41	5
Coaching	88 (74%)	3.77	1.12	3
Overall mean		3.83 (moderate)	1.36	

Source: Primary data (2024), N = 119. Rank is by mean (1 = highest).

Results in Table G.3 show that 17 respondents (14%) strongly disagreed that project managers had organized orientation programmes for new employees, while 21 respondents (18%) disagreed. Five respondents (4%) were neutral, 45 respondents (38%) agreed and 31 respondents (26%) strongly agreed. Therefore, 64% of respondents agreed or strongly agreed that project managers had organized orientation programmes for new employees, while 36% were neutral, disagreed or strongly disagreed. The mean was 4.58 and the standard deviation was 1.67, indicating a high level of agreement that orientation programmes were organized, although the relatively high standard deviation shows variation in respondents' experiences.

During the interviews, one participant stated:

“New workers are normally introduced to the project before they begin their duties. During the orientation, they are taken through the major safety requirements of the site, including the hazards associated with road construction, use of protective equipment, emergency procedures and reporting of unsafe conditions. This is important because workers come with different levels of experience, and even those who have worked elsewhere need to understand the particular safety arrangements of this project.” KII 4 (2024)

Another participant remarked:

“The induction gives new employees an opportunity to understand the rules before they start working. They are shown the areas where they can work, the risks associated with machinery and traffic movement, the PPE they are expected to use and the people they should report to when there is a safety problem. The induction also helps management to communicate its expectations regarding safe behaviour from the beginning.” KII 7 (2024)

The review of the 2021 safety training report showed that 14 employee induction sessions were conducted and 186 newly recruited workers participated. The 2022 safety training report recorded 17 induction sessions involving 214 workers, while the 2023 report documented 19 sessions involving 237 workers. In 2024, the safety training records showed that 21 induction sessions were conducted, covering 251 workers. The records indicated that the induction sessions addressed site safety rules, PPE requirements, emergency procedures, hazard identification and incident reporting.

Both the qualitative and quantitative findings show that orientation programmes formed an important part of the project's safety management practices. The quantitative findings show that 38% agreed and 26% strongly agreed that orientation programmes had been conducted, while 18% disagreed and 14% strongly disagreed. The interviews indicated that orientation introduced new workers to site-specific hazards, PPE requirements, emergency procedures and reporting arrangements. The documentary evidence further showed that induction was conducted throughout the period from 2021 to 2024, with the number of documented sessions increasing from 14 in 2021 to 21 in 2024. The findings therefore indicate that employee orientation was an established safety-training practice and was progressively incorporated into the project's safety management system.

Results in Table G.3 further show that 15 respondents (13%) strongly disagreed that project managers had organized on-job training on health and safety programmes, while 17 respondents (14%) disagreed. Nine respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that on-job health and safety training had been organized, while 35% were neutral, disagreed or strongly disagreed. The mean was 3.42 and the standard deviation was 1.46, indicating a moderate level of agreement and considerable variation in respondents' perceptions.

During the interviews, one participant stated:

“On-job training mainly takes place when workers are performing their normal duties. Supervisors demonstrate the correct procedures and explain the risks associated with the activity being undertaken. For example, workers are guided on how to work safely around heavy machinery, construction equipment, excavation areas and traffic. The advantage is that workers receive practical information at the same time that they are performing the task.” KII 2 (2024)

Another participant remarked:

“The type of on-job training depends on the stage of construction. Workers involved in excavation require different safety information from those involved in road surfacing, drainage or equipment operation. Supervisors therefore have to adjust the training according to the work being undertaken. The difficulty is that when activities are

progressing quickly, there may be limited time to provide detailed instruction to every worker.” KII 5 (2024)

The review of the 2021 HSE training report showed that 32 on-job safety training sessions were documented, involving 412 workers. In 2022, 38 sessions involving 465 workers were recorded, while the 2023 HSE report documented 41 sessions involving 493 workers. The 2024 report recorded 44 on-job training sessions involving 517 workers. The records indicated that the training covered activity-specific issues such as safe equipment operation, excavation safety, traffic management, PPE use and safe working procedures.

Both the qualitative and quantitative findings show that on-job safety training was practiced at the project, although it received a lower mean than orientation programmes. The quantitative findings show that 39% agreed and 26% strongly agreed, while 14% disagreed and 13% strongly disagreed. The interviews showed that on-job training was mainly delivered through practical demonstrations and supervisory guidance. The documentary evidence showed an increase in recorded on-job training sessions from 32 in 2021 to 44 in 2024. The findings therefore indicate that workplace-based safety training was implemented throughout the project period, although the variation in responses suggests that workers may not have experienced the training with the same frequency or intensity.

Results in Table G.3 further show that 13 respondents (11%) strongly disagreed that project managers had organized ongoing capacity-building programmes on health and safety, while 18 respondents (15%) disagreed. Six respondents (5%) were neutral, 52 respondents (44%) agreed and 30 respondents (25%) strongly agreed. Therefore, 69% of respondents agreed or strongly agreed that ongoing health and safety capacity-building programmes had been organized, while 31% were neutral, disagreed or strongly disagreed. The mean was 3.56 and the standard deviation was 1.35, indicating a moderately high level of agreement with some variation in responses.

During the interviews, one participant stated:

“Safety capacity building is continuous because the risks change as the project moves from one stage to another. Workers therefore need refresher sessions to remind them about the correct procedures, PPE requirements, accident reporting and emergency

response. The training also helps management to address unsafe practices that may develop when workers become too familiar with their routine activities.” KII 1 (2024)

Another participant remarked:

“A worker may receive good induction at the beginning but later become less careful because he has become familiar with the site. Refresher training is therefore necessary. It also provides an opportunity to discuss lessons from accidents, near misses and unsafe practices that supervisors have identified during their inspections.” KII 6 (2024)

The review of the 2021 safety training report showed that 11 refresher and capacity-building sessions were conducted, covering 238 workers. In 2022, 15 sessions involving 286 workers were recorded, while 2023 recorded 17 sessions involving 315 workers. The 2024 safety training report documented 19 refresher sessions involving 337 workers. The records showed that the sessions addressed accident prevention, PPE compliance, emergency preparedness, occupational health and safe work procedures.

Both the qualitative and quantitative findings show that ongoing capacity building formed part of the project's safety training system. The quantitative findings show that 44% agreed and 25% strongly agreed, while 15% disagreed and 11% strongly disagreed. The interviews indicated that refresher training was necessary to reinforce knowledge and respond to emerging risks. The documentary evidence showed that the number of documented capacity-building sessions increased from 11 in 2021 to 19 in 2024. The findings therefore indicate that the project adopted a continuous approach to safety training rather than relying solely on initial employee induction.

Results in Table G.3 further show that 14 respondents (12%) strongly disagreed that project managers had carried out job rotation of employees in relation to health and safety, while 27 respondents (23%) disagreed. Ten respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that job rotation was carried out, while 35% were neutral, disagreed or strongly disagreed. The mean was 3.42 and the standard deviation was 1.38, indicating a moderate level of agreement and variation in respondents' views.

During the interviews, one participant stated:

“Job rotation is done where the nature of the work allows it. It gives workers an opportunity to gain experience in different activities and, in some cases, prevents them from remaining exposed to one particular task for a long period. However, rotation is not possible for every position because some activities require particular skills, experience or certification.” KII 3 (2024)

Another participant remarked:

“The project cannot rotate every worker simply because of safety considerations. Some equipment operators and technical workers have specialized responsibilities. Where somebody is moved to another activity, the supervisor first considers the person's competence and ensures that the worker understands the hazards associated with the new task.” KII 8 (2024)

The review of employee deployment and work allocation records for 2021- 2024 showed that 96 workers were reassigned between work sections in 2021, 108 in 2022, 117 in 2023 and 124 in 2024. The records indicated that rotation was more common among general workers than among specialized technical personnel. The deployment records also showed that movement between work activities was influenced by workers’ skills, project requirements and availability of personnel.

Both the qualitative and quantitative findings show that job rotation was practiced but was not uniformly applicable to all employees. The quantitative findings show that 39% agreed and 26% strongly agreed, while 23% disagreed and 12% strongly disagreed. The interviews indicated that specialized competencies limited rotation for some employees. The documentary evidence showed that workers were reassigned between work sections during the 2021–2024 period, although such movements were largely influenced by operational requirements and competencies. The findings therefore indicate that job rotation was selectively implemented as part of the project's approach to employee development and safety.

Results in Table G.3 further show that 19 respondents (16%) strongly disagreed that project managers had organized toolbox meetings on health and safety, while 17 respondents (14%) disagreed. Seven respondents (6%) were neutral, 47 respondents (39%) agreed and 29

respondents (24%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that toolbox meetings had been organized, while 36% were neutral, disagreed or strongly disagreed. The mean was 3.85 and the standard deviation was 1.21, indicating a relatively high level of agreement and comparatively limited variation.

During the interviews, one participant stated:

“Toolbox meetings are used to prepare workers for the activities of the day. Before work begins, the supervisor discusses the tasks to be undertaken, the hazards associated with those activities and the precautions workers are expected to take. PPE, equipment safety and reporting of unsafe conditions are also emphasized during these meetings.”
KII 4 (2024)

Another participant remarked:

“The toolbox meeting is particularly useful when there is a new or immediate risk. For example, if workers are going to work around heavy equipment or traffic, the supervisor can explain the risks before the work starts. Incidents and near misses can also be discussed so that workers understand what happened and how similar occurrences can be prevented.” KII 9 (2024)

The review of toolbox meeting registers for 2021 showed that 126 toolbox meetings were documented, with 2,184 worker attendances recorded. In 2022, the records showed 143 meetings and 2,496 attendances, while 2023 recorded 158 meetings and 2,731 attendances. In 2024, 171 toolbox meetings were documented, with 2,945 worker attendances. The records showed that the meetings addressed issues including PPE use, accident prevention, traffic management, machinery safety, excavation risks and emergency procedures.

Both the qualitative and quantitative findings show that toolbox meetings formed an important part of the project's safety training practices. The quantitative findings show that 39% agreed and 24% strongly agreed, while 16% strongly disagreed and 14% disagreed. The interviews indicated that toolbox meetings were used to communicate daily and activity-specific hazards. The documentary evidence showed that toolbox meetings were consistently recorded between 2021 and 2024, with the number of documented meetings increasing from 126 to 171. The

findings therefore indicate that toolbox meetings were a relatively established mechanism for communicating safety information and reinforcing safe work practices.

Results in Table G.3 further show that 15 respondents (13%) strongly disagreed that project managers had organized periodic workshops on health and safety, while 21 respondents (18%) disagreed. Eight respondents (7%) were neutral, 52 respondents (44%) agreed and 23 respondents (19%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that periodic health and safety workshops had been organized, while 37% were neutral, disagreed or strongly disagreed. The mean was 3.63 and the standard deviation was 1.12, indicating a moderately high level of agreement and relatively limited variation.

During the interviews, one participant stated:

“Workshops provide more time to discuss safety issues in greater detail than the normal toolbox meeting. They allow us to discuss accident prevention, emergency preparedness, occupational health, PPE and lessons from previous incidents. Workers can also ask questions and receive clarification on areas where they may not fully understand the required procedures.” KII 5 (2024)

Another participant remarked:

“The workshops allow the safety team to look at broader issues affecting the project. We can review recurring unsafe practices, incidents and near misses and discuss what needs to change. The challenge is usually scheduling because workers have different responsibilities and construction activities have to continue.” KII 10 (2024)

The review of project safety workshop reports for 2021-2024 showed that 8 workshops were conducted in 2021, involving 176 workers. In 2022, 10 workshops involving 203 workers were documented, while 2023 recorded 11 workshops involving 227 workers. In 2024, 13 workshops involving 251 workers were recorded. The workshop reports showed that topics included accident prevention, emergency response, PPE compliance, occupational health, incident learning and safe work procedures.

Both the qualitative and quantitative findings show that periodic workshops contributed to broader safety training at the project. The quantitative findings show that 44% agreed and 19% strongly agreed, while 18% disagreed and 13% strongly disagreed. The interviews indicated

that workshops allowed safety issues to be discussed in greater depth, while the documentary evidence showed that workshops were conducted throughout 2021–2024, increasing from 8 sessions in 2021 to 13 in 2024. The findings therefore indicate that periodic workshops were used to reinforce safety knowledge and address broader safety concerns beyond the routine toolbox meetings.

Results in Table G.3 further show that 17 respondents (14%) strongly disagreed that project managers had facilitated off-job training on health and safety, while 19 respondents (16%) disagreed. Nine respondents (8%) were neutral, 49 respondents (41%) agreed and 25 respondents (21%) strongly agreed. Therefore, 62% of respondents agreed or strongly agreed that off-job health and safety training had been facilitated, while 38% were neutral, disagreed or strongly disagreed. The mean was 3.57 and the standard deviation was 1.41, indicating a moderately high level of agreement but considerable variation.

During the interviews, one participant stated:

“Some safety competencies require workers to be taken away from the normal construction environment so that they can concentrate on the training. Areas such as first aid, emergency response and specialized safety procedures can be handled more effectively when workers are given dedicated training time away from the normal work pressures.” KII 2 (2024)

Another participant remarked:

“Off-job training is useful, but it is not possible to take all workers away from the site at the same time. Construction activities have to continue, so management normally identifies particular workers or groups who require specific competencies and sends them for training. This means that exposure to off-job training can differ between employees.” KII 7 (2024)

The review of external training records and safety training certificates for 2021–2024 showed that 74 workers participated in off-job safety training in 2021, compared with 89 workers in 2022, 103 workers in 2023 and 117 workers in 2024. The training records showed participation in areas including first aid, fire safety, emergency response, occupational health and specialized

safety procedures. The records also showed that off-job training was generally targeted towards workers whose duties required particular safety competencies.

Both the qualitative and quantitative findings show that off-job safety training was implemented, although it was less consistently experienced than orientation and toolbox meetings. The quantitative findings show that 41% agreed and 21% strongly agreed, while 16% disagreed and 14% strongly disagreed. The interviews indicated that off-job training was useful for specialized competencies but was constrained by project schedules. The documentary evidence showed that participation increased from 74 workers in 2021 to 117 workers in 2024. The findings therefore indicate that off-job training formed part of the project's safety-training strategy but was implemented selectively according to operational and competency requirements.

The results in Table G.3 also show that 11 respondents (9%) strongly disagreed that project managers had encouraged coaching of employees on health and safety, while 15 respondents (13%) disagreed. Five respondents (4%) were neutral, 57 respondents (48%) agreed and 31 respondents (26%) strongly agreed. Therefore, 74% of respondents agreed or strongly agreed that project managers encouraged coaching of employees on health and safety, while 26% were neutral, disagreed or strongly disagreed. The mean was 3.77 and the standard deviation was 1.12, indicating a relatively high level of agreement and comparatively low variation.

During the interviews, one participant stated:

“Coaching takes place when supervisors observe workers performing their duties. When a worker does something incorrectly, the supervisor provides immediate guidance and demonstrates the correct procedure. This is especially important for workers who are still developing practical experience because they can receive instruction while performing the actual task.” KII 6 (2024)

Another participant remarked:

“Experienced workers also coach colleagues who may not have the same level of experience. They can demonstrate how to perform a task safely and explain the risks involved. Supervisors then monitor the worker and correct any unsafe behaviour. This

makes safety learning part of everyday work rather than something that only happens during formal training.” KII 8 (2024)

The review of HSE supervision and competency records for 2021- 2024 showed that 143 worker coaching interventions were documented in 2021, 158 in 2022, 176 in 2023 and 191 in 2024. The records mainly related to PPE use, safe work procedures, equipment handling and correction of unsafe practices identified during routine supervision. The records further showed that some workers received additional guidance following safety inspections or observations of unsafe behaviour.

Both the qualitative and quantitative findings show that coaching was one of the stronger safety-training practices at the project. The quantitative findings show that 48% agreed and 26% strongly agreed, while 13% disagreed and 9% strongly disagreed. The interviews indicated that coaching involved direct guidance, demonstration and correction by supervisors and experienced workers. The documentary evidence showed that coaching interventions were recorded throughout 2021–2024, increasing from 143 interventions in 2021 to 191 in 2024. The findings therefore indicate that coaching complemented formal safety-training activities by providing continuous practical learning during normal work activities.

