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# Provision of personal protective equipment and sanitary facilities to female construction site workers

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# Provision of personal protective equipment and sanitary facilities to female construction site workers

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## Declaration of Originality

I declare that this Research Report is my own, unaided work. It is submitted in fulfilment of the degree of Master of Science in the field of Mechanical, Industrial and Aeronautical Engineering at the University of the Witwatersrand, Johannesburg. It contains no section copied in whole or in part from any other source unless explicitly identified in quotation marks and with detailed, complete and accurate referencing.

It has not been submitted before for any degree or examination in any other university.



Signature of Candidate:
Simphiwe Nene (2413931)

# Abstract

The study was based on an aspect of social justice, namely gender equality in the workplace for the female workers who work on construction sites. The area covered in this study was the health and safety of women in construction in the form of the provision of personal protective equipment (PPE) and sanitary facilities to female workers. This specific focus is largely overlooked. The study explored, female workers' (end-user) perceptions and experiences on the provisions of sanitary and personal protective equipment through a qualitative approach. The main source of data collection was through semi-structured interviews and further supported with site observations in order to triangulate the interview responses. The results of the study found that the availability of PPE for females in the construction industry has improved as women are provided with female size PPE. However, quality and advanced gender sensitive PPE still needs attention. Sanitary facilities at established sites are generally up to standard. However, female workers still share these facilities with their male counter parts. Sanitary facilities at unestablished sites still need attention.

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# List of Terminologies

| Term | Definition |
|---|---|
| *Accidents* | *Refers to an unfortunate incident that happens unexpectedly and unintentionally, typically resulting in damage or injury.* |
| *Construction Site* | *Refers to an area or piece of land on which construction works are being carried out.* |
| *Established construction site* | *Refers to a site that has sophisticated infrastructure.* |
| *Female Construction Site Workers* | *Refers to females that physically work at construction sites.* |
| *Gender Sensitive* | *Awareness of the role, gender plays.* |
| *Personal Protective Equipment* | *Refers to equipment that will protect the user against health or safety risks at work.* |
| *Sanitary Facilities* | *Refers to toilets.* |
| *Unestablished construction site* | *Refers to a site that is yet to be constructed.* |

# List of Abbreviations

| Abbreviation | Description |
|---|---|
| *OHS* | *Occupational Health and Safety* |
| *PPC* | *Personal Protective Clothing* |
| *PPE* | *Personal Protective Equipment* |
| *WC* | *Work Clothing* |
| *WHO* | *World Health Organization* |
| *WIC* | *Women In Construction* |

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# 1. Introduction

## 1.1. Background to the Study

In most commercial countries, the construction industry is one of the most significant industries in contribution to gross domestic product (GDP). The industry is both economically and socially important (Sánchez et al., 2017). According to Kaur and Mittar, (2015), the industry provides 7% employment worldwide. Construction is the largest employer of labour (Cannon and Shah, 2019; Vijayaragunathan and Rasanthi, 2019). Occupational health is defined by the World Health Organization (WHO) as, the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations (Hooda and Mehta, 2020). Occupational Health and Safety (OHS) is the effort to identify and control hazards, accidents, and occupational diseases, which may occur in the workplace, in such a way that workers, visitors, and anybody present at the workplace as well as in its surroundings will be safe and free from unacceptable risks (Endroyo et al., 2015). Safety in construction projects is poor and still needs attention (Endroyo et al., 2015). Construction is one of the most hazardous industries; construction workers are frequently killed, maimed or caused to have poor health (Ness, 2012; Wong et al., 2020). The number of fatalities in construction is disproportionate when comparing the size of the workforce to other industries (Mroszczyk, 2015). Construction incidents are multi-causal in nature, involving an interaction between hazards, management, equipment, workplace, workers and factors unique to construction (Mroszczyk, 2015). These accidents are mostly caused by poor working conditions at building sites, falls, machine handling, sharp equipment, poor protective equipment and electrical installations (Gomes et al., 2016).

The construction industry is facing industrial issues such as; timely delivery of projects, delivering within budget and at the desired quality. ‘Women in construction’ has been a topic of concern by many nations, for many years. Given the rapid growth and demand in the construction sector, there has been an incremental demand in the participation of women in construction (Vijayaragunathan and Rasanthi, 2019). 21st century women are significantly represented in many occupations where male representation had dominated in the past, these include law, medicine, accountancy, information technologies and most of the secretaries’ positions. However, in the construction industry there is an easily observable disparity of female representation (Anuar, 2017; Arcand, 2016; Curtis et al., 2018; Francis, 2017; Vijayaragunathan and Rasanthi, 2019). The peculiarities of the construction workplace have been used to excuse the industry’s failures to implement gender equality (Ojo et al., 2019). Women bring new or alternative perspectives on how best to approach challenges in the workplace. A review conducted by the Harvard Business Review determined that the overall intelligence of teams was greater when females were incorporated as team members (Ojo et al., 2019). Women who work in the industry recognize the financial and psychological benefits including relatively high wages and benefits, ‘earn while you learn’ training opportunities, and satisfaction from tangible skill application. However, many tradeswomen note a lack of suitable provision to the peculiarity of women to work productively in the construction industry (Curtis et al., 2018). The current state of health and safety for women is still inadequate, there is a need for provisions specifically made for women (Behm, 2019; Cannon and Shah, 2019; Milligan, 2019). The inadequacy is inherently because, occupations were occupied by man, therefore health and safety was designed around men (Cannon and Shah, 2019; Milligan, 2019).

Globally, there is not enough research on the provision of personal protective equipment and sanitary facilities, from an end-user perspective. There is also a scarcity of research from the South African context on the issue of health and safety provisions for women in construction. Mariam et al., (2021) retrieved publications from the Scopus database on health and safety for women in construction with no year limit. The publication dates ranged from 1984 to 2019. The analysis of publications per country found that USA, South Africa and Australia had conducted more research on women's health and safety in construction than other countries. Although South Africa was ranked top three, it only had four publications.

## 1.2. Problem Statement

Personal protective equipment is designed and worn for protection against health and safety hazards within the work environment (Wagner et al., 2013). Categories of PPE/C available to workers in the construction trade include products for eye and face; hand; head; hearing; foot; body; respiratory; and fall protection (Wagner et al., 2013; Wong et al., 2020). Using PPE is considered an important way for protecting the health and safety of workers. The personal protective equipment must meet the requisite of the work (Guan et al., 2019). Everyone, from managers to frontline workers must use personal protective equipment (PPE) at construction work site (Hsiao et al., 2016). The safety-oriented design and production of PPE are critically important for the protection of all workers regardless of their gender, age or disability. Improperly fitting PPE could lead to serious injury or death, and productivity losses at the workplace (Hsiao et al., 2016; Milligan, 2019; Oo and Lim, 2020). Personal protective equipment (PPE) that does not provide a good fit would allow the hazardous material to come in contact with the user of the PPE (Mohd Amir Shazwan and Ee, 2018). Protective gear including fall protection harnesses that are too large and long, baggy vests are more likely to catch or snag on handrails, doors and equipment (Milligan, 2019; Cannon and Shah, 2019; Mariam et al., 2021). An individual's dexterity is reduced if gloves are big and the worker cannot properly grasp objects. Uncomfortable work tools expose women to unsafe ergonomic conditions (Milligan, 2019). The specific requirements of individuals need to be considered, which includes PPE and sanitary facilities that are sized and designed precisely for a workforce that is increasingly made up of women (Hsiao et al., 2016; Milligan, 2019; Oo and Lim, 2020). The past decade has shown a steady increase of female participation in the construction industry (Milligan, 2019). One of the challenges facing women in the trades is finding PPE that fits properly. This is a serious issue because PPE that does not fit properly will not adequately protect against occupational hazards and may increase the risk for illnesses, injuries and death (Behm, 2019). Ultimately, when safety for women is addressed, safety for everyone is improved (Cannon and Shah, 2019).

Previous studies on PPE and female construction workers have consistently reported that PPE commonly made available to female construction workers was not designed for women (Hsiao et al., 2016). Currently, most of the personal protective equipment (PPE) for the construction industry is designed to fit men. The PPE is traditionally designed and manufactured for men, who typically have larger bone structure than women as well as wider hands, feet and facial features. Providing PPE that is tailor-made for women in the construction workforce is critical for ensuring their safety and providing an inclusive environment that promotes their well-being and success, PPE is not a one-size-fits-all (Cannon and Shah, 2019; Milligan, 2019). Hsiao et al., (2016) pointed out that size is not the sole factor determining fit, since men and women are proportioned differently. Offering PPE in women's sizes is important, researchers have shown

that PPE, tools, and clothing need to be specifically sized and designed for a woman's body shape (Wagner et al., 2013).

While the General Industry Standard states that "the employer shall select PPE that properly fits each affected employee", there is no similar provision in the Construction Standard (Behm, 2019; Hsiao et al., 2016). Wagner et al., (2013), Hsiao et al., (2016) and Oo and Lim, (2020) argue that, research on PPE and work clothing exists, but few studies consider the differing body characteristics and needs of the genders. In order to bring about the necessary changes there must first be increased awareness within the industry of the challenges facing female construction workers. Milligan, (2019) argues that in order to meet exact needs of women, gathering feedback from female employees was imperative during their research.

Recent studies have also recognized that the health burden associated with absent or poor sanitation facilities falls disproportionately on women. Sanitation-related health consequences for women include increased risk of infections and maternal mortality (Winter and Barchi, 2016). An adequate toilet for women is: safe and conveniently located, separated by gender (if communal or public), which provides privacy (doors, locks), a culturally appropriate waste disposal option (trash bins, chutes, pits), water and soap is available for washing one's hands (water tap or bucket), suitable drainage and a 'safe space' away from men both during the day and night (safety) (Schmitt et al., 2018; Jones and Slater, 2020). Ness (2012); Thenguzhali and Veerachamy (2015) and Wong et al., (2020) argue that, many of the problems that female construction workers face, are made more severe than other industries by the construction industry's temporary, dynamic, and decentralized nature (Project sites change all the time). The findings by Occupational Safety and Health Administration established that, temporary sanitary facilities at construction sites are usually unisex without privacy and not well maintained resulting in unclean facilities which can invariably lead to health and safety impediments (Ojo et al., 2019).

It is therefore arguable that previous studies have found that the anthropometric differences lead to ill-fitting PPE and that sanitation is poor on construction sites (Hsiao et al., 2016; Milligan, 2019). There is however, not enough research focusing on female workers' (end-user) perspective on experiences and thoughts on the provisions of sanitary and personal protective equipment.

## 1.3. Primary Research Question

What are the experiences and perceptions of female construction site workers regarding the provision of personal protective equipment and sanitary facilities on sites?

## 1.4. Research Objectives

The aim of this research is to investigate the experiences and perceptions of female construction site workers regarding the provision of personal protective equipment and sanitary facilities on sites, and suggestions for sustainable mitigations.

1.4.1. To establish the perceptions of female construction workers, on the adequacy and appropriateness of personal protective equipment and sanitary provisions on site.
1.4.2. To investigate the experiences of female construction workers, in utilizing personal protective equipment and sanitary facilities on site.
1.4.3. To propose possible improvements to the provisions of personal protective equipment and sanitary facilities, from the perspective of the female construction workers.

## 1.5. Summary of Research Method

The study required insight on perceptions and experiences of the female construction site workers. Consequently, the most suitable research method to conduct the study was the qualitative method. The chosen method required interaction with human beings and therefore ethics clearance number: MIAEC 092/21 was obtained before conducting the research.

## 1.6. Delimitations

This research focused on gender sensitive health and safety for the female construction site workforce. Of the vast health and safety topics, the study concentrated on personal protective equipment and sanitary facilities provided at construction sites. The attention was further narrowed to only female construction site workers. This eliminated other groups within women in construction. The elimination of other groups such as female supervisors and managers, was due to relevant literature indicating that previous studies were mainly conducted with these female groups. Narrowing the gap identified by researchers, such as Chikafalimani et al., (2021), where they argued in their research that, concerns towards women's construction health and safety needs have been raised, however, these challenges have been compounded with minimal participation of women in construction research, education and practice. This is supported by the analysis of relevant literature as follows: Wagner, (2014) interviewed tradeswomen advocacies and training organizations, operating as non-profit organizations that were designed to specifically recruit and advocate for women. Lazar, (2014) interviewed women working as coolies or helpers in private construction sites. Wright, (2016) included representatives of employers of different sizes; and project stakeholders (including the project steering group and project managers) as part of respondents for their study. Gomes et al., (2016) focused their semi-structured interviews, on professionals. They indicated that, it is very difficult to gain the trust of a worker in the lower level of the hierarchy. There is a recurrent fear that if they express criticisms, it could be used against them. Wong et al., (2020), conveniently sampled and interviewed, construction workers who worked in the construction sites during their visit. These studies highlight the minimal participation of women in construction research, education and practice.

## 1.7. Assumptions

Females and males have appreciable differences in their anatomy, which demand consideration when providing apparels and facilities to them, more especially when it is critical facilities and apparels for their health and safety requirements. Hsiao et al., (2016) Conducted a study on whether female construction workers still have difficulty getting PPE that fits them correctly and, observed that several participants pointed out that size is not the sole factor determining fit, since men and women are proportioned differently. Cannon and Shah, (2019); Milligan,

(2019), noted in their studies that men typically have a larger bone structure than women as well as wider hands, feet and facial features. Recent studies have also recognized that the health burden associated with absent or poor sanitation facilities falls disproportionately on women due to their unique differences to men (Winter and Barchi, 2016). Participants in the study of Hsiao et al., (2016), indicated that an item of PPE that manages to fit the waist, may not fit the hips, as the PPE was not designed for women. Hsiao et al., (2016); Milligan, (2019); Oo and Lim, (2020) state that, if the anatomy differences are not considered, it could lead to serious injuries or death, and productivity losses at the workplace. If gloves are too large, an individual's dexterity is reduced and the worker cannot properly grasp objects. Long, baggy vests are more likely to catch or snag on handrails, doors and equipment (Milligan, 2019).

## 1.8. Summary of Chapters

1.8.1. This chapter introduced the study by providing the background of health and safety for women in construction from a global to the national level. Highlighting the components of health and safety that the study would be focusing on. The chapter further justified the significance of conducting the study and identified objectives to be accomplished.

1.8.2. The following chapter unpacked the main, secondary and primary bodies of knowledge that formed the theoretical framework of this study. The chapter further reviewed literature relevant to this study, highlighting findings and gaps for further exploration.

1.8.3. Chapter three covered the method selected to conduct this research after the analysis of the objectives. Looking at what methods previous researcher in this area deemed appropriate, considering validity, reliability and ethics.

1.8.4. The forth chapter presented and analysed results from the selected methodology in chapter three, to collect data. Data collection was aligned to the objectives and therefore, results were presented in the same manner. The analysis was done using Computer Assisted Qualitative Data Analysis Software (CAQDAS).

1.8.5. Chapter five discussed the findings and analysis of the results. Delving into the meanings of the findings to answer the research question and comparing those findings to findings from literature to measure whether literature is still relevant.

1.8.6. Chapter six provided conclusions for the study by making recommendations based on the implications of key findings.

# 2. Literature Review

## 2.1. Introduction

Relevant literature of this study was sourced from research articles and papers covering: Construction science and technology, Occupational health and safety, Women in construction, Personal protective equipment & Sanitary facilities. Journals and conference papers only, were considered as they are more reliable sources of literature review and provide detailed information compared to other sources (Mariam et al., 2021). The age range of the literature is mainly between 2018 and 2021, with a few 2017 and older. The significant themes identified using the theoretical framework of the study are: General health and safety issues in the construction industry, Health and safety problems for women in construction, Personal protective equipment for women in construction and sanitary facilities for women in construction.

## 2.2. Theoretical Framework

Based on several theoretical bodies of knowledge highlighted through key literature relevant to this study such as, Helgeson, (2015); Barnes, (2020); Fajarwati et al., (2020); Occupational Health and Safety Act, (1993); Hooda and Mehta, (2020); Delgado et al., (2018); Shaohui Dang et al., (2019); Chikafalimani et al., (2021). Figure 1 demonstrates the theoretical framework of this study.

The **main bodies** of knowledge are, gender; construction science and technology; health and safety. From these main bodies of knowledge, three **secondary bodies** of knowledge are derived as shown in figure 1. They are as follows; 1: Women in construction - derived from, gender and construction science and technology. 2: Health and safety in construction - derived from, construction science and technology and health and safety. 3: Gender sensitive health and safety - derived from gender and health and safety.

The above-mentioned secondary bodies of knowledge, form the **primary body** of knowledge which is: gender sensitive health and safety in construction. There is lack of suitable provisions to the peculiarity of women to work productively in the construction industry (Curtis et al., 2018). Poor and unhygienic living conditions affect the health and safety of the female workers on sites (Sinha et al., 2017). The focus of this study on the unsuitable and poor provisions for the women in construction is specifically on the provision of personal protective equipment and sanitary facilities to female construction workers on sites.

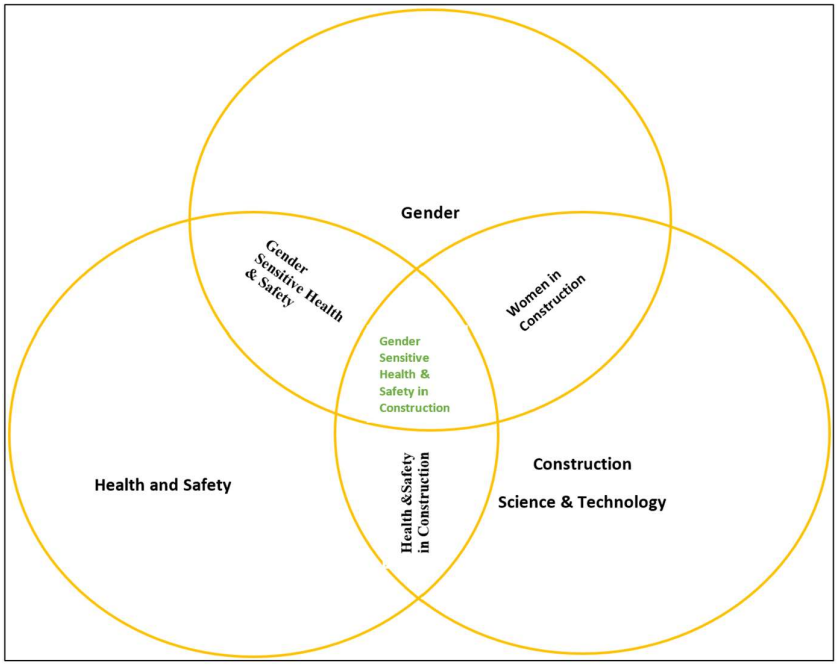


*Figure 1: Theoretical Framework*
*Source: Researcher's Own*

The key theories from existing literature on gender sensitive health and safety in construction indicate that part of the problem of the gender sensitive health and safety, is poor provision of personal protective equipment, resulting in ill-fitting personal protective equipment for women on sites (Hsiao et al., 2016; Milligan, 2019). Women have inhibited access to sanitary facilities at construction sites (Ojo et al., 2019). The gap identifies is, there is not enough research on gender sensitive health and safety in construction, especially from the local context of South Africa. Furthermore, there is not enough research, highlighting the problem from an end-user perspective. Based on the gap, there is need to collect more data from the field, directly from the workers, in order to further explore this area. Therefore, there is need to develop a perspective of the study. In order to explore a component of gender sensitive health and safety in construction, this study is focused on determining whether the female construction site workers' health and safety provisions of personal protective equipment and sanitary facilities are gender sensitive.