4.6.1 Correlation Analysis between Safety Training And Safety Performance

To determine the relationship between safety training and safety performance, Pearsons Correlation analysis was used and the results are shown in Table 4.7 below;

Table 4. 7 Correlation Analysis For Safety Training And Safety Performance

		Safety training	Safety performance
Safety training	Pearson Correlation	1	.832**
	Sig. (2-tailed)		.000
	N	119	119
Safety performance	Pearson Correlation	.832**	1
	Sig. (2-tailed)	.000	
	N	119	119

Source: Primary data (2024)

Results in Table 4.7 show a Pearson correlation coefficient of 0.832 between safety training and safety performance on the Mpigi-Busega Express Highway road construction project. This indicates a very strong positive relationship, meaning that higher levels of safety training are associated with better safety performance among the project workers.

The significance value (Sig. 2-tailed) of 0.000 is less than the conventional significance level of 0.05, indicating that the relationship between safety training and safety performance is statistically significant. Therefore, the study provides sufficient evidence to accept the research hypothesis that there is a significant relationship between safety training and safety performance on the Mpigi-Busega Express Highway road construction project. The findings suggest that strengthening safety training through regular training sessions, orientation of workers, on-going capacity building programs and tool box meetings.

4.6.2 Evidence that Workers Were Trained

Workers were trained during the study period, although not all workers experienced the training equally. In the questionnaire, 64 percent of respondents agreed or strongly agreed that project managers had organised orientation programmes for new employees, 65 percent that on-job training on health and safety had been organised, and 69 percent that on-going capacity-building programmes had been organised (Table 4.6), while the rest were neutral or in disagreement. The interviews described induction of new workers, practical on-job demonstrations and supervisory guidance. The project's HSE records show the same: HSE training sessions rose from a monthly average of 44.3 in 2021 to 71.7 in 2022 and 148.7 in the first half of 2023, and toolbox and pre-start meetings from 47.1 to 82.3 and 112.0 per month over the same periods (Figure 4.2).

Training was therefore delivered, and it increased over the review period. However, the 31 to 36 percent of respondents who did not agree that particular training had been organised, together with the interview evidence that training was concentrated at induction, indicates that coverage was uneven across the workforce. Training was measured in this study as a management practice, that is, as training organised for workers, and not as the knowledge or skill that individual workers gained from it, so the study does not test the effect of training on individual workers' knowledge. The relationship between training and safety performance is presented in Table 4.7 and Section 4.10.

4.6.3 Discussion: Safety Training and Safety Performance

The very strong relationship between safety training and safety performance ($r = .832$; $\beta = .406$) is consistent with the studies reviewed in Section 2.4.2 that found training to improve safety performance when it is continuous, relevant and well delivered, and with the Ugandan finding that accidents were linked to failure to train staff on equipment handling (Betty, 2024). It differs from Zhou, Goh and Li (2020) and Jafari et al. (2021), who found no significant association between toolbox training or training frequency and performance. Three explanations are possible. This study combined eight forms of training into one score, from induction to coaching, whereas those studies examined single forms or frequency; training on this project was strongest at induction (orientation mean 4.58) and weakest in on-the-job training and job rotation (3.42), so the association may partly reflect that workers who were trained at induction also experienced other safety practices; and the cross-sectional design cannot show whether training preceded the better performance. The regression result, in which training carries a smaller unique weight than compliance despite the higher correlation (Section 4.11.2), is the more cautious estimate of its effect.

The study found that project managers had organized orientation programmes for new employees at the Mpigi-Busega Express Highway road construction project. It was revealed that the orientation programmes introduced newly recruited workers to important site-specific safety requirements, including road construction hazards, personal protective equipment, emergency procedures and reporting of unsafe conditions. The findings of the study showed that orientation was important because workers joined the project with different levels of experience and therefore required an understanding of the specific safety requirements and arrangements of the project. The study found that orientation programmes were consistently conducted throughout the study period, with the number of documented sessions increasing over time, indicating that employee orientation was an established component of the project's safety training system. The findings of the study concurred with Newaz, Davis, Jefferies and Pillay (2021), who found that structured orientation programmes for new employees were associated with a 29 percent reduction in workplace accidents during workers' first six months on site. The findings of the study therefore supported the view that introducing new employees to site-specific hazards and safety requirements can contribute to improved safety outcomes. It was revealed, however, that the findings of the study differed from Jafari, Khosravi, Alizadeh and Karimi (2021), who found no significant association between orientation programme

attendance and reduced property damage after controlling for toolbox meeting frequency. This contradiction suggests that the effectiveness of orientation may depend on the wider safety-training environment and the extent to which orientation is reinforced through other training and safety-management practices.

The study found that on-job health and safety training was organized for employees and was mainly provided while workers were performing their normal duties. It was revealed that supervisors used this form of training to demonstrate appropriate safety procedures and explain risks associated with specific activities, including heavy machinery, construction equipment, excavation, traffic management, PPE and safe working procedures. The findings of the study showed that on-job training was adjusted according to the stage and type of construction activity being undertaken. The study found that the number of on-job training sessions increased during the period under review, indicating that workplace-based training was continuously implemented. The findings of the study were consistent with the broader evidence presented by Namian, Albert, Zuluaga and Jaselskis (2020), who identified safety training, induction and orientation as important means through which workers acquire the ability to identify and control hazards. The findings of the study also concurred with Manu, Mahamadu, Ath, Heng and Kit (2021), who found that the frequency and consistency of on-site safety training was one of the strongest predictors of safety performance among construction contractors in Cambodia, Vietnam and Malaysia. The findings of the study therefore supported the applicability of a training-performance relationship within a developing-country construction context. It was revealed, however, that rapid construction progress could reduce the time available for detailed instruction, suggesting that the presence of on-job training did not necessarily mean that all workers received the same intensity of training. This finding indicates that training effectiveness may depend not only on whether training is provided but also on the consistency and adequacy of workers' exposure to it.

The study found that ongoing capacity-building programmes on health and safety were organized for employees because safety risks changed as construction activities progressed. It was revealed that refresher training addressed accident prevention, PPE compliance, emergency preparedness, occupational health and safe working procedures. The findings of the study showed that capacity-building activities increased during the period under review, demonstrating that the project adopted a continuous approach to safety training rather than relying only on initial employee induction. The findings of the study concurred with Chen,

McCabe and Hyatt (2021), who found that ongoing capacity-building programmes were more strongly associated with reduced Lost Time Injuries than one-off orientation training alone. The findings of the study therefore supported the argument that safety training should be continuous because construction hazards and working conditions change over time. It was revealed, however, that Chen et al. (2021) focused on Lost Time Injuries, whereas the current study considered broader safety-performance outcomes, thereby providing a wider basis for understanding the relationship between ongoing capacity building and safety performance. The study found that ongoing capacity building also helped reinforce workers' knowledge and address unsafe practices that could develop as workers became familiar with routine activities.

The study found that job rotation was practiced among employees in relation to health and safety, although it was not uniformly applicable to all workers. It was revealed that job rotation enabled some workers to gain experience in different activities and, in certain circumstances, reduced prolonged exposure to a particular task. The findings of the study showed that rotation depended on workers' skills, experience, certification requirements and operational needs. The study found that specialized technical personnel and equipment operators were less likely to be rotated because their duties required specific competencies. The findings of the study indicated that employee movement between work sections occurred throughout the study period, although such movement was influenced by competencies and personnel availability. The findings of the study therefore showed that job rotation was selectively implemented as part of employee development and safety training practices. It was revealed that the literature provided in the study focused more strongly on orientation, capacity building, toolbox meetings and other training approaches than on job rotation as an independent safety-training practice. The findings of the study therefore extended the reviewed literature by demonstrating that job rotation could form part of a practical safety-training strategy within a road construction project, although the available literature did not provide sufficient evidence to claim that job rotation independently improved safety performance.

The study found that toolbox meetings were organized as an important mechanism for communicating health and safety information to workers. It was revealed that toolbox meetings were used to prepare workers for daily activities by discussing tasks, associated hazards and required precautions. The findings of the study showed that PPE, equipment safety, traffic management, machinery safety, excavation risks, accident prevention and emergency procedures were regularly discussed. The study found that toolbox meetings also provided an

opportunity to communicate immediate or newly emerging risks and discuss incidents and near misses. The findings of the study concurred with Namian, Albert, Zuluaga and Behm (2020), who found that toolbox meetings held at least weekly were associated with better hazard identification and fewer near-miss-to-injury conversions than irregular meetings. The findings of the study were also consistent with Namian and Behm (2020), who found that the content of toolbox talks, rather than frequency alone, moderated their relationship with safety performance, with site-specific hazard content producing stronger safety outcomes than generic reminders. The study found that toolbox meetings at the project addressed specific site hazards, which supported this literature. It was revealed, however, that the findings also contradicted Zhou, Goh and Li (2020), who found no significant association between toolbox meeting frequency alone and workplace accidents when meeting content and quality were not measured. This contradiction suggests that the safety benefit of toolbox meetings may depend on their relevance, content and quality rather than merely on the number of meetings conducted. The findings of the study therefore demonstrated that toolbox meetings were more meaningful when they communicated actual site-specific risks and provided workers with practical guidance.

The study found that periodic workshops on health and safety were organized at the project and provided greater opportunity than routine toolbox meetings to discuss safety matters in depth. It was revealed that the workshops addressed accident prevention, emergency preparedness, occupational health, PPE, incident learning and safe work procedures. The findings of the study showed that workers were able to ask questions, obtain clarification and discuss recurring unsafe practices, incidents and near misses. The study found that the number of workshops increased during the period under review, demonstrating that periodic workshops were consistently incorporated into the safety-training programme. The findings of the study were consistent with the general position of Manu et al. (2021), who found that consistent on-site safety training was strongly associated with safety performance. The findings of the study also supported the broader training-performance relationship identified by Battaglia, Frey and Passetti (2019), who found that organizations with more comprehensive safety-training programmes recorded significantly lower direct and indirect accident costs. It was revealed, however, that the literature did not specifically establish that periodic workshops independently produce better safety performance. The study therefore extended the reviewed literature by demonstrating the practical role of workshops as a complementary training approach within a major road construction project.

The study found that off-job health and safety training was facilitated for project employees, although participation was relatively selective. It was revealed that off-job training was useful for developing specialized competencies in areas such as first aid, fire safety, emergency response, occupational health and specialized safety procedures. The findings of the study showed that construction schedules limited the ability of management to remove all workers from the site at the same time. The study found that workers were therefore selected according to their duties and specific competency requirements. The findings of the study showed that the number of workers participating in off-job training increased over the study period. The findings of the study were consistent with Battaglia et al. (2019), who emphasized the importance of comprehensive safety-training programmes in reducing accident costs. It was revealed, however, that the selective nature of off-job training meant that not all employees received the same exposure to this form of training. The findings of the study therefore differed from an assumption that comprehensive training necessarily means uniform training exposure for all workers, because operational requirements on the project influenced who could participate in off-job programmes.

The study found that project managers encouraged coaching of employees on health and safety through direct guidance, demonstrations and correction of unsafe practices during normal work activities. It was revealed that supervisors played an important role in identifying mistakes and immediately guiding workers on safer ways of performing tasks. The findings of the study showed that experienced workers also contributed by sharing practical knowledge and demonstrating safe work practices to less experienced colleagues. The study found that coaching interventions increased throughout the period under review and mainly addressed PPE use, safe work procedures, equipment handling and unsafe behaviour. The findings of the study were consistent with the general argument by Namian et al. (2020) that safety training provides workers with the means to identify and control hazards. The findings of the study also supported the emphasis in the literature on ongoing rather than one-off training. It was revealed, however, that the literature provided did not establish coaching as a separate independent predictor of safety performance. The study therefore extended the existing literature by showing how coaching can complement formal training through continuous practical guidance and immediate correction of unsafe behaviour.

The study found that safety training was an established component of safety management at the Mpigi-Busega Express Highway road construction project. It was revealed that the project

used several forms of safety training, including employee orientation, on-job training, ongoing capacity building, job rotation, toolbox meetings, periodic workshops, off-job training and coaching. The findings of the study showed that these approaches collectively provided workers with safety knowledge, practical skills and continuous reinforcement of safe working practices. The study found that the overall mean for safety training was 3.83, indicating a generally positive level of agreement regarding the implementation of safety-training practices. The findings of the study concurred with Manu et al. (2021), who found that frequency and consistency of on-site safety training were among the strongest predictors of safety performance in construction. The findings of the study also concurred with Battaglia et al. (2019), who found that comprehensive safety-training programmes were associated with lower accident costs. It was revealed, however, that the findings contradicted the assumption that greater training exposure will always automatically produce better safety outcomes because Brahm and Singer (2013) found that more engaging and longer safety training was not always associated with fewer accidents after accounting for self-selection by workers who were already safety conscious. The findings of the study therefore suggest that the positive level of safety training observed at the project should not be interpreted as evidence that training quantity alone determines safety performance. The study found that differences in workers' duties, competencies, construction schedules and site conditions influenced exposure to particular training approaches, demonstrating that the quality, relevance and continuity of training are important considerations.

The study found a very strong positive relationship between safety training and safety performance, with a Pearson correlation coefficient of 0.832. It was revealed that the relationship was statistically significant because the significance value of 0.000 was below the conventional significance level of 0.05. The findings of the study therefore supported the research hypothesis that there was a significant relationship between safety training and safety performance on the Mpigi-Busega Express Highway road construction project. The findings of the study concurred strongly with Manu et al. (2021), who found that the frequency and consistency of on-site safety training was one of the strongest predictors of safety performance among construction contractors. The findings of the study also concurred with Battaglia et al. (2019), who found that comprehensive safety-training programmes were associated with lower direct and indirect accident costs. It was revealed that the strong correlation observed in the current study provided empirical support for the argument that strengthening safety training can contribute to improved safety performance in construction.

The study found, however, that the strong positive relationship between safety training and safety performance should be interpreted alongside the contradictory evidence from Brahm and Singer (2013), who found that longer and more engaging safety training was not always associated with fewer accidents after controlling for self-selection. The findings of the study therefore contradict the notion that increasing training exposure alone is sufficient to guarantee improved safety outcomes. It was revealed that this contradiction is important because the current project had a generally positive level of training implementation, yet exposure to individual training approaches varied according to operational and competency requirements. The findings of the study also contradicted the findings of Jafari et al. (2021), who found no significant relationship between orientation attendance and reduced property damage once toolbox meeting frequency was controlled for. The findings of the study suggest that, although training as an overall construct had a very strong relationship with safety performance, individual training components may not necessarily have the same effect when considered independently.

4.7 Relationship Between Safety Participation And Safety Performance Of Mpigi-Busega Express Highway Road Construction Project

The third objective examined the relationship between safety participation and safety performance of Mpigi-Busega Express Highway road construction project. Table 4.8 summarises respondents' ratings of the eight participation statements, and the full distribution is in Table G.4 (Appendix G).

Table 4. 8 Summary of Respondents' Ratings on Safety Participation

Safety participation practice	Agreed or strongly agreed, n (%)	Mean	Std. deviation	Rank
Participation in decision-making	82 (69%)	3.58	1.32	5
Responsiveness to safety measures	78 (66%)	3.55	1.30	6
Encouraging adherence to safety measures	76 (64%)	3.71	1.40	3
Reporting system	75 (63%)	3.81	1.59	2
Periodic feedback	76 (64%)	3.48	1.56	8

Safety participation practice	Agreed or strongly agreed, n (%)	Mean	Std. deviation	Rank
Regular monitoring	78 (66%)	3.62	1.87	4
Transparent monitoring system	74 (62%)	3.50	1.43	7
Community participation	88 (74%)	3.96	1.01	1
Overall mean		3.68 (moderate)	1.37	

Source: Primary data (2024), N = 119. Rank is by mean (1 = highest).

Results in Table G.4 show that 13 respondents (11%) strongly disagreed that all project workers had participated in decision-making in relation to health and safety, while 18 respondents (15%) disagreed. Six respondents (5%) were neutral, 52 respondents (44%) agreed and 30 respondents (25%) strongly agreed. Therefore, 69% of respondents agreed or strongly agreed that project workers participated in health and safety decision-making, while 31% were neutral, disagreed or strongly disagreed. The mean was 3.58 and the standard deviation was 1.32, indicating a moderately high level of agreement, although there was some variation in respondents' experiences.