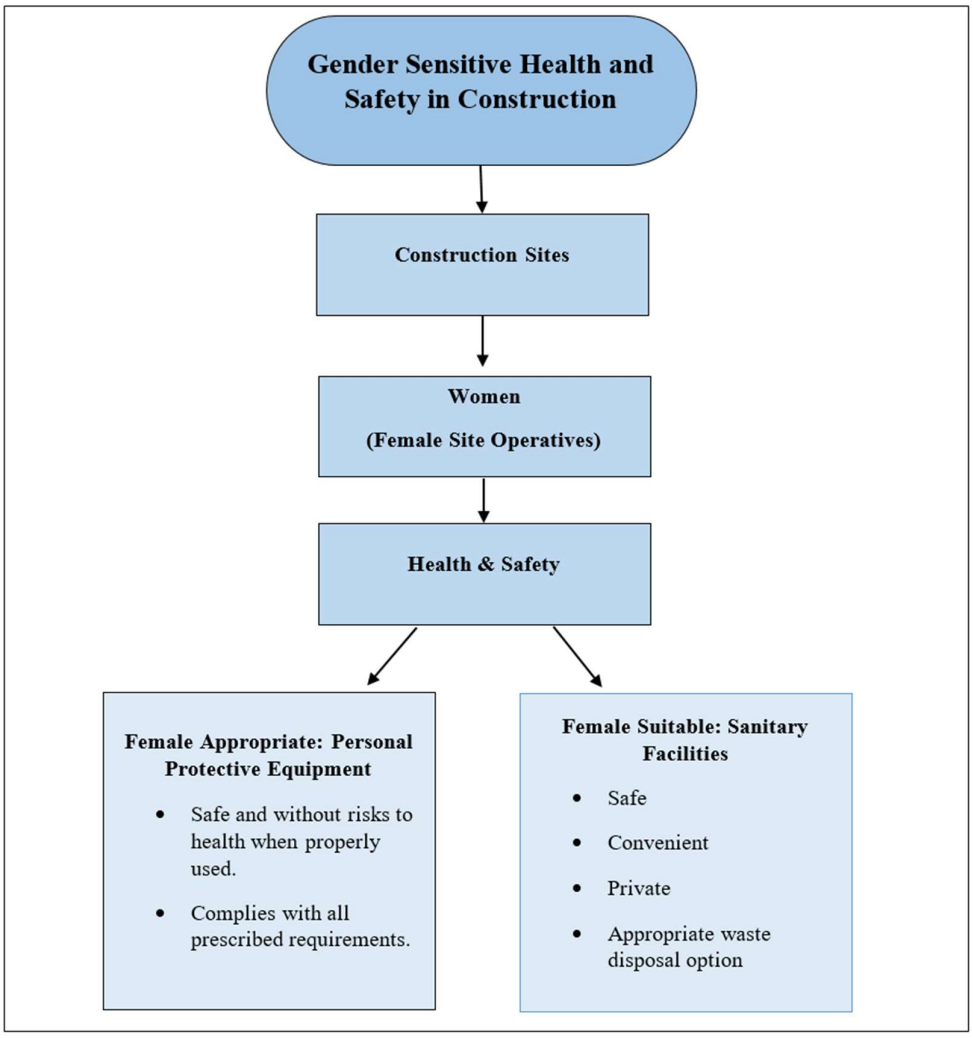


*Figure 2: Research Standpoint*
*Source: Researcher's Own*

## 2.3. Review of Relevant Literature

### 2.3.1. Health and Safety Issues in the Construction Industry

Section 8. (1) Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees. (2) Without derogating from the generality of an employer's duties under subsection 1, the matters to which those duties refer include in particular; (b) taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment; (e) providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his employees; enforcing such measures as may be necessary in the interest of health and safety (Occupational Health and Safety Act, 1993). Occupational health is defined by the International Labour Office (ILO) and the World Health Organization (WHO), as the promotion and maintenance of the highest degree

of physical, mental and social well-being of workers in all occupations (Hooda and Mehta, 2020). Mroszczyk, (2015) emphasised the importance of following rules, regardless of the construction site size. Given its temporary, dynamic, and decentralized nature, the high number of fatal and nonfatal occupational injuries and work-at-heights, outdoor operations and complicated on-site plants, construction is one of the most hazardous and accident-prone activities (Ness, 2012; Thenguzhali and Veerachamy, 2015; Wong et al., 2020). At a worldwide level, the probability of a fatality and that of an injury in the construction industry are three times and two times more likely than the average in all other industrial sectors, respectively (Wong et al., 2020). The possibility of a fatality is five times more likely than in a manufacturing industry, whereas the risk of a major injury is two and a half times higher (Hooda and Mehta, 2020). These statistics are worrying as, number of fatalities in the industry is disproportionate when compared to the size of the workforce and to other industries (Mroszczyk, 2015). Based on annual global statistic, there had been an estimated two million people worldwide that had been deemed disabled due to work related injuries where 25% or more would be caused onto the head, eyes, hands and feet (Mohd Amir Shazwan and Ee, 2018). Construction incidents are multi-causal in nature, involving an interaction between hazards, management, equipment, workplace, workers and factors unique to the industry (Mroszczyk, 2015). Falls account for the highest percentage of construction fatalities, the top three fall hazards are ladders, roof edge and scaffolds. Transportation, contact with objects and harmful substances/environments account for other fatalities (Mroszczyk, 2015; Wong et al., 2020). Artisanal trades contribute more to the percentage of fatalities. This group includes plumbing, heating, air conditioning, painting and paper hanging, electrical, masonry, carpentry, concrete work, structural steel work and excavation work (Mroszczyk, 2015).

### 2.3.2. Health and safety problems for Women in Construction

In addition to encountering general problems of health and safety in the construction sector even more severely than their male counterparts, women also face health and safety issues unique to them. Studies suggest that female workers face more risks relating to organizational processes and a culture that can be discriminatory and openly hostile (Curtis et al., 2018). At construction sites, Women are primarily tasked with unskilled labour work, generally as load carriers. They may have to carry loads of up to 51 kg at a time, which is far more than the weight limit recommended by occupation health and safety standards for women. Poor and unhygienic working conditions also affect the health of the female workers (Sinha et al., 2017). Construction's male-dominated culture can threaten tradeswomen's physical safety and mental health (Curtis et al., 2018). Globally, 17% of all work-related fatalities are in the construction sector. So far as women construction workers are concerned their conditions are even worse (Thenguzhali and Veerachamy, 2015). Construction is and will continue to be a people driven sector. The industry requires a greater workforce, and women must feel safe and welcome on jobsites if we want them to fill the workforce gap in construction (Cannon and Shah, 2019).

### 2.3.3. Personal Protective Equipment for Women in Construction

Section 10(1) of the of the Occupational Health and Safety Act reads, "Any person who designs, manufactures, imports, sells or supplies any article for use at work shall ensure, as far as is reasonably practicable, that the article is safe and without risks to health

when properly used and that it complies with all prescribed requirements." (Occupational Health and Safety Act, 1993, page 8). Personal protective equipment/clothing is designed to protect the body and is worn by tradesmen and tradeswomen for protection against health and safety hazards within their work environment (Wagner et al., 2013). The safety-oriented design and production of PPE are critically important for the protection of all workers regardless of their gender (Oo and Lim, 2020). In the table below, Wong (2020) lists categories and functions of PPE/C commonly used in the construction industry:

*Table 1: PPE/C commonly used in the Construction Industry*
*Source: Wong (2020)*

| PPE/C | Function |
|---|---|
| **Safety helmet** | Avoidance of head injury. |
| **Eye protectors** | Eye protection from dust, particles, flying chips, smoke and chemical splattering. |
| **Ear protectors** | Ear protection from high levels of noise. |
| **Mask and respirator** | Protection from inadequate oxygen supply, presence of toxic gases, harmful particles and virus in the air. |
| **Protective gloves** | Avoidance of hand injury. |
| **Safety belts** | Fall protection for working at heights |
| **Safety footwear** | Avoidance of foot injury and slipping on wet floors |
| **Protective clothing** | Physical protection and increase of comfort levels |

Everyone, from managers to frontline workers must use personal protective equipment (PPE) when they walk onto a construction work site (Hsiao et al., 2016). PPE needs to be individually adapted, and that it must meet the specific needs and characteristics of each end-user including man, woman, young worker as well as people with disabilities (Oo and Lim, 2020). Improperly fitting PPE could lead to serious injuries or death, and productivity losses at the workplace. As it would allow hazardous material to come in contact with the user of the personal protective equipment. The workers would have to constantly evaluate themselves regarding the fitting of the personal protective equipment (PPE) to ensure that the workers have lesser probability of exposing themselves to hazardous materials at construction sites (Mohd Amir Shazwan and Ee, 2018; Oo and Lim, 2020).

Many tradeswomen note a lack of available personal protective equipment designed for women's bodies (Curtis et al., 2018; Behm, 2019). Previous studies on PPE and female construction workers have consistently reported that PPE commonly made available to female construction workers was not designed for women. Most of the anthropometric data used for PPE templates are derived from studies on military personnel or the general employed population from the 1950-70s, when women were poorly represented (Kaur and Mittar, 2015; Hsiao et al., 2016; Milligan, 2019). Anthropometry, the science that defines a person's size, form and functional capacities, is critical to preventing occupational injuries and designing effective PPE (Milligan, 2019). Authors claim that women's anthropometric data is not readily available to manufacturers (Oo and Lim, 2020). Fall protection harnesses are often too large and require adjustments to fit women. PPE is not a one-size-fits-all (Cannon and Shah, 2019). Trades Union Congress encourages female employees to report issues on PPE to their supervisors and to the unions, and they should not just accept it when their employers say there is no suitable

PPE available for them (Oo and Lim, 2020). Milligan, (2019) emphasised the mindfulness that should be borne in mind of the specific PPE that is designed and sized precisely for a workforce that is increasingly made up of women (Milligan, 2019). It is also important to educate workforces on the importance of using PPE that fits properly, and to provide training on how to determine the proper and correct fit (Oo and Lim, 2020).

### 2.3.4. Sanitary Facilities for Women in Construction

2.3 billion people worldwide do not have basic sanitation and 1 billion still practice open defecation. The lack of access to adequate sanitation has been a particularly persistent problem that is associated with negative health consequences (Winter and Barchi, 2016; Kayser et al., 2019). One of the most pervasive yet common forms of gender discrimination experienced daily by women around the world is their inadequate access to a private, comfortable, and convenient toilet (Schmitt et al., 2018). Recent studies have also recognized that the health burden associated with absent or poor sanitation facilities falls disproportionately on women (Winter and Barchi, 2016). Ness (2012); Thenguzhali and Veerachamy (2015) and Wong et al., (2020) argue that, many of the problems that female construction workers face, are made more severe than other industries by the construction industry's lack of adequate sanitary facilities. Most of the time, the construction companies do not provide any, or even proper sanitation on sites (Thenguzhali and Veerachamy, 2015). Kaur and Mittar, (2015) and Ojo et al., (2019) identify inhibited access to basic facilities, as barriers that threaten the representation, health and safety of women in construction. The findings by Occupational Safety and Health Administration established that, temporary sanitary facilities are usually unisex without privacy and not well maintained resulted to unclean facilities which can invariably threaten the health and safety of women (Ojo et al., 2019). Schmitt et al., (2018); Jones and Slater, (2020), describe an adequate toilet for women as: a safe and conveniently located toilet, separated by gender, which provides privacy, a culturally appropriate waste disposal option, water and soap available for washing one's hands, suitable drainage and a 'safe space' away from men both during the day and night. In addition, actual consultation with girls and women regarding their sanitation needs is relatively rare (Schmitt et al., 2018).

## 2.4. The South African Perspective

### 2.4.1. Health and Safety Issues in the Construction Industry in South Africa

When the South African construction industry is scrutinised, it is found that, since 2008, the industry contributed approximately 9% of the GDP (Ofori, 2015; Mojekwu et al., 2016; Krugell Chris et al., 2017). South Africa is no exception to the poor health and safety record, that the global construction industry has (Legodi and Chelule, 2016). The South African construction industry is the third most hazardous, only exceeded by the agricultural and manufacturing sectors. Although there were interventions by various stakeholders to deal with this problem, the results remain unacceptable as accidents continue to persist in the construction industry. (Krugell Chris et al., 2017; Khoza and Haupt, 2021). Most fatalities reported in the South African construction sector are a result of falling from heights, slipping, moving machinery and vehicles (Legodi and Chelule, 2016). Findings from a survey carried out in Cape Town, South Africa reveals

that back pain among workers in construction companies occurred at a rate 25% more than in the developed countries which leads to absenteeism and low productivity (Nghitanwa and Zungu, 2017). In South Africa, a clear obligation to all parties is imposed by the Construction Regulation 2014 on construction projects and owners of assets, clients, their agent, the designers, the principal contractors, contractors, and owners of the structure (Khoza and Haupt, 2021). The private sector, government and unions have shown their commitment in addressing the matter, through the Construction Health and Safety Accord signed in August 2012 that aims to improve the status of health and safety in the construction industry (Krugell Chris et al., 2017).

### 2.4.2. Health and safety problems for Women in Construction in South Africa

Gender as an individual factor is one of the several factors that have been identified as contributors to occupational injuries and accidents (Legodi and Chelule, 2016). Construction Industry Development Board (CIDB) (2020) report on the status of the South African construction industry, states that women's contribution to the construction work force has been about 13% over the past 10 years. This undesirable gender employment inequality has economically worsened women's construction health and safety (Chikafalimani et al., 2021). Women have unique health and safety needs as construction work exposes them to high risks of injuries and fatalities (Mariam et al., 2021). Women are more than capable than men of finding appropriate solutions to meet their own construction health and safety challenges. However, these challenges have been compounded with minimal participation of women in construction (Chikafalimani et al., 2021).

### 2.4.3. Personal Protective Equipment for Women in Construction in South Africa

Provision of Personal Protective Equipment is important in ensuring OHS at workplaces, especially, when properly selected and used by workers, as they provide protection against risks (Nghitanwa and Zungu, 2017). Equipment, tools and personal protective equipment for work is designed only to fit the male body leaving women with the dilemma of finding comfortable PPE with the right fit. Uncomfortable work tools expose women to unsafe ergonomic conditions (Mariam et al., 2021).

### 2.4.4. Sanitary Facilities for Women in Construction in South Africa

Although poor working conditions could expose both men and women to health hazards, women are more likely to experience additional stressors specific to their gender or them just being women (Mariam et al., 2021). According to the Regulations relating to the health and safety of employees at work, the employer is required to provide adequate toilet and washing facilities (Nghitanwa and Zungu, 2017). Employers do not seem be complying with the health regulations, as even at a critical time, Amoah and Simpeh, (2021) noted in their study that one of the main problems, was the supply of poor health equipment by contractors, with regard to the implementation challenges of COVID-19 safety measures on project sites.

## 2.5. Summary of Findings

Women are poorly represented in construction, as the industry is male dominated (Vijayaragunathan and Rasanthi, 2019). There are traditional assumptions of women not being physically strong to take up the task (Anuar, 2017; Ojo et al., 2019; Wagner, 2014). Health and safety in construction has improved, however the construction industry remains as one of the most hazardous and accident-prone activities (Ness, 2012; Thenguzhali and Veerachamy, 2015; Wong et al., 2020). Females and males have appreciable differences in their anatomy, which demand consideration when providing apparels and equipment for their health and safety requirements. Hsiao et al., (2016) observed that several participants pointed out that size is not the sole factor determining fit, since men and women are proportioned differently. Cannon and Shah, (2019); Milligan, (2019), noted in their studies that men typically have a larger bone structure than women as well as wider hands, feet and facial features. Winter and Barchi, (2016) in their study, found that the health burden associated with absent or poor sanitation facilities fell disproportionately on women due to their unique differences to men. Hsiao et al., (2016); Milligan, (2019); Oo and Lim, (2020) state that, if the anatomy differences are not considered, it could lead to serious injuries or death, and productivity losses at the workplace.

The female construction site workers are not provided with adequate equipment and facilities in order to cater particularly for their protection and sanitation needs. The female construction site workers' health and safety needs, must be attended to, to promote gender sensitivity and equality at construction sites. With South Africa only having four publications, it was still ranked among the top three countries that had conducted more research on women's health and safety in construction, from a study conducted by Mariam et al., (2021), through analysis of publications from the Scopus database on health and safety for women in construction with no year limit. The publication dates ranged from 1984 to 2019. This demonstrates there is not enough research on gender sensitive health and safety, especially from the local context of South Africa. Furthermore, there is not enough research, highlighting the problem from an end-user perspective. There is therefore, need for more empirical studies.

# 3. Research Method

## 3.1. Research Design

Literature demonstrated that methodologies used by researchers in this area were either from a positivist or interpretivist perspective. Those papers that used the positivist perspective mainly focused on obtaining quantitative data regarding the number of women in construction that were dissatisfied with the fit of the common types of PPE/C used at construction sites. Some of the researchers, such as Afolabi et al., (2019) and Arcand, (2016) who took the positivist approach realised that once the quantitative data revealed the dissatisfaction, there was still a need to determine how the women in construction feel about the status quo. Researchers (Gomes et al., 2016; Hsiao et al., 2016; Ness, 2012; Wagner, 2014; Wong et al., 2020; Wright, 2016) that took an interpretivist's perspective were able to gain in-depth knowledge. Saunders et al., (2015): Denzin and Lincoln, (2017) explain that qualitative research is often associated with an interpretive philosophy because researchers need to make sense of the subjective and socially constructed meanings expressed about the phenomenon being studied.

The procedure followed (as per figure 3) in analysing objectives of this study to determine the most suitable methodology was; the outlining of the information required, together with the source of the information and where the information would be located. Once the information required had been outlined, the nature of the information was determined, thereafter suitable methods were defined. The analysis revealed that all objectives required a similar methodology that would enable, the collection of textual primary data, solicited directly from the female construction workers by a passive observer. The observer would then be required to determine themes and patterns, and to report findings.