During the interviews, one participant stated:

“Workers are given opportunities to raise issues concerning their safety during meetings and discussions with supervisors. They can explain the difficulties they are experiencing and suggest what they think should be changed. In some cases, the issue is handled immediately by the supervisor, while matters that require management attention are taken forward for further action. This allows workers to contribute because they are the ones directly exposed to many of the risks.”
KII 4 (2024)

Another participant remarked:

“It is important to involve workers in safety decisions because they understand the practical conditions of the work. Management may design a procedure, but the workers can explain whether that procedure is practical in the actual working environment.”

Their involvement also makes it easier for them to accept and follow the safety measures because they feel that they have been listened to.”
KII 8 (2024)

The review of safety meeting minutes, toolbox meeting records and HSE consultation records showed that workers were involved in discussions concerning health and safety issues. The records indicated that safety concerns raised by workers were discussed during meetings and, where necessary, referred to supervisors or the responsible project personnel for action. The records also demonstrated that safety participation was incorporated into routine communication between workers and management rather than being limited to formal management meetings.

Both the qualitative and quantitative findings show that workers participated in health and safety decision-making, although participation was not experienced equally by all respondents. The quantitative findings show that 44% agreed and 25% strongly agreed, while 15% disagreed and 11% strongly disagreed. The interviews indicated that participation mainly occurred through safety meetings, discussions with supervisors and reporting of workplace concerns. The documentary evidence further showed that worker concerns and safety issues were incorporated into project safety discussions. The findings therefore indicate that worker participation formed part of the project's approach to occupational safety management, although there was scope to make participation more consistent across different work sections.

The results in Table G.4 further show that 14 respondents (12%) strongly disagreed that project managers had been responsive to safety measures, while 27 respondents (23%) disagreed. Ten respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that project managers had been responsive to safety measures, while 35% were neutral, disagreed or strongly disagreed. The mean was 3.55 and the standard deviation was 1.30, indicating a moderately high level of agreement with some variation in responses.

During the interviews, one participant stated:

“When workers report a safety problem, management normally expects the supervisor or safety personnel to assess the issue and determine what needs to be done. Some matters can be corrected immediately, such as replacing damaged PPE or removing

an unsafe obstruction. Other issues may require changes to the work arrangement, additional equipment or consultation with the engineers before they can be resolved.”
KII 6 (2024)

Another participant remarked:

*“Management responsiveness depends partly on the nature of the safety issue. A small issue can be addressed quickly, but issues involving construction methods, machinery or traffic management may require more planning. What is important is that the concern is acknowledged and followed up rather than simply being ignored after it has been reported.”*KII 5 (2024)

The review of HSE inspection reports, corrective-action records and safety meeting minutes showed that safety concerns identified through inspections and worker reports were communicated to the responsible personnel for follow-up. The records demonstrated that management responsiveness involved identifying unsafe conditions, assigning responsibility for corrective action and following up on outstanding safety concerns. They further showed that some safety issues required coordination between the safety team, supervisors and other project departments before corrective measures could be implemented.

The findings therefore indicate that management was generally responsive to safety measures, although the level of responsiveness varied according to the nature and urgency of the safety concern. The quantitative results showed that nearly two-thirds of respondents agreed or strongly agreed with the statement. The interviews demonstrated that responsiveness involved assessment, corrective action and follow-up, while the documentary review showed that safety concerns were incorporated into the project's corrective-action processes. The evidence therefore suggests that management responsiveness supported employee participation by demonstrating that reported safety concerns could result in action.

The results in Table G.4 show that 19 respondents (16%) strongly disagreed that project managers had encouraged employee adherence to safety measures, while 17 respondents (14%) disagreed. Seven respondents (6%) were neutral, 47 respondents (39%) agreed and 29 respondents (24%) strongly agreed. Therefore, approximately 63% of respondents agreed or strongly agreed that project managers encouraged employee adherence to safety measures, while 37% were neutral, disagreed or strongly disagreed. The mean was 3.71 and the standard

deviation was 1.40, indicating a relatively high level of agreement, although there was some variation in the responses.

During the interviews, one participant stated:

“Management continuously reminds workers about the importance of following safety procedures. Supervisors are expected to observe workers during their activities and correct them when they see unsafe behaviour. This includes issues such as failure to use PPE, improper use of equipment or entering areas where a worker is not authorised to work. The intention is to ensure that safety requirements become part of normal work behaviour.” KII 3 (2024)

Another participant remarked:

“Adherence is encouraged through both training and supervision. Workers are first informed about the correct procedure, but supervisors then have to make sure that the procedure is followed. If someone repeatedly ignores a safety requirement, the matter is addressed through the appropriate supervisory process. This helps to reinforce the message that safety rules apply to everyone.” KII 6 (2024)

The review of HSE inspection records and safety compliance documentation showed that employee adherence was routinely considered during workplace inspections. The records covered issues such as PPE use, housekeeping, safe operating procedures and compliance with designated work areas. Where non-compliance was identified, corrective guidance was provided to the responsible workers or supervisors.

Both the quantitative and qualitative findings show that project management encouraged employees to adhere to safety measures. The survey findings indicate that a majority of respondents agreed or strongly agreed, while the interviews showed that adherence was promoted through reminders, supervision, correction and enforcement of established safety procedures. The documentary evidence further demonstrated that compliance was monitored through HSE inspections. The findings therefore suggest that employee adherence was treated as an important component of safety participation, although continued supervision was necessary to maintain compliance.

Results in Table G.4 further show that 15 respondents (13%) strongly disagreed that project managers had established an effective reporting system on health and safety, while 21 respondents (18%) disagreed. Eight respondents (7%) were neutral, 52 respondents (44%) agreed and 23 respondents (19%) strongly agreed. Therefore, 63% of respondents agreed or strongly agreed that an effective health and safety reporting system had been established, while 37% were neutral, disagreed or strongly disagreed. The mean was 3.81 and the standard deviation was 1.59, indicating a relatively high level of agreement but considerable variation in respondents' experiences.

During the interviews, one participant stated:

“Workers can report safety concerns through their supervisors or directly to the safety personnel. If there is an accident, incident or dangerous condition, the issue is expected to be reported so that it can be investigated and corrective action taken. Workers are also encouraged to report hazards before they result in an accident because prevention is better than waiting for someone to get injured.” KII 5 (2024)

Another participant remarked:

“The reporting system is important because management cannot identify every hazard by itself. Workers are present in different sections and may notice a problem before the safety team reaches that area. When they report the concern, it gives the project an opportunity to investigate it and correct the condition before it causes harm.” KII 3 (2024)

The review of accident reports, incident records, hazard reporting forms and HSE documentation showed that the project maintained mechanisms for documenting safety incidents and unsafe conditions. The records demonstrated that reporting was used not only for accidents but also for identifying hazards and conditions requiring corrective action. Safety documentation also provided evidence for following up reported concerns and determining whether appropriate action had been taken.

The quantitative, qualitative and documentary findings therefore converge to show that the project had established mechanisms for safety reporting. The relatively high mean indicates that respondents generally recognised the existence of these systems, while the interviews

showed that workers could report both actual incidents and potential hazards. The documentary evidence further demonstrated that reported safety concerns were recorded and followed up. However, the variation in responses suggests that the accessibility or effectiveness of the reporting system may not have been experienced uniformly by all workers.

The results in Table G.4 show that 17 respondents (14%) strongly disagreed that project managers had provided periodic feedback on health and safety, while 21 respondents (18%) disagreed. Five respondents (4%) were neutral, 45 respondents (38%) agreed and 31 respondents (26%) strongly agreed. Therefore, 64% of respondents agreed or strongly agreed that periodic health and safety feedback had been provided, while 36% were neutral, disagreed or strongly disagreed. The mean was 3.48 and the standard deviation was 1.56, indicating moderate agreement and considerable variation in responses.

During the interviews, one participant stated:

“Feedback is important because workers need to know what happened after they raised a safety concern. When an issue is reported, management should communicate whether it has been addressed, whether additional action is required or whether the matter is still being investigated. This encourages workers to continue reporting because they know their concerns are taken seriously.”
KII 2 (2024)

Another participant remarked:

“Feedback is sometimes given through meetings where management discusses safety issues that have been raised. The purpose is not only to tell workers what was done but also to make sure that everybody understands the lesson from the problem. If the same issue can affect other sections, the information is shared more widely so that it does not happen again.” KII 7 (2024)

The review of safety meeting minutes and HSE communication records showed that feedback was provided through safety meetings, supervisory discussions and communication of identified safety issues. The records indicated that safety concerns raised by workers were sometimes discussed collectively so that other employees could learn from the issue. They also

showed that feedback formed part of the follow-up process following inspections and safety incidents.

The findings therefore indicate that periodic safety feedback was practised, although it was less strongly rated than some other aspects of safety participation. The quantitative results show general agreement, while the interviews demonstrate that feedback helped communicate management responses and safety lessons. Documentary evidence further showed that safety issues were communicated through meetings and follow-up discussions. The relatively moderate mean and variation in responses nevertheless suggest that feedback could be made more regular and consistent across the project.

The results in Table G.4 further show that 15 respondents (13%) strongly disagreed that project managers had carried out regular monitoring on health and safety, while 17 respondents (14%) disagreed. Nine respondents (8%) were neutral, 47 respondents (39%) agreed and 31 respondents (26%) strongly agreed. Therefore, 65% of respondents agreed or strongly agreed that regular health and safety monitoring was carried out, while 35% were neutral, disagreed or strongly disagreed. The mean was 3.62 and the standard deviation was 1.87, indicating a generally positive assessment but substantial variation in respondents' experiences.

During the interviews, one participant stated:

“Safety monitoring is carried out in the different sections of the project. Supervisors and safety personnel observe the working environment, check whether procedures are being followed and identify conditions that may expose workers to risks. When a problem is found, the responsible personnel are informed and corrective action is expected.” KII 1 (2024)

Another participant remarked:

“The level of monitoring can depend on the activity being undertaken. High-risk activities such as excavation, lifting, heavy equipment operations and work near traffic require closer attention. The monitoring team therefore has to focus more on activities where the potential consequences of an unsafe practice are greater.” KII 2 (2024)

The review of HSE inspection reports, site inspection checklists and supervisory records showed that monitoring was incorporated into routine project activities. The records covered observations relating to workplace conditions, PPE, equipment, work practices and other safety requirements. Follow-up observations were also used to determine whether previously identified safety concerns had been addressed.

Both the quantitative and qualitative findings indicate that regular safety monitoring was undertaken at the project. However, the high standard deviation suggests that workers did not experience monitoring in exactly the same way. The interviews indicated that monitoring intensity could vary depending on the level of risk and type of construction activity, while documentary evidence demonstrated that inspections and supervisory observations formed part of routine HSE management. The findings therefore suggest that regular monitoring was established, but its consistency across work areas could be strengthened.

The results in Table G.4 show that 17 respondents (14%) strongly disagreed that project managers had developed a transparent monitoring system on health and safety, while 19 respondents (16%) disagreed. Nine respondents (8%) were neutral, 49 respondents (41%) agreed and 25 respondents (21%) strongly agreed. Therefore, 62% of respondents agreed or strongly agreed that a transparent health and safety monitoring system had been developed, while 38% were neutral, disagreed or strongly disagreed. The mean was 3.50 and the standard deviation was 1.43, indicating moderate agreement with some variation in perceptions.

During the interviews, one participant stated:

“Workers need to understand what the safety team is monitoring and the standards they are expected to meet. When inspections are carried out, the workers should know what has been identified and what needs to be corrected. This makes the process more transparent because people understand why they are being asked to change a particular practice.” KII 6 (2024)

Another participant remarked:

“Monitoring should not stop at identifying a problem. There needs to be follow-up to establish whether the corrective action was completed. When the findings are communicated to the responsible people and the progress is followed, workers can see

that the monitoring system is being applied consistently.”
KII 3 (2024)

The review of HSE inspection checklists, corrective-action records and safety committee documentation showed that monitoring activities were documented and followed by recommendations or corrective actions. The records provided evidence that safety inspections were used to identify areas requiring improvement and that responsibility for addressing identified concerns could be assigned to relevant personnel. However, the extent to which all workers were directly informed about the outcomes of monitoring was not consistently evident in every record reviewed.

The findings indicate that the project had mechanisms for transparent safety monitoring, although this aspect received a relatively moderate assessment. The survey findings show that 62% agreed or strongly agreed, while the interviews emphasised the importance of communicating inspection findings and following up corrective action. Documentary evidence confirmed the existence of inspection and corrective-action documentation. The findings therefore suggest that the monitoring system was established, but greater communication of monitoring outcomes could strengthen its transparency and encourage greater worker participation.

Finally, the results in Table G.4 show that 11 respondents (9%) strongly disagreed that project managers had encouraged community participation in health and safety, while 15 respondents (13%) disagreed. Five respondents (4%) were neutral, 61 respondents (51%) agreed and 27 respondents (23%) strongly agreed. Therefore, 74% of respondents agreed or strongly agreed that project managers encouraged community participation in health and safety, while 26% were neutral, disagreed or strongly disagreed. The mean was 3.96 and the standard deviation was 1.01, indicating a relatively high level of agreement and comparatively low variation.

During the interviews, one participant stated:

“The road project affects people beyond the workforce because members of the surrounding communities use the roads and interact with the construction areas. They therefore need information about diversions, restricted areas, traffic arrangements and other hazards. Community members can also raise concerns where they see a situation

that could endanger road users or people living around the project.”
KII 4 (2024)

Another participant remarked:

“Community participation is important because the project cannot have safety personnel monitoring every person who enters or passes near the construction area. Community members can identify unsafe access points, report dangerous behaviour or alert the project when children or other vulnerable people are entering areas where construction is taking place. Their information can help management prevent accidents.” KII 7 (2024)

The review of community engagement records, stakeholder meeting minutes and project safety communication materials showed that community safety formed part of engagement activities around the road construction project. The records indicated that communication with surrounding communities included issues relating to construction activities, road use, access, traffic movement and potential hazards. Community engagement therefore provided a channel through which safety information could be communicated outside the immediate project workforce and concerns from affected communities could be brought to the attention of project personnel.

Both the quantitative and qualitative findings show that community participation was one of the stronger aspects of safety participation at the project. The quantitative findings show that 51% agreed and 23% strongly agreed, while only 13% disagreed and 9% strongly disagreed. The interviews demonstrated that community participation was important because road construction creates risks that extend beyond workers to pedestrians, road users and surrounding communities. Documentary evidence further showed that community safety concerns were incorporated into stakeholder engagement and safety communication activities. The relatively high mean of 3.96 and lower standard deviation indicate that respondents had a comparatively consistent perception that communities were involved in health and safety matters.

4.7.1 Correlation Analysis between Safety Participation and Safety Performance

To determine the relationship between safety participation and safety performance, Pearson's Correlation Coefficient was determined and the results are shown in Table 4.9 ;

Table 4. 9 Correlation Analysis For Safety Participation And Safety Performance On The Road Construction Project 6

		Safety Participation	Safety Performance
Safety Participation	Pearson Correlation	1	.732**
	Sig. (2-Tailed)		.000
	N	119	119
Safety Performance	Pearson Correlation	.732**	1
	Sig. (2-Tailed)	.000	
	N	119	119

Source: Primary data (2024)

Results in Table 4.9 show a Pearson correlation coefficient of 0.732 between safety participation and safety performance on the Mpigi-Busega Express Highway road construction project. This indicates a strong positive relationship, meaning that higher levels of safety participation are associated with better safety performance among workers on the project.

The significance value (Sig. 2-tailed) of 0.000 is less than the conventional significance level of 0.05, indicating that the relationship between safety participation and safety performance is statistically significant. Therefore, the study provides sufficient evidence to accept the research hypothesis that there is a significant relationship between safety participation and safety performance on the Mpigi-Busega Express Highway road construction project. The findings suggest that encouraging workers to actively participate in safety activities, such as reporting hazards, contributing to safety discussions, following safety initiatives, and taking part in safety improvement activities, is associated with improved safety performance on the project.

4.7.2 Discussion: Safety Participation and Safety Performance

The positive and significant relationship between safety participation and safety performance ($r = .732$; $\beta = .138$) is consistent with the studies in Section 2.4.3 that found worker

involvement, reporting and feedback to be associated with better outcomes. It differs from Yiu, Sze and Chan (2021) and Yang, Wang and Xue (2020), who found no significant association. A likely explanation is that participation on this project was not only one-way communication: the highest-rated forms were community participation (3.96) and the reporting system (3.81), whereas periodic feedback (3.48) and transparent monitoring (3.50) were the weakest, which matches the literature that participation helps where management responds and gives feedback. Safety participation also had the smallest unique effect of the three practices ($\beta = .138$, 11.7% of the combined weight), because it overlaps with compliance and training and adds less once they are accounted for. Neal and Griffin (2006) treat participation as a different behaviour from compliance, and the weaker link found here suggests that, on this project, it is the least developed of the two.

The study found a strong positive relationship between safety participation and safety performance. The findings of the study therefore provided sufficient evidence to support the research hypothesis that there was a significant relationship between safety participation and safety performance on the Mpigi-Busega Express Highway road construction project. The findings of the study concurred with Mullen et al. (2021), who linked safety participation with reduced injury and accident rates. The findings of the study also concurred with Zhang et al. (2020), who found that worker participation in safety decision-making was associated with fewer workplace accidents where worker input visibly influenced site practice. The findings of the study further concurred with Alruqi et al. (2021), who identified response to and adherence to safety measures as the participation sub-indicator most consistently associated with reduced injuries. The findings of the study therefore provided empirical support for the argument that active involvement of workers and other stakeholders in safety matters was associated with improved safety performance.

The study found, however, that the strong relationship between safety participation and safety performance did not mean that every form of participation automatically resulted in improved safety outcomes. It was revealed that this finding contradicted Yiu, Sze and Chan (2021), who found no significant association between formal safety monitoring committees and property damage where the committees lacked enforcement authority. The findings of the study also contrasted with Yang, Wang and Xue (2020), who found no significant association between worker participation in safety decision-making and reduced accidents in strongly hierarchical management environments where worker input was solicited but rarely acted upon. The

findings of the study therefore suggest that the effectiveness of participation depends on whether participation results in meaningful action rather than merely providing workers with an opportunity to express their views. It was revealed that this interpretation was further supported by Xia et al. (2020), who found that management's visible response to worker input was important for achieving safety improvements.

These findings also contradicted Yung and Chan (2020), who found that one-way management-to-worker safety communication was not significantly associated with reduced Lost Time Injuries. The current study found a positive relationship between safety participation and safety performance, while also identifying reporting, feedback and worker involvement as components of participation. The findings of the study therefore suggest that two-way communication and feedback may be more important than one-way communication in supporting safety performance. It was revealed that this interpretation was consistent with Oyewobi et al. (2021), who found that communication and feedback on near-miss and incident information encouraged continued hazard reporting and was associated with reduced Lost Time Injuries. The findings of the study therefore demonstrated that safety participation was most meaningful when workers could raise concerns, management could respond to those concerns and the outcomes could be communicated back to workers.

The study found that workers participated in decision-making concerning health and safety on the Mpigi-Busega Express Highway road construction project. The findings of the study showed that worker participation mainly occurred through safety meetings, discussions with supervisors and reporting of workplace concerns. The review of safety meeting minutes, toolbox meeting records and HSE consultation records further confirmed that workers were involved in discussions concerning health and safety issues and that concerns raised by workers were discussed and, where necessary, referred to supervisors or responsible project personnel for action. The findings of the study concurred with Zhang, Fang and Zhou (2020), who found that worker participation in safety decision-making was associated with fewer workplace accidents where worker input visibly influenced site practices. The findings of the study therefore support the argument that participation becomes meaningful when workers' safety concerns can influence decisions and actions on site. It was revealed, however, that worker participation was not experienced uniformly across all work sections. The findings of the study therefore partly contradicted any assumption that worker participation in decision-making was

consistently experienced by all workers, while also supporting Zhang et al. (2020), who emphasized the importance of visible management response to worker input.

The study found that project managers were generally responsive to safety measures and concerns raised by workers. The findings of the study showed that management responsiveness involved assessing reported safety concerns, implementing corrective measures and following up outstanding issues. HSE inspection reports, corrective-action records and safety meeting minutes demonstrated that safety concerns identified through inspections and worker reports were communicated to responsible personnel for follow-up. The findings of the study concurred with Xia, Griffin, Wang and Liu (2020), who found that the effect of safety participation on safety performance depended on management's visible response to worker input and that participation without follow-up communication did not produce measurable reductions in accidents. The findings of the study therefore support the view that worker participation becomes more effective when management demonstrates that workers' contributions are taken seriously and acted upon. It was revealed, however, that some safety concerns required coordination between the safety team, supervisors and other project departments before corrective measures could be implemented. The findings of the study therefore indicated that management responsiveness existed but was sometimes subject to organizational and operational processes, which could affect the speed with which workers' concerns were addressed.

The study found that project managers encouraged employees to adhere to established safety measures. The findings of the study showed that adherence was promoted through safety reminders, supervision, correction of unsafe behaviour and enforcement of established safety procedures. HSE inspection records and safety compliance documentation routinely considered PPE use, housekeeping, safe operating procedures and compliance with designated work areas. Where non-compliance was identified, corrective guidance was provided to responsible workers or supervisors. The findings of the study concurred strongly with Alruqi, Hallowell and Techera (2021), who found in their meta-analysis that response to and adherence to safety measures was the participation sub-indicator most consistently associated with reduced injuries across countries. The findings of the study therefore provided support for the view that employee adherence to established safety measures is an important component of safety participation and safety performance. The study found, however, that continued supervision was necessary to maintain adherence, suggesting that worker compliance could not be assumed

merely because safety measures had been established. It was revealed that this finding was consistent with the literature because Alruqi et al. (2021) emphasized adherence to safety measures rather than simply the existence of safety requirements.

The study found that an effective health and safety reporting system had been established on the project. The findings of the study showed that workers could report accidents, incidents, dangerous conditions and potential hazards through supervisors or directly to safety personnel. Accident reports, incident records, hazard reporting forms and other HSE documentation confirmed the existence of mechanisms for documenting safety incidents and unsafe conditions. The findings of the study concurred with Oyewobi, Suleiman and Muhammad-Jamil (2021), who found that regular communication and feedback on near-miss and incident data was associated with reduced Lost Time Injuries because workers who received feedback continued reporting hazards. The findings of the study therefore support the argument that effective reporting systems can contribute to improved safety performance by ensuring that hazards and incidents are communicated and addressed. It was revealed, however, that the accessibility and effectiveness of reporting mechanisms were not experienced uniformly by all workers. The findings of the study therefore suggested that establishing a reporting system was not sufficient on its own and that workers also needed to perceive the system as accessible, responsive and useful.

The study found that periodic health and safety feedback was provided to workers, although this aspect received a comparatively moderate assessment. The findings of the study showed that feedback was provided through safety meetings, supervisory discussions and communication of identified safety concerns. Safety meeting minutes and HSE communication records indicated that some concerns raised by workers were discussed collectively so that other employees could learn from the issues. The findings of the study concurred with Oyewobi et al. (2021), who found that communication and feedback on near-miss and incident information were associated with reduced Lost Time Injuries. The findings of the study also concurred with Xia et al. (2020), who emphasized that management's response and follow-up communication were important for translating worker participation into improved safety performance. It was revealed, however, that communication of safety outcomes was not as strong or consistent as some other participation practices on the project. The findings of the study therefore contradicted any assumption that worker participation automatically results in

effective feedback, because the findings demonstrated that feedback itself required deliberate and consistent management attention.

The study found that regular health and safety monitoring was undertaken on the project. The findings of the study showed that supervisors and safety personnel monitored workplace conditions, PPE use, work practices, equipment and compliance with safety requirements. Monitoring intensity varied according to the level of risk and type of construction activity, with excavation, lifting, heavy equipment operations and work near traffic requiring closer attention. The findings of the study concurred with Guo, Yiu and González (2021), who found that community and worker participation in safety monitoring was associated with fewer fines and penalties because worker-led monitoring could identify violations before regulatory inspections. The findings of the study therefore support the importance of worker and management involvement in monitoring safety conditions. It was revealed, however, that Yiu, Sze and Chan (2021) found no significant association between formal safety monitoring committees and property damage where such structures lacked enforcement authority. The findings of the study therefore contradicted the assumption that the mere existence of monitoring structures is sufficient to improve safety outcomes. The current findings instead suggest that monitoring is more meaningful when it involves actual observation, identification of deficiencies and follow-up action.

The study found that the project had developed a transparent health and safety monitoring system, although this aspect received a moderate assessment. The findings of the study showed that transparency involved communicating inspection findings, explaining safety expectations and following up corrective actions. HSE inspection checklists, corrective-action records and safety committee documentation demonstrated that monitoring activities were documented and followed by recommendations or corrective actions assigned to responsible personnel. The findings of the study concurred with Xia et al. (2020), who found that the effect of safety participation depended on management's visible response to worker input. The findings of the study therefore indicated that transparency and communication of safety actions could strengthen the connection between participation and safety performance. It was revealed, however, that the extent to which all workers were directly informed about monitoring outcomes was not consistently evident in every record reviewed. The findings of the study therefore contradicted the notion that a documented monitoring system automatically

constitutes a fully transparent system, because transparency also requires that the outcomes of monitoring are communicated to those affected.

The study found that community participation was one of the stronger aspects of safety participation on the project. The findings of the study showed that community participation was important because road construction activities created safety risks extending beyond the immediate workforce to pedestrians, road users and surrounding communities. Community engagement involved communication concerning construction activities, road use, access, traffic movement and potential hazards. The findings of the study concurred with Guo, Yiu and González (2021), who found that community and worker participation in safety monitoring was associated with fewer fines and penalties by regulatory authorities. The findings of the study therefore supported the argument that safety participation can extend beyond workers to other stakeholders affected by construction activities. It was revealed, however, that the literature focused on the relationship between community and worker participation in safety monitoring and regulatory outcomes, whereas the current study found that community participation formed part of broader safety communication and stakeholder engagement. The findings of the study therefore extended the reviewed literature by demonstrating the relevance of community participation within a Ugandan highway construction context.

The study found that safety participation was an established component of safety management on the Mpigi-Busega Express Highway road construction project. Workers participated in safety decision-making, project managers responded to safety concerns, employees were encouraged to adhere to safety measures, reporting mechanisms were established, periodic feedback was provided and regular monitoring was undertaken. The findings of the study further showed that mechanisms for transparent monitoring and community participation were in place. The findings of the study concurred with Mullen, Kelloway and Teed (2021), who linked safety participation, understood as employees' behaviour-based involvement in communication and decision-making on safety matters, with reduced injury and accident rates. The findings of the study also concurred with Alruqi et al. (2021), who identified response to and adherence to safety measures as one of the participation practices most consistently associated with reduced injuries. The findings of the study therefore demonstrated that participation involved more than simply attending safety meetings because it included decision-making, reporting, adherence, communication, feedback and monitoring.

The study found, however, that safety participation was not equally strong across all dimensions. The findings of the study therefore suggested that the project had established mechanisms for participation but had opportunities to strengthen communication of safety outcomes and consistency of monitoring across work areas. The findings of the study concurred with Zhang et al. (2020), who emphasized that worker participation was more effective where worker input visibly changed site practices. It was revealed that this also supported Xia et al. (2020), who found that participation without management response and follow-up communication did not produce measurable improvements in safety outcomes. The findings of the study therefore indicated that the quality of participation and the response to participation were important in determining its potential contribution to safety performance.

4.8 Trend in HSE Management Practices, 2021 - June 2023

The trend in the HSE management practices on Mpigi-Busega Express Highway road construction project are shown in Figure 4.2 below;

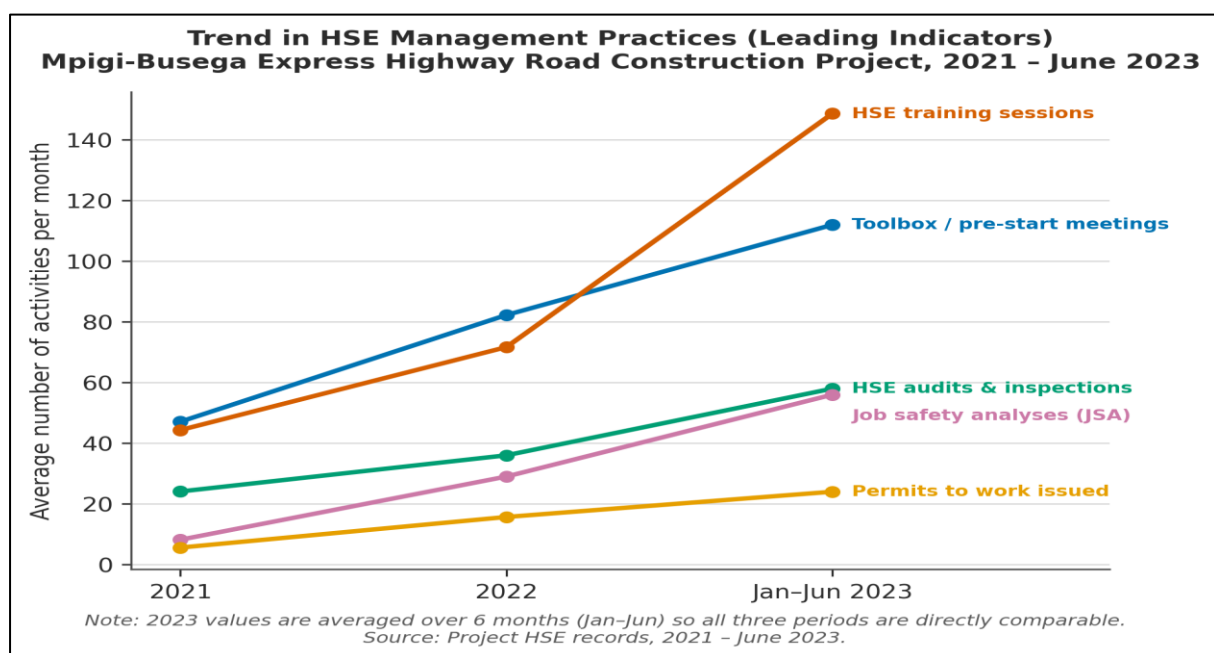


Figure 4. 2 Trend in HSE Management Practices (Leading Indicators), 2021 - June 2023

Source: Project HSE records, 2021 - June 2023.

Figure 4.2 tracks five leading indicators of HSE management practice on Mpigi-Busega Express Highway road construction project, namely toolbox and pre-start meetings, HSE training sessions, HSE audits and inspections, Job Safety Analyses (JSAs) and permits to work

issued, expressed as a monthly average for 2021, 2022 and January-June 2023. All five indicators rose consistently across the three periods, though at markedly different rates. HSE training sessions recorded the steepest and most sustained increase, rising from an average of 44.3 per month in 2021 to 71.7 per month in 2022 and 148.7 per month in the first half of 2023, more than tripling over the review period and overtaking toolbox and pre-start meetings, which it had trailed in 2021, to become the single most frequent safety activity on site by 2023. Toolbox and pre-start meetings themselves rose steadily from 47.1 to 82.3 and then 112.0 per month, a strong but comparatively more gradual increase.

HSE audits and inspections and job safety analyses followed closely parallel trajectories, rising from 24.1 to 36.0 to 58.0 per month and from 8.2 to 29.0 to 56.0 per month respectively, converging to almost identical levels by the first half of 2023 despite job safety analyses starting from a much lower base. Permits to work issued rose from 5.6 to 15.7 to 24.0 per month, more than quadrupling proportionally even though it remained the smallest of the five indicators in absolute terms throughout the period.

This pattern indicates that Mpigi-Busega Express Highway road construction project did not intensify a single safety management practice in isolation, but scaled up HSE activity broadly and simultaneously across training, toolbox engagement, audits, job safety analysis and permitting, with HSE training sessions and toolbox meetings emerging as the two most frequent and fastest-growing practices by 2023.

4.9 Graphical Presentation of the Relationship between Safety Management Practices and Safety Performance

Figure 4.3 shows the graphical presentation of the relationship between safety management practices and safety performance of Mpigi-Busega Express Highway road construction project.