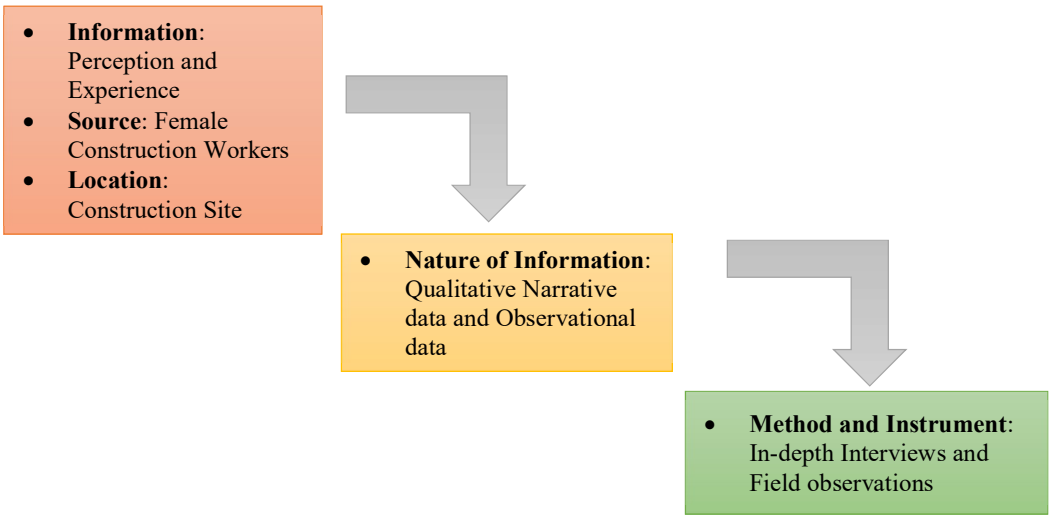


*Figure 3: Analysis of Research Objectives*
*Source: Researcher's Own*

The qualitative methodological choice assisted to adequately address the research objectives by gathering high-quality data from a limited number of people. The methodological choice enabled the researcher to study the female construction site workers' meanings and relationships between those meanings.

## 3.2. Research Instruments

The instruments are discussed below:

### 3.2.1. Semi-structured Interviews

The study aimed to explore views and insights of individuals. It therefore required interviews to be able to infer underlying relationships between variables (Saunders et al., 2015). This was important since it fit the aim of this study. Therefore, semi-structured interviews were deemed appropriate to be the main source of data. Semi-structured interviews enabled the researcher to gather respondent perspectives through pre-prepared key questions around the objectives of this study (Creswell and Creswell, 2017).

### 3.2.2. Direct Observation

Creswell and Creswell, (2017) and Yin, (2017) describe qualitative observation as a suitable instrument for when a researcher required to gain knowledge on the behavior and activities of individuals at the research site. This description was fitting to the study and therefore non-participatory participant observations were deemed appropriate to be used as an additional source of data and method of collection to triangulate interviews undertaken.

## 3.3. Sampling

Prior to the process of sampling respondents and sites for conducting interviews and observations respectively. The researcher needed to determine the process to sample relevant construction companies to contact for the search. A list of top 30, skills development levy (SDL) paying companies was obtained from SAWIC and PDP. High levy paying represents a higher number of employees and a greater possibility of female site workers' existence. The researcher used a systematic sampling technique to sample from the list of companies and every fifth company on the list was sampled to obtain the six companies needed for the sample number as per construction site approach on point 3.3.2 below. Of the six sampled companies, all were willing to participate, however not all had female construction site workers. The females working on site for these companies were quantity surveyors, site security and site cleaners. Only two companies were relevant for the research. Sampling continued as follows:

### 3.3.1. Respondents

For appropriate sampling purposes, Saunders et al., (2015), advise that for a general study, you should expect to undertake between 5 and 30 interviews, Creswell and Creswell, (2017) deem 5–25 semi-structured/In-depth interviews as adequate. Previous researchers (Gomes et al., 2016; Wong et al., 2020) who used qualitative techniques, sampled 31 respondents. Due to the small number of women in construction, a

purposive sampling technique was used, as the researcher needed to exercise judgement in selecting cases that best enabled the researcher to answer the research question and to meet the objectives of this study. The targeted sample size was 15 respondents who represented female construction workers, with resent experience in actively working at construction sites as bricklayers, carpenters, plumbers, electricians etc. Saunders et al., (2015) caution that, for most academic studies involving individuals, response rates of approximately 50 per cent are reasonable and up to 90 per cent for face-to-face interviews. From the anticipated 15 respondents, 11 female workers agreed to participate. The participants represented three trades namely, electrical, bricklaying and plumbing. The number could have increased to 13, however there was a communication barrier between two of the respondents and the researcher. The two respondents were determined to participate. However, the participants could not speak English nor any of the other languages understood by the researcher.

### 3.3.2. Construction Sites

Observations acted as a tool to triangulate interview responses. The targeted sample size for direct observations was three construction sites. However, Saunders et al., (2015) caution that, for most academic studies involving organizations' representatives, response rates of approximately 35 to 40 per cent are reasonable. This therefore implied that the sample size for the project required to be doubled to 6. The researcher was fortunate to secure 3 sites, even though one of the sites due to security protocol, permitted only interviews.

## 3.4. Data Collection

Figure 4 below illustrates the data collection flow of the study. Firstly, the study required access to the construction sites and to participants. Secondly, appropriate research instruments were determined for data collection. Thirdly, a clear procedure for collecting data was laid out. Lastly, the efficiency of the data collection was measured and found to be efficient as broader understanding was obtained.

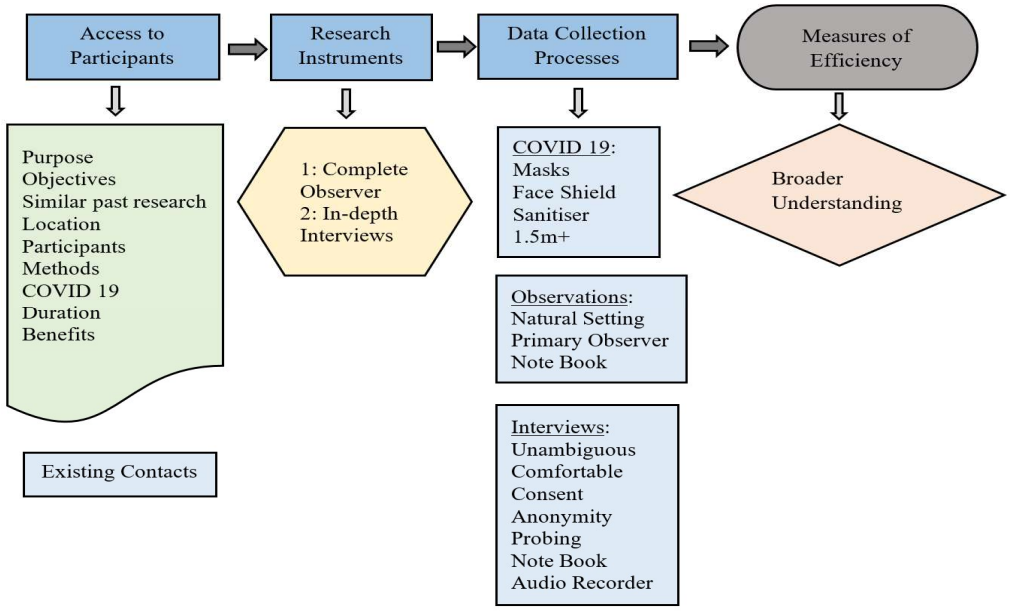

*Figure 4: Data Collection Flowchart*
*Source: Researcher's Own*

### 3.4.1. Semi-structured interviews

Semi-structured interviews, was the main data collection tool used. Semi-structured interviews allowed the researcher to prepare some key questions to be covered during the interviews. Additional probing questions were required to explore the responses from the prepared questions (Saunders et al., 2015; Creswell and Creswell, 2017). The problem-solving questions and themes of this study regarding the provisions of PPE and sanitary equipment, emanated from the analysis of the research objectives. The first objective of the study, related to establishing the perceptions of the female workers and, questions one and two were posed to address this objective. The second objective related to investigating experiences of the female workers and questions three and four were posed to address this objective. The third objective was to propose possible solutions for female workers' dissatisfaction. All questions can be viewed in Appendix A. The adopted structure in appendix A was from the method proposed by Berkeley et al., (2012). It covered all ethical issues, statistical information and deep focused questions to address the objectives of the study. Appendix A was submitted as part of ethics clearance and clearance number: MIAEC 092/21 was granted considering the appendix.

Respondents were organized by site managers and project managers of construction companies. Interviews with respondents lasted between 12 to 20 minutes. Gomes et al., (2016) indicated that, workers in the lower level of the hierarchy, have recurrent fear that if they express criticisms it could be used against them. The respondents were eager and willing to assist, however were not comfortable with recordings and consenting in writing. The researcher pre-empted the issue of written consent and highlighted at ethics application that written consent would only be from construction companies and verbal consent will be from the site workers. Therefore, the researcher reassured participants that they would remain anonymous. The one barrier experienced by the researcher was being compelled to decline two participants due to language barrier.

### 3.4.2. Observations

Complete participant observation was the second data collection tool used as a way to support results of the interview process and to reduce the risk of systematic biases, raised by Flick, (2017). The researcher did not take part in the activities at the sites, observations by the researcher were done in an unobtrusive way (Saunders et al., 2015; Creswell and Creswell, 2017). The adopted structure in appendix B was from the components of the AEIOU framework proposed by Berkeley et al., (2012), which best suited the objectives of the research. The framework helpfully arranged the observation process mnemonically. This assisted to cover the, activity, environment, interactions, objects and users (AEIOU) at the three sites visited. The **provisions** of personal protective equipment and sanitary facilities were covered under activity. The **use** of personal protective equipment and existence of sanitary facilities were covered under environment, objects and users. Observing interactions would not have assisted with the objectives of the research and therefore interactions were not considered.

During data collection, all health and safety protocols were observed (this includes protocols relating to COVID 19). Safety boots, reflector jacket, hardhat and N95 mask were worn at all times. The researcher did not need to provide masks nor hand sanitisers to participants, the construction companies provided for their employees. The researcher visited three sites, one in Bryntirion (Pretoria), one in Selby (Johannesburg) and another in Waterfall (Midrand). No health and safety cases were reported at the sites, before and after data collection.

## 3.5. Data Analysis

The purpose of interpretivist research is to create new, richer understanding and interpretations of social worlds and contexts (Saunders et al., 2015: Creswell and Creswell, 2017). The research was interested in different opinions and narratives that could help to address the objectives of this study. After the rich information was obtained in the interviews, it then followed the stage of interpretation. The below analysis focused on understanding the thoughts and stories of the female construction site works.

Analysis of data was continuous in this study. The collected data was analysed as it was being collected and further analysis was done after all data was collected. This assisted with field-work and the cycle of back and forth between thinking about collected data and generating strategies for collecting new data (Miles et al., 2013).

The study was centred around, the perceptions, experiences and possible suggestions for improvements to the provided equipment and facilities to women at construction sites. Therefore, during field interviews and observations, data was categorised into the three groups (perceptions, experiences and suggestions). Data was then analysed for themes arising from the interviews and observations, identified and grouped together.

Saunders et al., (2015); Creswell and Creswell, (2017); Yin, (2017) and Flick, (2013), discuss the overview of the data analysis process as; first organizing and preparing the data for analysis, reading or looking at all the data, starting to code all of the data, generating a description and themes and lastly, representing the description and themes. After collecting data for both interviews and observations through printouts of approved templates (refer to appendix A and appendix B), field notes were typed on Microsoft Word for grammar and spelling. The Microsoft Word documents were then consolidated on Microsoft Excel, then categorised to research objectives and analysed for codes and themes, appendix D demonstrates the coding and interpretation. The codes and themes were updated and changed as analysis progressed. Codes are labels that assigned symbolic meaning to the descriptive or inferential information obtained during data collection relating to; perceptions, experiences and suggestions by the female workers. These codes were used to retrieve and categorize similar data chunks so the researcher could find, pull out, and cluster segments relating to a particular research objective (Miles et al., 2013; Saunders et al., 2015). Coding was focused on supporting the achievement of the study's aim.

The researcher executed four stages of coding (appendix F), the first two stages of coding were done per site, where coding was done during and after each data collection and then performed again at the end of all data collection of the site. Once this was done for all sites, the next two stages of coding started, where the combined data was coded and verified once more in preparation for identification of themes. The research used Nowell et al., (2017) guide on thematic analysis. The researcher first read the data to understand and be familiar with the content, the data was then coded to focus on specific characteristics, the codes were grouped

into themes to recognise relationships of recurrent codes. The themes were refined to identify coherent patterns.

Given the central role of coding in most programs, analytic approaches using this, including, thematic analyse, are served best by a software (Flick, 2013). The use of a software aided continuity and increased both transparency and methodological rigour (Saunders et al., 2015; Creswell and Creswell, 2017; Yin, 2017; Zamawe, 2015; Belotto, 2018). Further structuring was done on Qualtrics XM and report exported to Atlas.ti 22 for rigorous analysis. Because the study is highly qualitative in nature, it therefore needed a tool that would assist with analysing rich data while allowing customization to optimally interrogate the data. The researcher evaluated the applicability of Qualtrics XM and Atlas.ti 22 to the research and deemed the programmes appropriate for the analysis planned to be undertaken (Saunders et al., 2015).

## 3.6. Validity

Validity refers to the appropriateness of the measures used, accuracy of the analysis of the results and generalisability of the findings (Saunders et al., 2015). Qualitative validity required the researcher to check for the accuracy of the findings by employing procedures such as using more than one data collection source and in doing so, ensuring triangulation (Creswell and Creswell, 2017: Yin, 2017). Data triangulation involves using more than one source of data and method of collection to confirm the validity/credibility/authenticity of research data, analysis and interpretation. The researcher chose this approach since qualitative research has elements of subjectivity and this process mitigated risks involved. The study used both interviews and observations to collect data, and this increased validity of findings. Themes were established based on converging several perspectives from participants. The converging process can be claimed as adding to the validity of the study (Creswell and Creswell, 2017: Yin, 2017). Conducting interviews was valid for the type of research envisaged as, interviews the investigator to obtain in-depth information by probing (Kumar, 2010). The researcher spent one week per project site, this granted ample time to be familiar with the environment. The more experience that a researcher has with participants in their settings, the more valid the findings are (Creswell and Creswell, 2017).

## 3.7. Reliability

Reliability refers to replication and consistency (Saunders et al., 2015). Qualitative reliability required that the researcher's approach remains consistent across different researchers and among different projects (Creswell and Creswell, 2017: Yin, 2017). Interview questions were repeated word-for-word at all sampled project sites, ensuring the reliability of data collection process, in order to use it to build a coherent justification for themes (Creswell and Creswell, 2017).

## 3.8. Ethics

The university of Witwatersrand has ethics clearance requirements, that were compulsory for the researcher to fulfil before conducting the research. The researcher was mandated to apply for the clearance certificate (clearance number: MIAEC 092/21) as shown on appendix C. The application process included taking an ethics test that required a 100% pass. The researcher further attended and successfully completed a training course in research ethics that is valid for

three years. At the time data collection started, the researcher was knowledgeable and capable of conducting the research ethically.

Ethics refer to the standards of behaviour that guide your conduct in relation to the rights of those who become the subject of your work, or are affected by it (Saunders et al., 2015: Creswell and Creswell, 2017). The first potential risk identified related to potential Sample Bias: Sampling in Gauteng was somewhat convenient as the researcher resided in Gauteng. The researcher targeted companies that had a national foot print, in order to lower the levels of potential impact of the risk. The second potential risk identified related to Pre-Arranged Sampling Deviation & Ethical Recruiting. A low response rate could have led to interviewing whoever is available (such as female construction site professionals or cleaners), this risk was possible as the female representation in the construction industry is negligible. In order to mitigate this risk, the researcher did not deviate from the pre-arranged sampling and remained ethical in conducting the research. The third potential risk identified related to voluntary participation: Interviews could be seen as imposed to the female construction workers, given relationships that possibly existed with their employers. The researcher emphasized the seriousness of occupational hazards linked to the subject matter of PPE and sanitary facilities and also assured voluntary participation during introductions. The forth potential risk related to participant Anonymity. Where applicable, the identity of the participants needed to be protected. Permission to record interview sessions was requested and rejections respected. The fifth potential risk is the non-response bias. In order to mitigate this risk, the sample was increased in line with the non-response statistics of Saunders et al., (2015). The researcher acted ethically and conduct the research for all respondents and report ethically.

# 4. Data Analysis and Results

## 4.1. Introduction

This chapter presents results from the analysis of the interviews and observations.

The demographic information of the female construction site workers forms part of the introduction as it provides insight on the relevance of the participants. The information is presented in the table below.

*Table 2: Demographic information*
*Source: Researcher's own*

| Respondents | Age | Province | Education | Experience | Occupation | Duties |
|---|---|---|---|---|---|---|
| **1** | 31 | Limpopo | Diploma in Electrical Engineering | 6 years | Electrical engineer | Service transformers and generators. electrical maintenance |
| **2** | 27 | Mpumalanga | Electrical Engineering N6 | 1 year | Electrical engineer | Electrical Maintenance (substations) |
| **3** | 28 | Limpopo | Matric, N2 Bricklaying, N6 Electrical | 3 years | Bricklayer | Mixing Mortar, Bricklaying |
| **4** | 28 | Venda | Matric | 3 years | Bricklayer | Building structures |
| **5** | 31 | Limpopo | N2 Electrical Engineering | 3 years | Bricklayer | Mixing of mortar |
| **6** | 31 | Limpopo | N4 Electrical Engineering | 3 years | Bricklayer | Building structures |
| **7** | 32 | Limpopo | Grade 11 | 3 years | Electrician | Wiring installation |
| **8** | 26 | Limpopo | Matric, Firefighting Certificate | 1 year | Electrician | Wiring installation |
| **9** | 32 | Limpopo | Matric, Traffic Policing | 3 years | Electrician | Installation of DB and maintenance |
| **10** | 32 | Eastern Cape | Grade 11 | 3 years | Plumber | Sinks and baths installation |
| **11** | 27 | Eastern Cape | Matric, Artisan | 5 years | Plumber | Installation of pipes, drainages, sinks, geysers, baths |

The respondents represented female construction workers, who had resent experience in actively working at construction sites. The recent experience assured the researcher that participants would be able to share current data that was not influenced by past/old experiences when contributing to the research. The breakdown of the demographics demonstrated work experience to be between three and six years. This gave assurance that information shared was likely to be experiences not older that three years on average. The breakdown also demonstrated that respondents were not originally born in Gauteng, therefore representing other provinces. The respondents were reasonably literate, experienced and mentally matured. 73% of the respondents had post school qualifications and the 27% were pursuing post school studies.

The researcher also conducted field observation to triangulate findings from interviews. All observations for this study were done in Gauteng. Observation only relating to PPE was done at site 1 in Pretoria Central and observation of sanitary facilities was done at site 2 in Selby South. The researcher was able to conduct observation of both PPE and sanitary facilities at site 3 in Midrand, however, sanitary facilities could only be observed from a distance. Site 1 was a high security area and therefore access was limited for site observation, however the interviews were permitted.

## 4.2. CAQDAS (Computer Assisted Qualitative Data Analysis Software – Atlas.ti) Analysis

Atlas.ti was used to identify possible key concepts and suggested relationships from coding the units of data.