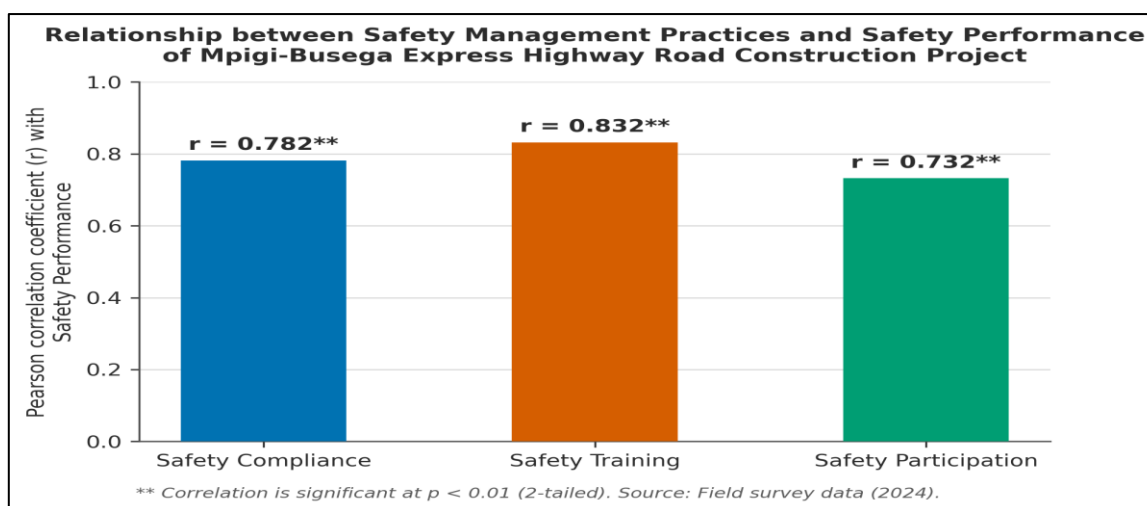


Figure 4. 3 Correlation between Safety Management Practices and Safety Performance of Mpigi-Busega Express Highway Road Construction Project
Source: Field survey data (2024).

Figure 4.3 shows that all three dimensions of safety management practices, safety compliance ($r = .782$), safety training ($r = .832$) and safety participation ($r = .732$), are positively and significantly correlated with safety performance of Mpigi-Busega Express Highway road construction project ($p < .01$ in each case). Safety training has the strongest relationship with safety performance, followed by safety compliance, while safety participation, though still significant, records the weakest of the three correlations. The graph shows clearly that an improvement in any of the three safety management practices is associated with an improvement in safety performance, with training offering the largest marginal benefit and participation the smallest.

4.10 Multiple Linear Regression Analysis Of Safety Management Practices And Safety Performance Of Mpigi-Busega Express Highway Road Construction Project

A multiple regression analysis was carried out to jointly assess the three hypotheses: (i) that there is a significant relationship between safety compliance and safety performance, (ii) that there is a significant relationship between safety training and safety performance, and (iii) that there is a significant relationship between safety participation and safety performance of Mpigi-Busega Express Highway road construction project. The regression results are presented in Table 4.10 below.

Table 4. 10 Model Summary of Safety Management Practices And Safety Performance

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.933 ^a	.870	.863	.30719
a. Predictors: (Constant), Safety compliance, Safety training, Safety participation				

Source: Primary data (2024)

The model summary in Table 4.10 shows that the three predictors, safety compliance, safety training and safety participation, are jointly and positively correlated with safety performance, with an overall correlation coefficient (R) of .933 at $p < 0.05$. The model's R Square of .870 indicates the proportion of variance in safety performance explained by safety management practices, while the Adjusted R Square of .863 shows that safety management practices account for 86.3% of the variation in safety performance of Mpigi-Busega Express Highway road construction project. Since 86.3% is well above the 50% threshold, the three predictors combined explain the great majority of variation in safety performance, with the remaining 13.7% attributable to factors outside the model.

Table 4. 11 Analysis of Variance (ANOVA) of Safety Management Practices And Safety Performance 7

ANOVA ^b						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.398	3	12.799	135.634	.000 ^a
	Residual	5.756	115	.094		
	Total	44.154	118			
a. Predictors: (Constant), Safety compliance, Safety training, Safety participation						
b. Dependent Variable: Safety performance						

Source: Primary data (2024)

Table 4.11 presents the Analysis of Variance (ANOVA) results for the regression model examining the effect of safety compliance, safety training, and safety participation on safety performance on the road construction project. The ANOVA results further show an F-statistic of 135.634 with a significance level of 0.000 ($p < 0.001$). This indicates that the overall regression model is statistically significant. In other words, safety compliance, safety training,

and safety participation, when considered together, significantly predict safety performance on the road construction project. The probability of obtaining an F-value of 135.634 if the three safety management practices had no combined effect on safety performance is less than 0.001.

Therefore, the null hypothesis that safety management practices do not significantly influence safety performance is rejected. The findings imply that improvements in safety compliance, safety training, and safety participation are collectively associated with improvements in safety performance on the road construction project.

Table 4.12: Summary for Regression Analysis of safety management practices and safety performance of road construction project

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.235	.210		1.123	.264
	Safety compliance	.658	.060	.639	9.134	.000
	Safety training	.728	.070	.406	6.239	.000
	Safety participation	.663	.061	.138	2.614	.000
Dependent Variable: safety performance on the road construction project						

Source: Primary data (2024)

Table 4.12 presents the multiple regression analysis examining the contribution of safety compliance, safety training, and safety participation to safety performance on the road construction project.

The results show that safety compliance had a positive and statistically significant effect on safety performance ($B = 0.658$, $\beta = 0.639$, $t = 9.134$, $p < 0.001$). This means that, holding the other safety management practices constant, a one-unit improvement in safety compliance was associated with a 0.658-unit increase in safety performance. The standardized beta of 0.639 indicates that safety compliance was the strongest predictor of safety performance among the three variables. Therefore, improved adherence to safety rules, procedures and requirements was associated with better safety performance on the road construction project.

The findings further show that safety training had a positive and statistically significant effect on safety performance ($B = 0.728$, $\beta = 0.406$, $t = 6.239$, $p < 0.001$). This implies that a one-unit increase in safety training was associated with a 0.728-unit increase in safety performance, when safety compliance and safety participation were held constant. The standardized beta of 0.406 indicates that safety training made a substantial contribution to safety performance, although its contribution was lower than that of safety compliance. This suggests that providing workers with appropriate health and safety training can enhance their knowledge, skills and ability to undertake construction activities safely.

Similarly, safety participation had a positive and statistically significant effect on safety performance ($B = 0.663$, $\beta = 0.138$, $t = 2.614$, $p < 0.001$). This indicates that a one-unit improvement in safety participation was associated with a 0.663-unit increase in safety performance, holding safety compliance and safety training constant. Although safety participation had the smallest standardized beta ($\beta = 0.138$), its effect was still statistically significant. This implies that involving workers in safety activities, safety discussions, reporting of hazards and other safety-related initiatives contributes to improved safety performance.

The constant was 0.235 and was not statistically significant ($t = 1.123$, $p = 0.264$). This indicates that when the three safety management practices are assumed to be zero, the predicted level of safety performance represented by the constant is not statistically different from zero.

Overall, the regression results demonstrate that safety compliance, safety training and safety participation are all significant positive predictors of safety performance on the road construction project. Among the three practices, safety compliance was the strongest predictor, followed by safety training and safety participation. These findings imply that strengthening workers' compliance with established safety requirements, providing effective safety training, and encouraging workers to actively participate in safety activities can contribute to improved safety performance on road construction projects.

The regression equation can therefore be expressed as:

$$\text{Safety Performance} = 0.235 + 0.658 (\text{Safety Compliance}) + 0.728 (\text{Safety Training}) + 0.663 (\text{Safety Participation}).$$

Thus, the study provides empirical evidence that effective safety management practices significantly improve safety performance on the road construction project.

4.11 Contribution of Each Safety Management Practice and Emphasis of the Analysis

The results in Sections 4.5 to 4.10 were produced with three analytical tools: correlation, regression and graphs. This section states what each tool was used for, where the emphasis of the analysis lay, and how each safety management practice contributed to safety performance.

4.11.1 Emphasis of the Analysis

The concentration of the analysis was on the relationship between each safety management practice and safety performance, as the three objectives require. Pearson correlation was the primary tool for testing the three hypotheses, objective by objective (Tables 4.5, 4.7 and 4.9); it shows the strength and direction of the association between each practice, taken alone, and safety performance. Multiple regression was the confirmatory tool, and the one on which the emphasis for the question of contribution rests (Tables 4.10 to 4.12). It shows the joint contribution of the three practices (Adjusted R Square = .863) and the unique contribution of each with the other two held constant, which correlation cannot show because the three practices are themselves strongly related. The graphs were used for presentation only: Figure 4.3 displays the three correlation coefficients side by side, and Figures 4.1 and 4.2 display the change over time in recorded HSE outcomes and HSE activities. No conclusion in this study rests on a graph alone. Correlation and regression are therefore complementary and not competing: correlation answers whether each practice is associated with safety performance, and regression answers how much each contributes once the others are accounted for.

4.11.2 Reading the Correlation and Regression Results Together

Table 4.13 brings the correlation and regression results for the three practices into one table.

Table 4. 13 Summary of Correlation and Regression Results for the Three Safety Management Practices

Practice	r	r ²	B	Beta (β)	t	Share of combined β (%)
Safety compliance	.782	.612	.658	.639	9.134	54.0
Safety training	.832	.692	.728	.406	6.239	34.3
Safety participation	.732	.536	.663	.138	2.614	11.7

Source: Primary data (2024). r is from Tables 4.5, 4.7 and 4.9; B, β and t are from Table 4.12; r² and the share of combined β were computed by the researcher (r² = r squared; share = β of the practice divided by the sum of the three β values). All coefficients are significant at $p < .05$.

Safety training has the highest correlation with safety performance ($r = .832$) but not the highest regression weight ($\beta = .406$), while safety compliance has a lower correlation ($r = .782$) but the highest weight ($\beta = .639$). This is not a contradiction. A correlation coefficient contains all the association between a practice and safety performance, including the part it shares with the other two practices, whereas a standardised beta contains only the part that is unique to that practice. Where practices are closely related, as these three are, a practice can be strongly correlated with performance and yet add less once the others are in the model. The results therefore show that safety training is the practice most strongly associated with safety performance on its own, and that safety compliance makes the largest unique contribution when all three practices are considered together. Because the three practices overlap, their contributions should not be added up as if they were separate effects, and because the study is cross-sectional, all of them are associations and not proof of causation (Section 5.6).

4.11.3 How Safety Compliance Contributed to Improved Safety Performance

Safety compliance made the largest unique contribution to safety performance ($B = 0.658$, $\beta = 0.639$, $t = 9.134$, $p < .05$), about 54 percent of the combined standardised weights of the three practices (Table 4.13). Holding training and participation constant, a one-point rise in the compliance score was associated with a 0.658-point rise in the safety performance score. The

documentary records show the pattern behind this result. As HSE audits and inspections rose from a monthly average of 24.1 in 2021 to 36.0 in 2022 and 58.0 in the first half of 2023, and permits to work from 5.6 to 15.7 and 24.0, unsafe acts fell from 21.0 to 11.6 and 6.2 per month, unsafe conditions from 26.75 to 13.4 and 7.3, and total recordable HSE events from 16.5 to 13.2 and 8.2 (Figures 4.1 and 4.2). The most plausible route is that written policy, procedures, risk assessment and inspection give supervisors and workers the standard against which unsafe acts and unsafe conditions are detected and corrected, so that fewer of them develop into accidents, injuries and property damage.

4.11.4 How Safety Training Contributed to Improved Safety Performance

Safety training made the second largest unique contribution ($B = 0.728$, $\beta = 0.406$, $t = 6.239$, $p < .05$), about 34 percent of the combined weights, and had the highest correlation with safety performance when taken alone ($r = .832$). HSE training sessions rose from a monthly average of 44.3 in 2021 to 71.7 in 2022 and 148.7 in the first half of 2023 (Figure 4.2), the period over which recorded unsafe acts and recordable HSE events fell. Part of the association of training with performance overlaps with that of compliance, since induction and toolbox meetings are also the means by which procedures and risk assessments are communicated to workers, which explains why its unique weight is lower than its correlation.

4.11.5 How Safety Participation Contributed to Improved Safety Performance

Safety participation made the smallest unique contribution ($B = 0.663$, $\beta = 0.138$, $t = 2.614$, $p < .05$), about 12 percent of the combined weights, but the contribution was still significant, and its correlation with safety performance was strong ($r = .732$; $r^2 = .536$, so that participation on its own accounts for about 54 percent of the variation in performance). The gap between the strong correlation and the small unique weight shows that most of what participation is associated with is shared with compliance and training: workers participate more where procedures are clear and training has been given. Its unique contribution is what it adds beyond them, mainly through reporting of hazards, feedback and monitoring, which help management to find and correct problems that formal systems miss. The documentary records show growth in participative activity such as job safety analyses, from a monthly average of 8.2 in 2021 to 29.0 in 2022 and 56.0 in the first half of 2023 (Figure 4.2), over a period in which recorded unsafe acts and unsafe conditions fell. Since participation was the least developed of the three practices (Section 5.2.3), it is the practice with the most room to increase its contribution.

4.11.6 Summary

The three practices together explain 86.3 percent of the variation in safety performance (Adjusted R Square = .863). Safety compliance contributes the most when the practices are considered together, safety training is the most strongly associated with safety performance when taken alone, and safety participation contributes the least but significantly. The emphasis of the analysis was on regression for the contribution of each practice, on correlation for the test of each hypothesis, and on graphs for presentation only.

4.12 Testing of Hypotheses

Table 4.14 reports the result of testing each of the three hypotheses (Section 1.4) at the 5% level of significance. A hypothesis was accepted where the Pearson correlation was positive and its significance value was below .05.

Table 4. 14 Results of Testing the Hypotheses

Hypothesis	Test result	Significance (p)	Decision
H1: Safety compliance has a positive and significant relationship with safety performance	$r = .782$ ($r^2 = .612$); $\beta = .639$, $t = 9.134$	$< .05$	Supported: null hypothesis rejected
H2: Safety training has a positive and significant relationship with safety performance	$r = .832$ ($r^2 = .692$); $\beta = .406$, $t = 6.239$	$< .05$	Supported: null hypothesis rejected
H3: Safety participation has a positive and significant relationship with safety performance	$r = .732$ ($r^2 = .536$); $\beta = .138$, $t = 2.614$	$< .05$	Supported: null hypothesis rejected
Joint model: the three practices together predict safety performance	$R = .933$; $R^2 = .870$; Adjusted $R^2 = .863$; $F(3, 115) = 135.634$	$< .05$	Supported

Source: Primary data (2024), N = 119. Tables 4.5, 4.7, 4.9, 4.10, 4.11 and 4.12. Table 4.12 prints the significance of safety participation as .000; for $t = 2.614$ with 115 degrees of freedom the two-tailed value is about .010, which is also below .05, so the decision is the same.

All three hypotheses were therefore supported: each practice has a positive and statistically significant relationship with safety performance when taken alone, and each retains a significant unique contribution when the three are entered together. Safety training has the strongest simple relationship, safety compliance the largest unique contribution, and safety participation the weakest of both.

4.13 Determinants of Safety Compliance, Training and Participation that Explain Safety Performance

The regression in Section 4.10 was run on composite scores, so it shows how much weight each practice carries, not which individual element within a practice carries it. To show what within each practice explains safety performance, Table 4.15 sets the item means of Tables 4.4, 4.6 and 4.8 beside the regression weights of Table 4.12. The item evidence is descriptive, since item-level regression was not run.

Table 4. 15 Determinants within Each Practice and Their Weight in Explaining Safety Performance

Practice	Overall mean (level)	Strongest elements (mean)	Weakest elements (mean)	Unique effect (β) and share of combined weight
Safety compliance	3.73 (moderate)	Safety regulations (4.33); Implementation of safety policies (3.77); Safety procedures (3.75)	Risk assessment (3.25); OSH action plans (3.29); Safety inspections (3.35)	$\beta = .639$; 54.0%
Safety training	3.83 (moderate)	Orientation programmes (4.58); Toolbox meetings (3.85); Coaching (3.77)	On-job training (3.42); Job rotation (3.42); On-going capacity building (3.56)	$\beta = .406$; 34.3%

Practice	Overall mean (level)	Strongest elements (mean)	Weakest elements (mean)	Unique effect (β) and share of combined weight
Safety participation	3.68 (moderate)	Community participation (3.96); Reporting system (3.81); Encouraging adherence to safety measures (3.71)	Periodic feedback (3.48); Transparent monitoring system (3.50); Responsiveness to safety measures (3.55)	$\beta = .138$; 11.7%

Source: Primary data (2024). Item means are from Tables 4.4, 4.6 and 4.8; β values are from Table 4.12; the share of combined β was computed by the researcher.