Based on the analysis of the respondent transcripts through a **word cloud analysis report** from Atlas.ti (refer to appendix E for the report), fit and quality emerged as key themes for PPE. Themes linked to the appropriateness of the PPE in relation to fit were; “weight”, “size(s)”, “cut(s)”. Key themes linked to the quality based on experience of the PPE were “tears”, “sewing”, “fades”. The key theme on sanitary facilities was around the facility itself. Words such as; “present”, “provide(d)”, “days”, were themes linked to the adequacy of the sanitary facilities. Moreover, regarding experience on sanitary facilities; “bushes”, “sometimes”. Key themes from the word cloud relating to emergent possible solutions were “stretch”, “comfortable”, “materials” for PPE and words such as; “always”, “hire”, “clean”, “replace”, “dedicated”, for sanitary facilities.

The respondent transcripts were analysed on Atlas.ti’s **sentiment analysis report** (refer to appendix E for the report), to obtain the general feeling of the respondents, and to interpret and classify their emotions. The report revealed that, most of the participants responded in a neutral sensation (79%) that did not attach feelings when providing insight. The dominantly expressed sentiment was a negative one, representing 17% of participants that attached emotions in their responses. This only left 4% of participants with positive sentiments.

Further analysis of codes was done on Atlas.ti’s **code analysis report**, to identify possible emerging patterns. The report on appendix F, demonstrates the frequency of occurrence, where density is defined as the number of linkages between codes; grounded-ness is defined as the number of quotations coded. Groups were links to the objectives of the study. The report identifies properly fitting PPE, quality of the PPE and unisex toilets as the highest number of quotations coded. Bad standard and ill-fitting PPE had the highest number of linkages between codes.

A network report from Atlas.ti was used to analyse and interpret the density and grounded-ness of the themes. The **network analysis report** on appendix F provides insight to contributing factors regarding causes of the favourable and unfavourable standards of provisions of PPE and sanitary facilities. Furthermore, the causes are highlighted and resolutions proposed to remedy the roots and sequentially remedying the origin of the concerns and answering the research question

## 4.3. Results

### 4.3.1. Perception On Adequacy and Appropriateness of PPE and Sanitary Provisions

With regards to the perception participants have on the provisions of PPE, 10 of the 11 participants indicated that they received properly fitting PPE and only participant 1 indicated the provided PPE was ill-fitting. According to participant 2, the provided PPE is safe and all PPE items including gloves, fit properly; the participant had no concerns with the provision of correct sizes. Participant 10 indicated that they are requested to submit their suitable sizes before orders are placed. Participants 3,4,5,6,7,8,9 and 11 likewise confirmed that the fit is good. The researcher similarly observed that the female workers wore PPE that visibly fit, and the safety boots worn by participant one and two had a touch of pink. The one participant (respondent 1) that was dissatisfied with the fit indicated that, "you get supplied with two pairs of the same size, from the same supplier but the pairs are different".

Initially, 10 of the 11 participants indicated the provisions of sanitary facilities were of good standard. Participant 2 abstained from expressing their perception due to discomfort and limited experience. Upon further probing, the researcher noted that participant 7,8,9,10 and 11 who indicated the provisions are of good standard, were participants who solely worked at developed sites, that already had sophisticated sanitary infrastructure. Participants 1,3,4,5 and 6 had experience of working at unestablished sites (developing sites) this enabled the participants to provide insight. Participant 1 indicated that they had to use mobile toilets that were unhygienic. Participant 4 reported that no toilets were provided on site and participant 3 reported that some days, the mobile toilets will be on site, on other days, there won't be toilets available.

### 4.3.2. Experience in Utilizing PPE and Sanitary Provisions

Results regarding the utilization of PPE indicated that 8 of the 11 participants raised issues of poor quality on the PPE provided, while participant 3 and 4 opted not to comment and participant 8 reported a pleasant experience in utilising the PPE. Participant 1,2,5,6,7,10 and 11 raised issues on quality of the work suits. Quality led to the work suits; fading, easily tearing; around the wrists, between the thighs and the jackets tearing under the arms and back. Participant 1 and 11 raised issues on the design of the PPE. The pants did not use stretch material. The participants further elaborated that, the non-elasticity could be an issue should the participants need to climb a ladder, gain weight or fall pregnant.

In relation to results on the utilization of sanitary facilities, 6 of the 11 participants reported a pleasant experience on the utilisation of sanitary facilities and upon further probing, the participants disclaimed that their experiences were simply based on established construction sites with sophisticated infrastructure. Four participants who had worked at developing sites, reported an unpleasant experience. Only one participant opted not to comment. Participants 1,7,8,9,10 and 11 reported that although they are provided with appropriate toilets, the participants still needed to share them with their male counter parts. Participant 3,4,5 and 6 that reported an unpleasant experience, elaborated that the unestablished sites, at times, do not provide sanitary facilities. Participant 3,4 and 5 would need to walk to a nearby mall to relieve themselves and if there is no mall nearby, they would need to knock at neighbouring houses or relieve themselves in the bushes. Participant 4 indicated that there was one site that was secluded and there were no near bushes and had to go to distant bushes to relieve herself. On days that the unestablished sites provide mobile toilets, the toilets are in a bad state. Therefore, participants still preferred to use bushes and to rather throw used sanitary towels on the ground rather than use the mobile toilets at the site.

### 4.3.3. Possible Improvements to PPE and Sanitary Provisions

Participants further proposed solutions to the concerns raised regarding the provision of PPE. Participants 1,2,5,6,7,9,10, and 11, stressed that manufacturers need to improve the quality of the work suits, making them more durable and practical for their unique needs. By providing thick socks for the safety boots, stretching and strong material for work suits to accommodate their gender needs. Participants 3 and 11, emphasised the need to improve the frequency of the distribution and replacement of the PPE.

Regarding possible improvements to sanitary facilities. Participants 1,2,6,8,9,10 and 11, suggested that companies need to take responsibility for ensuring sanitary facilities are always available at unestablished sites. The companies should provide gender separated toilets (whether mobile or immobile) with water, toilet paper and washing liquid.

# 5. Discussion

## 5.1. Introduction

This chapter discusses the fieldwork results of this qualitative study conducted through interviews and observation to answer the objective, which was to find out from female workers about their perceptions, experiences and possible improvements regarding the provision of the PPE and sanitary facilities components of health and safety at construction sites.

## 5.2. Perception On Adequacy and Appropriateness of PPE and Sanitary Provisions

In terms of fit, manufacturers have improved on accommodating female workers, in terms of appropriate PPE sizes that are easily accessible. The one participant that was not satisfied, could be a result of a muddle of male and female sizes that ended up being provided to her. According to literature on the adequacy of provisions of PPE to female construction site operatives. Behm, (2019); Cannon and Shah, (2019) and Oo and Lim, (2020) indicated in their studies that, women have a challenge with finding PPE that fit properly in most trades and construction is no exception. Similarly, local researchers such as Mariam et al., (2021) and Nghitanwa and Zungu, (2017) noted comparable findings in their study. Findings on literature regarding the adequacy of PPE provided, stipulated that female construction site workers have challenges with finding PPE that adequately fit. However, these finding were not supported by the findings of this study. There seems to have been a change since the literature findings. Interviewed female construction site workers stated that, they are required to submit their preferred sizes before orders are placed and the site workers confirmed that the cuts are for females, and this was triangulated by the researcher through observations.

In relation to the appropriateness of sanitary facilities, the results indicate that sanitary facilities at developed sites are up to standard. However, sanitation at developing construction sites, are inappropriate. Literature on the appropriateness of sanitary facilities, Ness (2012); Thenguzhali and Veerachamy (2015) and Wong et al., (2020) argue that one of the challenges for women workers is the dearth of adequate sanitary facilities at most worksites (bathrooms that are not clean, available, accessible, and private). Local literature from Nghitanwa and Zungu, (2017); Mariam et al., (2021), corroborates with the position raised by international researchers. Literature findings on appropriateness of sanitary facilities provided, indicated that female workers have challenges with finding adequate sanitary facilities at most worksites. These findings were partially supported by the findings of this study. The literature does not elaborate on established and unestablished sites. This study confirmed with the female workers' sanitary provisions are appropriate at developed sites and are still inappropriate at developing sites.

## 5.3. Experience in Utilizing PPE and Sanitary Provisions

Now that the female workers are generally provided with fitting PPE. The female workers were now able to test the PPE and have reported the quality and design of the PPE to be below acceptable standard. Literature review on the utilization of PPE by female construction site workers, according to Curtis et al., (2018); Milligan, (2019) and Oo and Lim, (2020), tradeswomen lack PPE designed for their bodies, this includes construction. Locally, finding by Nghitanwa and Zungu, (2017); Mariam et al., (2021), corroborate that PPE anthropometry used, was based on male physique. Findings from literature regarding the utilization of PPE provided, stipulated that female construction site workers lack gender sensitive PPE. These findings from literature are supported by findings of this study. As concerns raised by participants regarding PPE provided were in relation to the design and quality of the PPE.

Construction sites that have sophisticated sanitary infrastructure, are the established sites. Sanitary facilities at unestablished construction sites are usually temporary, unreliable and not up to standard. According to literature on the utilization of sanitary facilities, Thenguzhali and Veerachamy, (2015), Kaur and Mittar, (2015) and Ojo et al., (2019), noted that most of the time, construction companies do not provide proper sanitation on sites. The researchers further found that, temporary sanitary facilities are usually unisex without privacy and not well maintained. Literature findings on the utilization of sanitary facilities provided, indicate that sanitary facilities are not provided at times, mobile toilets are not well maintained, and clean toilets are usually unisex. Although findings from literature did not distinguish between established and unestablished sites, the findings are consistent with this study, this study was further able to delve more and found that established sites are still unisex. With regards to unestablished sites, the results found in this study, corroborates with literature that the workers' experience is at unestablished sites is unpleasant.