Two points explain safety performance. First, the practice with the largest unique weight, safety compliance (54.0% of the combined weight), is the one in which the formal elements, safety regulations, procedures and implementation of policies, are best developed, while the elements that enforce and check them, risk assessment, OSH action plans and inspections, are weakest; the determinants of compliance that matter for performance are therefore enforcement and monitoring, not the existence of written rules. Second, in both training and participation the strongest elements are one-off or outward-facing (orientation, toolbox meetings, community participation, reporting) and the weakest are the continuing and two-way elements (on-the-job training, job rotation, periodic feedback, transparent monitoring). Training and participation explain performance when they are continued after induction and when workers see action on what they report. These findings are the basis of the recommendations in Chapter Five.

4.14 Summary of Major Findings

This section summarises the major findings and ties each objective to its research question, hypothesis, result and conclusion (Table 4.16).

Safety performance. Perceived safety performance was moderate (mean 3.59 of 5; 62–69% agreement on each of eight indicators), and the records show improvement: recordable injury cases fell from 7.6 per month in 2021 to 2.3 per month in January–June 2023, lost time injuries from 5 to 2 to none, and no fines were imposed (Table 4.3).

Objective 1: safety compliance. Compliance was rated at the upper end of the moderate level (mean 3.73).

The study found that there is a statistically significant positive relationship between safety compliance and safety performance of Mpigi-Busega Express Highway road construction project, shown by the Pearson correlation coefficient of 0.782, which indicated a strong positive relationship between safety compliance and safety performance. The significance value (0.000) confirmed that this relationship was statistically significant. This means that by strengthening safety compliance, through occupational safety and health action plans, safety policy, safety procedures, risk assessment, safety regulations and safety inspections and audits, there will be an improvement in safety performance of the project. Therefore, the research hypothesis that safety compliance significantly relates to safety performance was accepted.

Objective 2: safety training. Training was rated at the upper end of the moderate level (mean 3.83).

From the study it was found that safety training positively relates to safety performance, shown by the Pearson correlation coefficient of $r = 0.832^{**}$, indicating a very strong positive relationship, the strongest of the three safety management practices examined. The significance value of 0.000 showed that this relationship is statistically significant, meaning that as safety training efforts, orientation programmes, on-the-job and off-job training, capacity-building programmes, toolbox meetings and coaching, improve, safety performance of Mpigi-Busega Express Highway road construction project tends to improve as well. The research hypothesis that safety training significantly relates to safety performance was accepted.

Objective 3: safety participation. Participation was rated moderate (mean 3.68).

The study found that safety participation enhances safety performance, shown by a Pearson correlation coefficient of 0.732 with a significance value ($p = 0.000$). This means that improvements in safety participation, worker involvement in decision-making, adherence to safety measures, reporting and feedback systems, monitoring and community participation, result in improvements in safety performance of Mpigi-Busega Express Highway road construction project. However, of the three safety management practices, the degree of relationship between safety participation and safety performance was the weakest, though still strong. The research hypothesis that there is a significant relationship between safety participation and safety performance was accepted.

Joint effect. The three practices together explained 86.3% of the variance in safety performance ($\text{Adjusted } R^2 = .863$; $F(3, 115) = 135.634$, $p < .05$). Safety compliance contributed 54.0% of the combined standardised weight, safety training 34.3% and safety participation 11.7% (Table 4.13).

Table 4. 16 How the Objectives, Research Questions, Hypotheses, Findings and Conclusions Tie Together

Objective	Research question	Hypothesis and result	Key finding	Conclusion
1. Examine safety compliance and safety performance	What is the relationship between safety compliance and safety performance?	H1 supported ($r = .782$, $p < .05$)	Strong positive relationship; largest unique effect ($\beta = .639$); enforcement elements weakest	Section 5.2.1
2. Assess safety training and safety performance	What is the relationship between safety training and safety performance?	H2 supported ($r = .832$, $p < .05$)	Strongest simple relationship; unique effect $\beta = .406$; training concentrated at induction	Section 5.2.2
3. Explore safety participation and safety performance	What is the relationship between safety participation and safety performance?	H3 supported ($r = .732$, $p < .05$)	Positive but weakest ($\beta = .138$); feedback weakest element	Section 5.2.3

Source: Primary data (2024).

4.15 Developed Framework and Implications for Practice

Figure 4.4 brings the findings back to the conceptual framework (Figure 1.1). It shows the three practices with their correlation with safety performance and their unique weight in the regression, the eight performance indicators with their ratings, the share of variance explained, and the intervening variables that stand outside the model and may account for the 13.7% of variance not explained.

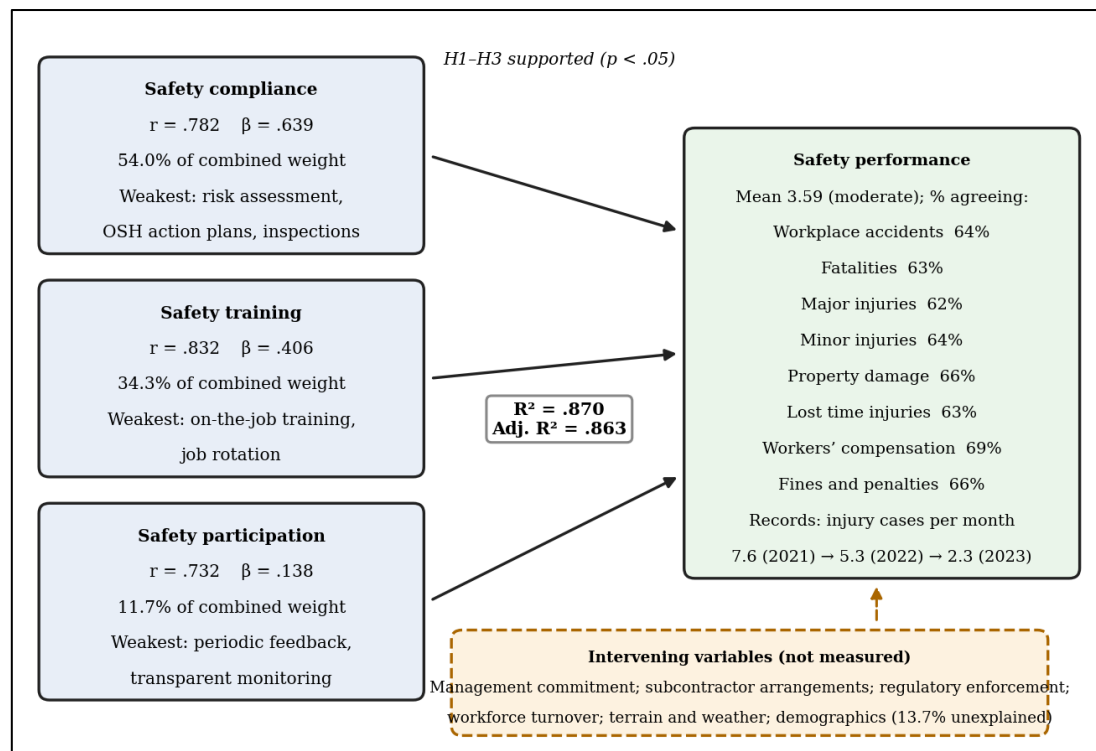


Figure 4. 4 Developed Framework: Safety Management Practices, Safety Performance and Intervening Variables

Source: Researcher's own, based on the study findings (2024), adapted from Figure 1.1.

Implications for practice. First, because compliance carries the largest unique weight, project managers should put enforcement ahead of documentation: unannounced inspections, audits and up-to-date risk assessments are the weakest compliance elements and the ones most likely to move performance. Second, because training is most strongly associated with performance but is concentrated at induction, it should be sustained through on-the-job coaching, refresher training and competency checks. Third, participation adds the least, but it is cheapest to improve, and its weakest element, feedback, requires only that management tells workers what was done about their reports. Fourth, the intervening variables, especially subcontractor management and regulatory enforcement, should be managed alongside the three practices, since they may account for part of the variance the practices did not explain.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusions of the study for each specific objective, with the main statistics from Chapter Four, followed by recommendations that rest on each conclusion, general and policy recommendations, the contribution of the study, its limitations and areas for further research. The summary of findings and the discussion of the findings in relation to other studies are in Chapter Four (Sections 4.5 to 4.7 and 4.14).

5.2 Conclusions

This section presents the conclusions of the study based on the study objectives.

5.2.1 Safety Compliance and Safety Performance

The study concludes that safety compliance has a strong and significant relationship with safety performance on Mpigi-Busega Express Highway road construction project. It was established that where OSH action plans, safety policies and procedures, risk assessments, safety regulations, inspections and audits were consistently implemented, the project recorded fewer unsafe acts, fewer unsafe conditions and fewer recordable HSE events. The study therefore concludes that safety compliance is not a peripheral, paperwork exercise but a central determinant of how safely a road construction project is actually run. However, the study also revealed that compliance on the project was still constrained by gaps in the consistency of implementation, the rigour of audits, and the enforcement of existing policies across all levels of the workforce. Addressing these gaps would further strengthen the already strong relationship between safety compliance and safety performance, and would help sustain the improving trend in HSE outcomes observed over the study period. Statistically, the relationship is strong ($r = .782$, $p < .05$), so that safety compliance alone accounts for 61.2% of the variation in safety performance ($r^2 = .612$); it had the largest unique effect when the three practices were considered together ($\beta = .639$, 54.0% of the combined standardised weight). Respondents rated compliance at 3.73 out of 5, about 64% agreeing on average with the eight compliance statements, with safety regulations rated highest (4.33) and risk assessment (3.25), OSH action plans (3.29) and inspections (3.35) lowest.

5.2.2 Safety Training and Safety Performance

The study concludes that safety training is the practice most strongly associated with safety performance among the three safety management practices examined. It was revealed that orientation programmes, on-the-job training, ongoing capacity-building, job rotation, toolbox meetings, periodic workshops, off-job training and coaching, taken together, equipped workers with the practical knowledge and hazard-awareness needed to work safely, and that this translated into a measurable decline in unsafe acts and unsafe conditions on site. The study therefore concludes that investment in structured, continuous safety training is the single most effective lever available to the project for improving safety performance. At the same time, the study found that training on the project was not yet fully continuous or refresher-based, with several respondents indicating that training was concentrated at induction rather than sustained throughout the course of the project. Closing this gap would consolidate the gains already achieved and further reduce the incidence of unsafe acts linked to skill and knowledge gaps. Statistically, the relationship is very strong ($r = .832$, $p < .05$), the strongest simple relationship of the three, accounting for 69.2% of the variation in safety performance ($r^2 = .692$); its unique effect was smaller than that of compliance ($\beta = .406$, 34.3% of the combined weight). Respondents rated training at 3.83 out of 5, about 66% agreeing on average with the eight training statements, with orientation programmes rated highest (4.58) and on-the-job training and job rotation lowest (3.42).

5.2.3 Safety Participation and Safety Performance

The study concludes that safety participation, while still exerting a positive and significant influence on safety performance, is the weakest of the three safety management practices examined and the one with the greatest unrealised potential on the project. It was found that where workers were involved in safety-related decision-making, where management was responsive to safety concerns raised from the ground, and where reporting and feedback systems functioned effectively, safety performance improved accordingly. However, the study also revealed that worker involvement in decision-making and community participation in safety matters remained the least developed aspects of the project's safety management system. The study concludes that safety performance on the project is being held back not by an absence of policies or training, but by a participation gap: workers and surrounding communities are not yet drawn into safety management as fully as the strength of the compliance and training practices would allow, and closing this gap represents the most significant remaining

opportunity for improving safety performance on the project. Statistically, the relationship is strong and significant ($r = .732$, $p < .05$), accounting for 53.6% of the variation in safety performance ($r^2 = .536$), but its unique effect was the smallest ($\beta = .138$, 11.7% of the combined weight). Respondents rated participation at 3.68 out of 5, about 66% agreeing on average with the eight participation statements, with community participation rated highest (3.96) and periodic feedback lowest (3.48).

5.2.4 Safety Performance and the Joint Effect of the Three Practices

The study concludes that safety performance on the project was moderate and improving: the mean rating was 3.59 out of 5, about 64% of respondents agreed that each of the eight outcomes had been controlled, and recordable injury cases fell by 69% in the monthly rate between 2021 (7.6 per month) and January to June 2023 (2.3 per month). The three practices together explained 86.3% of the variation in safety performance (Adjusted $R^2 = .863$; $F(3, 115) = 135.634$, $p < .05$), and all three hypotheses were supported. The remaining 13.7% is likely to be due to intervening variables that were not measured, such as management commitment, subcontractor arrangements and regulatory enforcement (Section 4.3.1).

5.3 Recommendations

This section details the recommendations of the study. Each set of recommendations rests on the conclusion for the corresponding objective in Section 5.2.

5.3.1 Safety Compliance and Safety Performance

The following recommendations rest on the conclusion in Section 5.2.1 that safety compliance has a strong relationship with safety performance ($r = .782$; $\beta = .639$), but that enforcement elements, risk assessment, OSH action plans and inspections, were rated weakest;

- i. Strengthen unannounced safety audits and inspections: The Project Manager, HSE Manager and Section HSE Officers of the Mpigi-Busega Express Highway road construction project should institute a structured schedule of unannounced safety audits and inspections across all work sections, in addition to routine inspections. The HSE Manager should coordinate the inspection programme, while Section HSE Officers should conduct inspections using standardised checklists and report findings to the Project Manager. Corrective actions should be assigned to responsible supervisors and followed up until closure. This will improve consistency in the implementation of safety

requirements across work sections, enable early identification of unsafe acts and conditions, and reduce safety incidents and recordable HSE events.

- ii. Strengthen enforcement of safety policies and OSH requirements: The Project Manager, HSE Manager, Construction Managers and Site Supervisors should strengthen enforcement of existing safety policies, procedures, regulations and OSH action plans. This should be achieved by clearly assigning safety responsibilities to supervisors, communicating requirements during toolbox meetings and enforcing consistent and graduated sanctions for non-compliance among workers, subcontractors and supervisors. The HSE Manager should monitor enforcement, while Construction Managers and Site Supervisors should ensure compliance within their respective work sections. This will increase accountability, promote consistent adherence to safety procedures and reduce repeated cases of non-compliance and unsafe behavior.
- iii. Ensure continuous updating of risk assessments: The Project Manager, HSE Manager, Construction Managers and Section HSE Officers, in coordination with UNRA's designated project supervision team, should ensure that risk assessments are reviewed and updated before the commencement of each major construction phase and whenever there are significant changes in work activities, equipment, methods or site conditions. The HSE team should involve workers and supervisors in identifying new hazards and determining appropriate control measures, with updated assessments communicated before work begins. This will ensure that safety controls remain relevant to changing construction hazards, improve workers' preparedness and reduce exposure to accidents, injuries and other HSE risks.

5.3.2 Safety Training and Safety Performance

The following recommendations rest on the conclusion in Section 5.2.2 that safety training has the strongest simple relationship with safety performance ($r = .832$), but is concentrated at induction (orientation 4.58 against on-the-job training 3.42);

- Establish a continuous safety training and refresher programme: The Project Manager, HSE Manager and Training Coordinator of the Mpigi-Busega Express Highway road construction project should move from mainly induction-based safety training to a continuous refresher-training calendar covering various safety training components.

The HSE Manager should develop an annual or quarterly training schedule, while the Training Coordinator and Section HSE Officers should organise periodic workshops, practical demonstrations and coaching sessions for workers, foremen and supervisors. This will sustain workers' knowledge and awareness of workplace hazards, strengthen safe-work skills throughout the project period and further improve safety performance.

- Strengthen toolbox meetings and on-the-job safety coaching: The HSE Manager, Section HSE Officers, Construction Managers, Foremen and Site Supervisors should increase the frequency and quality of toolbox meetings and on-the-job coaching as complements to formal safety training. Toolbox meetings should be conducted before work begins and should focus on the specific hazards, work activities and control measures relevant to the day's tasks, while supervisors and foremen should provide practical coaching and correct unsafe practices at the point of work. Attendance and key issues discussed should be documented for monitoring purposes. This will reinforce knowledge gained through formal training, improve workers' application of safety procedures in real work situations, increase hazard awareness and reduce unsafe acts and conditions on site.
- Make periodic safety training mandatory for contractors and subcontractors: UNRA's Project Engineer, the Project Manager and HSE Manager should require all contractors and subcontractors working on the Mpigi-Busega Express Highway project to participate in periodic safety workshops, refresher training and other capacity-building sessions as a condition of their engagement on the project. Compliance should be incorporated into contractor safety requirements, with attendance records and training completion monitored by the HSE Manager and reviewed during contractor performance assessments. This will ensure that safety knowledge and practices are standardised across the entire workforce, including subcontracted workers, and will reduce variations in safety performance arising from differences in training among contractors.
- Introduce competency-based assessment following safety training: The HSE Manager, Training Coordinator and Section HSE Officers should assess workers' understanding and practical application of safety training after induction and refresher sessions through short assessments, demonstrations and workplace observations. Workers who

do not demonstrate adequate understanding should receive additional coaching before undertaking high-risk tasks. This will ensure that training results in actual competence rather than attendance alone, improve workers' ability to apply safety controls and reduce errors and unsafe work practices.

5.3.3 Safety Participation and Safety Performance

The following recommendations rest on the conclusion in Section 5.2.3 that safety participation is positive and significant ($r = .732$) but the weakest practice ($\beta = .138$), with feedback rated lowest (3.48);

- Establish structured worker safety participation mechanisms: The Project Manager, HSE Manager and Construction Managers of the Mpigi-Busega Express Highway road construction project should establish structured channels through which workers can participate in safety-related decision-making. This should include regular safety committee meetings involving elected worker representatives from different work sections, with documented discussions, agreed actions and follow-up on issues raised. Section HSE Officers should ensure that workers are informed about the outcomes of these meetings and how their concerns have been addressed. This will give workers a formal voice in safety management, strengthen ownership of safety practices and increase workers' willingness to participate in activities that improve safety performance.
- Strengthen responsiveness to workers' safety concerns: The HSE Manager, Section HSE Officers, Construction Managers and Site Supervisors should establish a clear reporting and feedback mechanism through which workers can raise safety concerns and receive timely responses. Reported concerns should be recorded, assigned to responsible officers and addressed within defined timelines based on the level of risk, with feedback provided to the workers who raised them. High-risk concerns should be immediately escalated to the Project Manager for action. This will build workers' confidence in the reporting system, encourage greater reporting of hazards and unsafe conditions, and result in earlier identification and control of safety risks before they lead to accidents or injuries.
- Strengthen community participation in project safety management: UNRA's Project Engineer, the Project Manager, HSE Manager and Community Liaison Officer should extend safety participation beyond workers to communities living and conducting

activities around the Mpigi-Busega Express Highway. This should be achieved through regular community safety engagement forums, consultations with local leaders and awareness sessions on risks associated with construction activities, traffic movement, work zones and access to project areas. Community safety concerns should be documented and incorporated into relevant project safety plans and risk assessments. This will improve communication between the project and surrounding communities, enable early identification of public safety risks and reduce accidents, injuries and other safety incidents affecting road users and community members.

- Increase worker involvement in hazard identification and risk assessment: The HSE Manager, Section HSE Officers, Foremen and Site Supervisors should involve workers directly in identifying hazards and reviewing control measures before and during high-risk construction activities. Workers should be encouraged to provide practical information on hazards encountered during their daily tasks, and their observations should be incorporated into job safety analyses and risk assessments. This will strengthen worker ownership of safety controls, ensure that risk assessments reflect actual site conditions and improve the effectiveness of measures used to prevent workplace accidents.
- Introduce a formal feedback mechanism for safety participation: The Project Manager and HSE Manager should establish a system for communicating back to workers the actions taken in response to safety suggestions, reports and concerns. This could be achieved through toolbox meetings, safety noticeboards, safety committee meetings and supervisor briefings. The HSE Manager should periodically review the number of concerns raised, actions completed and outstanding issues. This will demonstrate that worker participation leads to tangible management action, strengthen trust between workers and management and encourage continued participation in safety improvement activities.

5.3.4 General Recommendations

The study recommends the following.

- i. Manage the three practices as one package, in order of weight. The Project Manager and the HSE Manager should treat safety compliance, safety training and safety participation as one safety management system and give priority in that order. This should be done through a single annual safety plan that sets targets, budgets and

responsible officers for all three practices; a monthly safety review meeting where the three practices are discussed together and a larger share of HSE staff time and money going to enforcement of compliance followed by continuing training and then participation and feedback. This will result in fewer injuries, because the practice with the largest effect gets the most attention; no duplication or competition between separate programmes; better use of a limited HSE budget and a continued fall in recorded injury cases.

- ii. Track performance with both ratings and records: The HSE Manager should report the eight performance indicators every quarter. This should be done through a short worker rating survey each quarter, repeating the same eight statements; the monthly HSE records of accidents, fatalities, lost time injuries, property damage, compensation and fines and a one-page quarterly report to the Project Manager and UNRA that puts the two sets of figures side by side. This will result in early warning, because a fall in worker ratings often shows before a rise in recorded injuries; detection of under-reporting, where records look better than workers say they feel; management decisions based on evidence, not opinion and a safety performance record that the project can show to UNRA and to workers.
- iii. Manage the intervening variables; The Project Manager should bring subcontractors under the same induction, training and inspection regime as directly employed workers, and should document management commitment and regulatory inspections. This should be done through making the same site induction and toolbox meetings compulsory for subcontractor employees before they start work; including subcontractor work areas in the unannounced inspection schedule and keeping a register of management safety walkabouts, safety meetings chaired by senior managers and regulator visits. This will result in the same safety standard for all categories of worker; fewer incidents involving subcontracted workers, who are often the least trained and least supervised; a record of leadership and regulatory activity that later studies can use to test whether these factors explain the 13.7% of safety performance the three practices did not explain and stronger evidence for the project in any contractual or legal dispute after an incident.

5.4 Policy Recommendations

The following policy recommendations are addressed to the institutions that regulate and procure road works, and rest on the finding that enforcement of compliance, continuing training and feedback explain safety performance;

Put safety performance requirements into road contracts; The Uganda National Roads Authority (UNRA) should make safety performance a mandatory condition in all road construction contracts. This should include contract clauses requiring contractors to report recordable injury rates and lost-time injuries every month, provisions allowing UNRA to conduct unannounced safety audits, and clearly defined consequences for repeated non-compliance, such as corrective action notices or withheld payments. This approach will give contractors a financial incentive to maintain safety standards, make it more difficult to rely on paperwork without actual compliance, and enable UNRA to obtain comparable safety data across projects. It will also encourage contractors with strong safety practices while discouraging those who compromise worker safety to reduce costs.

Strengthen inspection under the Occupational Safety and Health Act, 2006; The Ministry of Gender, Labour and Social Development should strengthen its inspection of public road construction projects by establishing a regular inspection programme supported by adequate numbers of labour officers and transport for site visits. The Ministry should also conduct follow-up inspections to confirm that identified safety defects have been corrected and publish inspection findings to promote accountability. These measures would increase the likelihood of detecting non-compliance, encourage contractors to address safety problems promptly, and strengthen public and donor confidence in road projects financed by development partners such as the African Development Bank. The inspection findings would also provide evidence to help the Ministry identify and take action against repeat offenders.

Set a minimum safety training standard for road contractors. The Ministry of Works and Transport, together with UNRA, should establish minimum standards for safety induction, refresher training and competency-based training for all road construction workers, including subcontractors. These standards should specify the minimum training content, frequency and assessment requirements. Contractors should maintain training records for inspection by UNRA and assess workers' competence after training rather than relying on attendance records alone. This recommendation addresses the study's findings that training was mainly

concentrated at induction, with weaknesses in on-the-job training and job rotation. A common training standard would ensure that workers receive consistent safety instruction across different contractors and provide evidence that training improves competence. It is particularly important because training had the strongest simple relationship with safety performance in the study.

Require worker participation and feedback structures: UNRA should require every road construction contract to provide for a functioning worker safety committee and a documented feedback mechanism. Each committee should include worker representatives, meet monthly and maintain minutes of its meetings. Contractors should also keep a register recording workers' safety concerns, the actions taken and the dates on which feedback was communicated. This register should be available during safety audits. Implementing these measures would address the study's finding that feedback was the weakest element of worker participation, with a mean score of 3.48. When workers see that their concerns lead to action, they are more likely to report hazards early, strengthening trust between workers and management. Improving participation would also provide a practical and relatively low-cost way of supporting safety compliance and training.

Maintain a national road-sector safety database; UNRA should establish and maintain a central database containing consistent safety performance information from road construction projects across Uganda. All contractors should submit monthly reports using a standard template covering the same eight safety performance indicators, with the information stored in a central UNRA database. Summary findings should be periodically shared with researchers and relevant regulatory bodies. This would enable UNRA to compare projects, identify high-risk sites early and monitor safety trends over time. It would also provide a stronger national evidence base for policy development and future research. In particular, researchers would be able to examine whether the relationships identified in this study apply to other road construction projects, addressing the limitation of relying on a single-project study. Regular data collection would also support the analysis of changes in safety performance over time, which the cross-sectional design of the current study could not establish.

5.5 Contribution of the Study to the Existing Body of Knowledge

The contribution of this study to the existing body of knowledge is stated below under four headings. Each states what was not previously known or done and what this study adds.

Empirical contribution. Most of the literature reviewed examines safety management practices as a single construct or focuses on manufacturing, general construction, and road projects outside Uganda. This study examines safety compliance, safety training, and safety participation separately within a Ugandan expressway project, demonstrating their relative contributions to safety performance. The findings show that safety training has the strongest individual association with safety performance, while safety compliance makes the greatest unique contribution. Safety participation also contributes significantly, although its contribution is comparatively smaller. To the researcher's knowledge, the study provides novel empirical evidence on these relationships within a public highway construction project in Uganda.

Methodological contribution. The study contributes a practical approach to measuring safety performance by distinguishing actual safety outcomes from compliance with safety requirements. It uses a composite measure based on safety performance indicators and compares the findings with the project's monthly Health, Safety and Environment (HSE) records. This approach provides a replicable method for assessing safety performance in construction settings where incident records cannot be directly linked to individual respondents. It also demonstrates the value of combining questionnaire responses with routine project safety records to strengthen the assessment of safety outcomes.

Theoretical contribution. The findings contribute to the application of Safety Climate Theory in temporary, high-risk road construction projects in a developing-country context. They demonstrate the differing contributions of safety compliance, safety training, and safety participation to safety performance within this setting. In particular, the findings highlight the importance of safety compliance while also showing that training and worker participation play meaningful roles in promoting safer working conditions. These insights provide context-specific evidence that helps explain how different dimensions of safety management relate to safety performance in road construction.

Practical and policy contribution. The study provides evidence to guide project managers, the Uganda National Roads Authority (UNRA), and the Ministry of Works and Transport in

prioritising safety interventions. The findings highlight the importance of strengthening safety compliance systems, maintaining training beyond the initial induction stage, and improving structured worker participation. In addition, the use of routine HSE records to monitor safety outcomes offers a practical approach for tracking contractor performance throughout project implementation. These findings can inform the development of safety management policies, contract requirements, inspection procedures, and monitoring systems aimed at improving worker safety on public road construction projects in Uganda.

5.6 Limitations of the Study

This section details the limitations of the study;

Scope of the study. The study focused on safety management practices and safety performance within a single project, the Mpigi-Busega Express Highway road construction project. This narrow scope may limit the generalisation of the findings to other road construction projects, other regions of Uganda, and privately financed infrastructure projects with different management structures and regulatory requirements.

Research design limitations. The study adopted a cross-sectional research design, collecting primary data at a single point in time and supplementing it with documentary review. This design limits the ability to establish causal relationships between safety management practices and safety performance. It also does not capture how these relationships may change as a road construction project progresses towards completion.

Data collection limitations. The study relied on self-administered questionnaires and an interview guide to collect primary data, which may have introduced respondent bias. Some workers may have been reluctant to provide unfavourable information about their supervisors or project management. Although documentary review of the project's Health, Safety and Environment (HSE) records helped address this limitation, subjective experiences, such as workers' confidence in reporting hazards, could not be independently verified through documentary evidence alone.

Measurement and analytical limitations. Safety performance was measured using respondents' perceptions rather than direct counts of fatalities, accidents, property damage, and lost-time injuries. These perceptions may differ from actual recorded safety outcomes. Furthermore, the project's monthly safety records could not be linked to individual respondents, limiting their use to corroborating questionnaire findings. The analysis also established associations rather

than causal relationships, while the close relationship between the safety management practices means that their individual contributions to safety performance may overlap.

Limitations in examining other influencing factors. The analysis used composite scores for the entire sample without examining differences across respondents' demographic characteristics. It also did not assess the influence of other factors, such as management commitment, subcontractor arrangements, and regulatory enforcement, which may affect the relationship between safety management practices and safety performance. Consequently, the potential influence of these factors on the study findings could not be established.

5.7 Areas for Further Research

- Comparative studies across different road construction projects; Further research should compare safety management practices and safety performance across different road construction projects in Uganda. Such studies could include projects of different sizes, contractors and geographical locations to establish whether the relationships identified in the Mpigi-Busega Express Highway project are consistent across different construction contexts.
- Longitudinal studies on safety management practices and safety performance; Further research should use a longitudinal research design to examine how safety management practices influence safety performance over different stages of a road construction project. This would provide a better understanding of whether improvements in safety compliance, training and participation are sustained throughout the project lifecycle.
- Role of safety leadership in improving safety performance; Further research should examine the influence of safety leadership and management commitment on safety performance in road construction projects. This would help establish how the actions, attitudes and commitment of project managers, HSE managers, supervisors and foremen influence workers' compliance with safety requirements and participation in safety activities.
- Influence of subcontracting on safety performance; Further research should examine how the use of subcontractors affects safety management practices and safety performance on road construction projects. Particular attention should be given to

differences in safety training, supervision, compliance and reporting between directly employed workers and subcontracted workers. This would help identify measures for ensuring consistent safety standards across all categories of workers.

- Effect of demographic and intervening variables: Further research should analyse the relationships by respondent category, education and gender, and should measure intervening variables such as management commitment, subcontractor arrangements and regulatory enforcement, to establish how far they explain the part of safety performance that safety compliance, training and participation do not.

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APPENDICES

APPENDIX A: QUESTIONNAIRE

Dear respondent

I am Ibrahim Kawuya a student at Uganda Christian University pursuing a master's degree in Science Environmental Health and Safety Management. I am carrying out a study research entitled "Safety Management Practices and Safety Performance of Mpigi-Busega Express Highway road construction project" You are among the respondents randomly selected to provide information. Please you are requested to respond to the questions by ticking on the appropriate box or write a brief statement where applicable. The information provided will be kept confidential and will only be for academic purposes.

PART A: BIO DATA OF THE RESPONDENTS

Please tick (✓) the box that matches your answer to the questions and give the answers in the spaces provided as appropriate.

1. Gender of Respondent Female [] Male []
2. Respondent's Age 20 to 29 years [] 30 to 39 years [] 40 -49 years [] Above 50 years
3. Please indicate your highest level of Education: Postgraduate [] Degree [] Diploma [] Certificate [] Others []

PART B: SAFETY PERFORMANCE, SAFETY COMPLIANCE, SAFETY TRAINING AND SAFETY PARTICIPATION

This part comprises of four sections providing questions pertaining to the research variables. Please indicate by ticking according to the scale below your order of preference. Using a Likert scale of 1 – 5 to rate the following alternatives from A – I where 1 – Strongly Disagree (SD), 2 – Disagree (D), 3- Not Sure (NS), 4 - Agree (A) and 5 - Strongly Agree (SA). Please kindly tick where appropriate

SECTION A: SAFETY PERFORMANCE		RANKING				
		SD 1	D 2	NS 3	A 4	SA 5
a)	UNRA has registered a general decline in cases of occupational accidents on all its road construction projects					
b)	UNRA has registered no single case of fatal accident on its road construction projects					
c)	UNRA has registered few cases of major injuries of its employees on its road construction projects					
d)	UNRA has registered few cases of minor inquiries of its employees on its road construction projects					
e)	UNRA has registered few cases of property damages on its road construction projects					
f)	UNRA has registered a decrease in lost time of injury on its road construction projects					
g)	UNRA employees have received workers' compensation premium after getting injuries					
h)	UNRA has faced fines and penalties for non-compliance to safety measures by regulating authorities					
SECTION B: SAFETY COMPLIANCE		SD 1	D 2	NS 3	A 4	SA 5
a)	UNRA has developed Occupational Safety and Health Action plans to protect its employees from injuries					

b)	UNRA has developed a comprehensive Safety policy to protect its employees from injuries					
c)	UNRA has developed safety procedures to protect its employees from injuries					
d)	UNRA has conducted regular risk assessment to protect its employees from injuries					
e)	UNRA has developed safety regulations to protect its employees from injuries					
f)	UNRA has conducted regular safety inspection to protect its employees from injuries					
g)	UNRA has implemented all safety policies to protect its employees from injuries					
h)	UNRA has conducted regular safety audits to protect its employees from injuries					
	SECTION C: SAFETY TRAINING	SD 1	D 2	NS 3	A 4	SA 5
a)	UNRA has organized orientation programs for new employees					
b)	UNRA has organized on-job trainings on health and safety programs					
c)	UNRA has organized on-going capacity building programs on health and safety					
d)	UNRA has carried out job rotation of its employees in relation to health and safety					
e)	UNRA has organized tool box meetings on health and safety					
f)	UNRA has organized periodic workshops on health and safety					
g)	UNRA has facilitated off-job trainings on health and safety					
h)	UNRA has encouraged coaching of its employees on health and safety					
	SECTION D: SAFETY PARTICIPATION	SD	D	NS	A	SA

		1	2	3	4	5
a)	All employees have participated in decision making in relation to health and safety					
b)	UNRA is responsive to safety measures					
c)	UNRA has encouraged employee adherence to safety measures					
d)	UNRA have established an effective reporting systems on health and safety					
e)	UNRA has provided periodic feedback on health and safety					
f)	UNRA has carried out regular monitoring on health and safety					
g)	UNRA has developed a transparent monitoring system on health and safety					
h)	UNRA has encourage community participation on health and safety					

Thank you for your cooperation

APPENDIX B: INTERVIEW GUIDE

I am Ibrahim Kawuya a student at Uganda Christian University pursuing a master's degree in Science Environmental Health and Safety Management. I am carrying out a study research entitled "Safety Management Practices and Safety Performance of Mpigi-Busega Express Highway road construction project". You are purposively selected to be interviewed because of your strategic position and the interview will take about 30 minutes. All responses will be kept confidential and will purely be for academic purposes.

Safety Compliance and Safety performance of Mpigi-Busega Express Highway road construction project

- i. How have Occupation Safety and Health Action plans improved on safety performance of Mpigi-Busega Express Highway road construction project?
- ii. How has Safety policy improved on safety performance of Mpigi-Busega Express Highway road construction project?
- iii. How have Safety procedures and implementation improved on safety performance at UNRA?
- iv. How has risk assessment improved on safety performance of Mpigi-Busega Express Highway road construction project?
- v. How have safety regulations improved on safety performance of Mpigi-Busega Express Highway road construction project?
- vi. How has safety inspection and audits improved on safety performance of Mpigi-Busega Express Highway road construction project?

Safety Training and Safety performance of Mpigi-Busega Express Highway road construction project

- i. How have orientation programs improved on safety performance of Mpigi-Busega Express Highway road construction project?
- ii. How have on-going capacity building programs improved on safety performance of Mpigi-Busega Express Highway road construction project?
- iii. How have tool box meetings improved on safety performance of Mpigi-Busega Express Highway road construction project?

Safety Participation and Safety performance of Mpigi-Busega Express Highway road construction project

- i. How has safety decision making improved on safety performance of Mpigi-Busega Express Highway road construction project?

- ii. How have safety response to / adherence to safety measures improved on safety performance of Mpigi-Busega Express Highway road construction project?
- iii. How has safety communication and feedback improved on safety performance of Mpigi-Busega Express Highway road construction project?
- iv. How has safety monitoring improved on safety performance of Mpigi-Busega Express Highway road construction project?

Thank you for your cooperation

APPENDIX C: DOCUMENTARY REVIEW CHECKLIST

This checklist was used to guide the documentary review of Mpigi-Busega Express Highway road construction project's HSE records described in Section 3.5.3 and Section 3.6.3. For each document reviewed, the researcher recorded the information below.

Field	Detail
Document type (e.g., monthly HSE activity log, monthly HSE event log, incident report, safety audit report, training attendance register)	
Document reference / file number	
Custodian department (HSE Department, Mpigi-Busega Express Highway road construction project)	
Period covered by the document (month and year)	
Date of review	
Reviewed by	

Part A: HSE Activity (Leading) Indicators

HSE Activity (Leading) Indicator	Monthly count (Jan 2021 - Jun 2023), source document ref., date extracted
HSE meetings held (number)	
Toolbox and pre-start meetings held (number)	
HSE training sessions conducted (number)	
HSE inductions conducted (number)	

Emergency drills conducted (number)	
HSE audits and inspections conducted (number)	
Permits to work issued (number)	
Job safety analyses (JSAs) conducted (number)	
Safety initiatives / best practices recorded (number)	
HSE anomalies reported (number)	
HSE awards given (number)	

Part B: HSE Event (Lagging) Indicators

HSE Event (Lagging) Indicator	Monthly count (Jan 2021 - Jun 2023), source document ref., date extracted
Fatalities (number)	
Lost time injuries (number)	
Restricted workday cases (number)	
Medical treatment cases (number)	
First aid cases (number)	
Environmental damages recorded (number)	
Material losses recorded (number)	
Near misses recorded (number)	
Workers compensated (number)	

Fines and penalties issued by regulating authorities (number)	
Occupational illnesses recorded (number)	
Unsafe acts observed and recorded (number)	
Unsafe conditions observed and recorded (number)	

For each indicator, the researcher recorded the monthly count as stated in the source document, the document reference from which it was extracted, and any notes on data quality (for example, a month with a missing or illegible record).

APPENDIX D:KRJECIE AND MORGAN TABLE(1970)

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

APPENDIX E: RESEARCH ETHICS COMMITTEE (REC) APPROVAL LETTER

 UGANDA CHRISTIAN UNIVERSITY A Centre of Excellence in the Heart of Africa	 Office of the Vice Chancellor Research Ethics Committee UG-026	
IBRAHIM KAWUYA Uganda Christian University kawuya.ibra@gmail.com +256-772 000091		12 th April, 2026
UG-REC-026 APPROVAL NOTICE		
To: Ibrahim Kawuya; Principal Investigator		
Re: UCU-REC Application titled: <i>Safety Management Practices and Safety Performance on Road Construction Projects in Uganda.</i>		
Application Number: UCUREC-2026-1934		
Version: 4.1		
Type of Review: ☐ INITIAL REVIEW ☐ Protocol Amendment ☐ Letter of Amendment ☐ Continuing Review ☐ Material Transfer Agreement ☐ Other, Specify:		
I am pleased to inform you that the UG-REC-026; UCUREC under expedited review approved the above referenced application. Approval of the research is for a period from 12th April, 2026 to 12th April, 2027. This research is considered minimal risk category. As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval: 1. All co-investigators must be kept informed of the status of the research. 2. Changes, amendments, and additions to the protocol or the consent form must be submitted to the REC for re-review and approval <u>prior</u> to the activation of the changes. The REC application number assigned to the research should be cited in any correspondence.		
		

Research and Ethics



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Office of the Vice Chancellor
Research Ethics Committee UG-026



3. Reports of unanticipated problems involving risks to participants or other must be submitted to the REC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for REC review.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by subjects and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Regulations require review of an approved study not less than once per 12-month period. Therefore, a continuing review application must be submitted to the REC eight weeks prior to the above expiration date of 12th April, 2027 in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. Your research details have been shared with the Executive secretary of Uganda National Council for Science and Technology (UNCST) and you are not required to get clearance since it is for a Master's degree. Refer to UNCST Research registration and clearance Policy and guidelines (July 2016) in Uganda section 6.

The following is the list of all documents approved in this application by UG-REC _026:

	Document Title	Language	Version	Version Date
1.	Protocol	English	1.0	2026-03-25
2.	Budget	English	1.0	2026-03-25
3.	Study work plan	English	1.0	2026-03-25
4.	Questionnaire for supervisors	English	1.0	2026-03-25
5.	Informed Consent Supervisors & Foremen	English	1.0	2026-03-25
6.	Interview Guide Managers UNRA	English	1.0	2026-03-25
7.	Informed Consent form Managers	English	1.0	2026-03-25

Signed and Stamped

Prof. Peter Waiswa,
UCUREC Chairperson,
pwaiswa@musph.ac.ug



Research and Ethics

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UCUREC is accredited by Uganda National Council for Science & Technology, FDA, and National Institutes for Health of the United States of America

APPENDIX F: PROJECT HSE RECORDS (RAW DATA)

This appendix reproduces the project's recorded HSE events by month, as taken from the project HSE records for January 2021 to June 2023. The counts by performance indicator in Table 4.3 are compiled from this table.

Table F. 1 Statistics of Safety Performance of Busega-Mpigi Express Highway from 2021 – June 2023

HSE Events (Recordable)	2021	2022	2023 (Jan end June)						Project to date From 2021 to end June 2023
			Jan	Feb	March	April	May	June	
Fatality (FAT)	02	00	00	00	00	00	00	00	02
Lost time of injury (LTI)	05	02	00	00	00	00	00	00	07
Restricted workday case (RWC)	08	06	00	01	00	00	00	00	15
Medical treatment case (MTC)	10	07	00	00	01	00	00	00	18
First aid case (FAC)	66	49	04	04	02	01	01	00	127
Environment damages (ED)	08	07	02	0	01	00	00	00	18
Material loss (ML)	23	19	03	01	00	01	00	00	47
Near miss (NMI)	43	39	04	03	04	02	01	02	29
No, of workers compensated	04	01	00	00	00	00	00	00	05
Fines and penalties by authorities	00	00	00	00	00	00	00	00	00

Occupational illness	33	29	03	02	00	00	01	00	68
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Source: Project HSE records, 2021 - June 2023.

APPENDIX G: DISTRIBUTION OF RESPONSES (RAW SURVEY DATA)

This appendix gives the item-by-item distribution of respondents' ratings (N = 119) on which the summary tables in Chapter Four are based. SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree.

Table G. 1 Distribution of Respondents' Ratings on Safety Performance

STATEMENT	SD	D	N	A	SA	Mean	Std Deviation
Road construction project has registered a general decline in cases of occupational accidents on all its road construction projects	19 (16%)	17 (14%)	7 (6%)	47 (39%)	29 (24%)	3.3077	1.22935
Road construction project has registered no single case of fatal accident on its road construction projects	15 (13%)	21 (18%)	8 (7%)	52 (44%)	23 (19%)	3.3808	1.19624
Road construction project has registered few cases of major injuries of its employees on its road construction projects	17 (14%)	19 (16%)	9 (8%)	49 (41%)	25 (21%)	3.8462	1.94733
Road construction project has registered few cases of minor inquiries of its employees on its road construction projects	17 (14%)	21 (18%)	5 (4%)	45 (38%)	31 (26%)	3.9923	1.99091

Road construction project has registered few cases of property damages on its road construction projects	15 (13%)	17 (14%)	9 (8%)	47 (39%)	31 (26%)	3.5769	1.82477
Road construction project has registered a decrease in lost time of injury on its road construction projects	17 (14%)	19 (16%)	8 (7%)	49 (41%)	26 (22%)	3.7308	1.68928
Road construction project employees have received workers' compensation premium after getting injuries	13 (11%)	18 (15%)	6 (5%)	52 (44%)	30 (25%)	3.1538	1.99773
Road construction project has faced fines and penalties for non-compliance to safety measures by regulating authorities	14 (12%)	27 (23%)	10 (8%)	47 (39%)	31 (26%)	3.2308	1.39488
Mean						3.5869	1.52477
N=119							

Source: Primary data (2024)

Table G. 2 Distribution of Respondents' Ratings on Safety Compliance

STATEMENT	SD	D	N	A	SA	Mean	Std Deviation
Project managers have developed Occupational Safety and Health Action plans to protect its employees from injuries	15 (13%)	17 (14%)	9 (8%)	47 (39%)	31 (26%)	3.2885	1.47311
Project managers have developed a comprehensive Safety policy to protect its employees from injuries	17 (14%)	19 (16%)	8 (7%)	49 (41%)	26 (22%)	3.6346	1.31401
Project managers have developed safety procedures to protect its employees from injuries	13 (11%)	18 (15%)	6 (5%)	52 (44%)	30 (25%)	3.7500	1.20253

Project managers have conducted regular risk assessment to protect its employees from injuries	14 (12%)	27 (23%)	10 (8%)	47 (39%)	31 (26%)	3.2500	1.26607
Project managers have developed safety regulations to protect its employees from injuries	19 (16%)	17 (14%)	7 (6%)	47 (39%)	29 (24%)	4.3269	1.02366
Project managers have conducted regular safety inspection to protect its employees from injuries	15 (13%)	21 (18%)	8 (7%)	52 (44%)	23 (19%)	3.3462	1.26622
Project managers have implemented all safety policies to protect its employees from injuries	17 (14%)	19 (16%)	9 (8%)	49 (41%)	25 (21%)	3.7692	1.46348
Project managers have conducted regular safety audits to protect its employees from injuries	17 (14%)	21 (18%)	5 (4%)	45 (38%)	31 (26%)	3.3654	1.35804
Mean						3.7346	1.21401
N=119							

Source: Primary data (2024)

Table G. 3 Distribution of Respondents' Ratings on Safety Training

STATEMENT	SD	D	N	A	SA	Mean	Std Deviation
Project managers have organized orientation programs for new employees	17 (14%)	21 (18%)	5 (4%)	45 (38%)	31 (26%)	4.5769	1.67258
Project managers have organized on-job trainings on health and safety programs	15 (13%)	17 (14%)	9 (8%)	47 (39%)	31 (26%)	3.4231	1.45987

Project managers have organized on-going capacity building programs on health and safety	13 (11%)	18 (15%)	6 (5%)	52 (44%)	30 (25%)	3.5577	1.34912
Project managers have carried out job rotation of its employees in relation to health and safety	14 (12%)	27 (23%)	10 (8%)	47 (39%)	31 (26%)	3.4231	1.37693
Project managers have organized tool box meetings on health and safety	19 (16%)	17 (14%)	7 (6%)	47 (39%)	29 (24%)	3.8462	1.21081
Project managers have organized periodic workshops on health and safety	15 (13%)	21 (18%)	8 (7%)	52 (44%)	23 (19%)	3.6346	1.12073
Project managers have facilitated off-job trainings on health and safety	17 (14%)	19 (16%)	9 (8%)	49 (41%)	25 (21%)	3.5731	1.40540
Project managers have encouraged coaching of its employees on health and safety	11 (9%)	15 (13%)	5 (4%)	57 (48%)	31 (26%)	3.7692	1.12272
Mean						3.8255	1.36252
N=119							

Source: Primary data (2024)

Table G. 4 Distribution of Respondents' Ratings on Safety Participation

STATEMENT	SD	D	N	A	SA	Mean	Std Deviation
All project workers have participated in decision making in relation to health and safety	13 (11%)	18 (15%)	6 (5%)	52 (44%)	30 (25%)	3.5769	1.31874
Project managers have been responsive to safety measures	14 (12%)	27 (23%)	10 (8%)	47 (39%)	31 (26%)	3.5538	1.30436

Project managers have encouraged employee adherence to safety measures	19 (16%)	17 (14%)	7 (6%)	47 (39%)	29 (24%)	3.7115	1.40498
Project managers have established an effective reporting systems on health and safety	15 (13%)	21 (18%)	8 (7%)	52 (44%)	23 (19%)	3.8077	1.59091
Project managers have provided periodic feedback on health and safety	17 (14%)	21 (18%)	5 (4%)	45 (38%)	31 (26%)	3.4808	1.55979
Project managers have carried out regular monitoring on health and safety	15 (13%)	17 (14%)	9 (8%)	47 (39%)	31 (26%)	3.6154	1.86668
Project managers have developed a transparent monitoring system on health and safety	17 (14%)	19 (16%)	9 (8%)	49 (41%)	25 (21%)	3.5000	1.43486
Project managers have encouraged community participation on health and safety	11 (9%)	15 (13%)	5 (4%)	61 (51%)	27 (23%)	3.9615	1.00901
Mean						3.6754	1.36668
N=119							

Source: Primary data (2024)