## 5.4. Possible Improvements to PPE and Sanitary Provisions

The issue of accessibility to properly fitting PPE for women, has reduced. Employers still need to address the frequency of replacing PPE. Improvement on quality of the PPE provided, is of greater concern. Wagner et al., (2013) concluded that, from the design side, there is still significant room for improvement in creation and distribution of PPE for women. Findings on literature regarding possible improvements to PPE provided, was the emphasis of room for improvement to the design of PPE. This conclusion is supported by the findings of this study, the female construction site workers stressed the need to improve the design and quality.

According to Jones and Slater, (2020), An adequate toilet for women is: a safe and conveniently located toilet, separated by gender (if communal or public), which provides privacy (doors, locks), a culturally appropriate waste disposal option (trash bins, chutes, pits), water and soap is available for washing one's hands (water tap or bucket), suitable drainage and a 'safe space' away from men both during the day and night (safety). Literature findings on possible improvements to sanitary facilities provided, specified what an adequate toilet for women was. This description of an adequate sanitary facility corroborates with the suggested improvements proposed by the female workers in this study.

## 5.5. Achievement of objectives

### 5.5.1. Objective One

The study was able to obtain the workers' perception on PPE and concluded, the perception has slightly changed when compared to related literature. The provision of properly fitting equipment has improved. The research was further able to obtain the perception of the workers on provision of sanitary facilities, and confirmed the perception has not changed from findings of relevant literature when it comes to undeveloped construction sites. The results of this study articulated the appropriateness of facilities at developed sites alongside inappropriateness of facilities at undeveloped sites. This, therefore, addressed the first objective of this study which was, to establish perceptions on adequacy and appropriateness of PPE and sanitary provisions to female construction site workers.

### 5.5.2. Objective Two

The research was similarly able to obtain the workers' experience on PPE provisions. In the study workers, expressed the need for improvement on the design and quality of the PPE. The research further obtained the workers' experience on the provision of sanitary facilities. The study was able to obtain more insight on the dissatisfaction of sanitary facilities, the workers indicated their concerns on both established and unestablished construction sites. Thus, addressing the second objective of the study which was, to investigate experiences of the female construction site workers in utilizing PPE and sanitary provisions.

### 5.5.3. Objective Three

Finally, the research was able to propose possible solutions that manufacturers and employers need to accommodate change in the construction workforce by bearing in mind, gender sensitivity and quality on PPE. The research obtained possible solutions that employers need to take accountability for the health of their workers by providing facilities that are always up to standard. Thus, addressing the third objective of the study, which was to, propose suggestions for possible improvements to the PPE and sanitary provisions.

## 5.6. Addressing the Research Question

The primary research question sought to find out, experiences and perceptions of female construction site workers regarding the provisions of personal protective equipment and sanitary facilities on sites. The results indicated that the perception is moving towards the right direction in relation to fit of PPE and condition of sanitary facilities at developed sites. However, the experience indicates that more work still needs to done with regard to the quality and design of PPE; and sanitary facility conditions at undeveloped sites.

## 5.7. Validity and Reliability

This study opted to use interviews as the main source of data collection for obtaining reliable results. Due to the subjective nature of interviews, the responses needed to be validated, to be deemed reliable. The researcher therefore triangulated the interviews with observations. Triangulation assisted to test the concluding statement of participant one, that PPE is still inappropriateness. On the day of the interviews, the researcher observed that participant one's PPE looked appropriate as far as fit is concerned. This then assisted the research to reasonably conclude that the participant could have been mistakenly provided with a male size PPE during distribution.

# 6. Conclusion

## 6.1. Introduction

The objective of this study was to explore health and safety needs for the South African women in construction. The focus was on the provision of PPE and sanitary facilities. The study was most relevant since it sought to obtain information from the foot soldiers themselves who are the female construction site workers, which was the justification of the study. The issue of health and safety for women in construction is one that is closely monitored by researchers, this need is due to the gradual rise of participation by females in the construction space. Findings of this study intended to update the state of health and safety for South African women in construction.

## 6.2. General Overview

The findings of this study pointed out the progression made on improving the state of health and safety for the South African women in construction and furthermore, pointing out the gaps that remain. The study offered a different perspective from previous studies, as the information on progressions gained and remaining gaps were obtained directly from the women in construction. Highlighting contentment and concerns raised by the women in construction, based on perceptions and utilization of PPE and sanitary facilities at construction sites.

## 6.3. Overarching Results

Results suggest the need to address the quality of the PPE, mainly referring to materials used. Materials that should accommodate the gender sensitivity needs of the women in construction. Gender sensitivity mentions the design improvements to accommodate rapid weight gain, weight loss and other practicalities that would allow workers to move around comfortably while safely executing their duties. The results further suggest the workers are satisfied concerning the fit of their PPE, mentioning the cuts are now gender specific. Results on sanitary facilities at undeveloped construction sites, however, suggest that health for the women in construction continues to be compromised. The provision of toilets at developing sites remains poor. The tendency is that developed construction sites that require extensions/renovations had toilets that were largely satisfactory to the workers although there were concerns on privacy. This was most concerning to the researcher as the fear was, construction companies could use established sites as reasons to seclude women in construction from unestablished sites and only place the women in construction at established sites.

## 6.4. Key findings

After assessing emerging themes from the collected data, patterns were identified which led to findings and those findings were grouped into the key findings per objective below:

6.4.1. The availability of PPE for females in the construction industry has improved. The workers are now able to receive female sizes on their PPE. However, quality and advanced gender sensitive PPE in the construction industry still needs

attention. The workers raised concerns that the PPE tear easily and also does not accommodate for weight gain.

6.4.2. Sanitary facilities at established sites are generally up to standard. This is not the construction companies' achievement, but rather where the sites are situated. Even so, the female workers still experience difficulty. The workers reported that, they still share these facilities with their male counter parts. Sanitary facilities at unestablished sites still need attention. The workers reported that at some sites, there are no sanitary facilities at all, the workers are left to make their own plan.

6.4.3. The female construction site workers have cost effective suggestion for improving the provisions of PPE and sanitary facilities. These suggestions cover quality, design of PPE and standard of acceptable sanitary facilities.

The above key finding bare implications that needed to be addressed per objective in order to demonstrate the impact of the findings.

## 6.5. Implications

Overall implications are, women in construction will struggle to increase and researchers will not be able to obtain different results, if the status quo remains unchanged or changes gradually. Below are implications per key finding on 6.4 above.

6.5.1. Because the availability of the female PPE has improved, this implies that manufacturers are in the better position to improve on quality, focusing on gender sensitivity. However, if the quality and gender sensitiveness is not attended to, the PPE will continue to tear and restrict the workers' movement. The female site workers will not be adequately protected and may be exposed to danger.

6.5.2. Not attending to the sanitary concerns at established sites, implies that the female site workers will continue to be unsafe by sharing facilities with males. Similarly, neglecting unestablished sites, implies that the female site workers will continue to be vulnerable regarding health and safety.

6.5.3. The implications of not considering suggestions from the ground workers will increase the possibility of dissatisfaction with the provisions and reduce female participation in the construction industry even further.

The implications expressed above needed to be packaged in a manner that would assist in a form of recommendations, on a way forward.

## 6.6. Recommendations

The findings imply that since manufacturers and construction companies have taken the step to address the fit issue of the PPE, they can start focusing on improving the durability and gender sensitiveness of their PPE. Researchers would need to find out what work has been done regarding the quality and gender sensitiveness of PPE, by manufacturers and construction companies and how effective the changes are. Construction companies would need to take accountability by ensuring the suitable provision of sanitary facilities at all construction sites for their workforce. Researchers would need to follow up if the experiences have changed/improved.

## 6.7. Concluding Statement

Construction sites are mainly a ground up development. Indeed, part of construction are some renovations and additions to existing structures. However, ground up developments are where most or even all of the trades are utmost operational. This is where health and safety is paramount. Consequently, even though the female construction sites workers are satisfied with the sizes of PPE, there are still quality and gender sensitivity issues as far as safety is concerned and sanitary facilities remain a significant issue at unestablished construction sites which threatens their health.

The conclusion is similar to that of Cannon and Shah, (2019), the construction industry needs a bigger workforce to work more efficiently and effectively, women in construction is a resource that can assist to achieve this milestone. The women must feel safe and welcome at construction sites, if we want them to choose careers in construction. Ultimately, when the safety of women is addressed, the safety of everyone is also improved. Addressing the issues of quality on the PPE will also benefit the male construction site workers.

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# Appendices

## Appendix A: Interview Instrument

### Interview Instrument

The research will use the structure proposed by Berkeley et al., (2012).

Before the interviews can commence, all ethical issues will be addressed during introduction and the objectives of the study stated. Statistical information will be gathered (in a form of demographics information) that will be useful for further analysis of findings and to guide discussions. During deep focus, the objectives of the study will be addressed and questions posed will be aligned to the objectives of the study. After addressing the objectives, confirmation of responses received will be done and recommendations will be obtained directly from the workers in order to utilise the recommendations at the discussion stage of the report. To conclude, a platform will be opened for any other challenges that could be reported and proposed for further research.

---

**Site Name: ……...**

**Interview Date: ……...**

**Interview Time: …….**

**Interview Participant No: …….**

### Introduction:

| | NOTE |
|---|---|
| Introductions | |
| Purpose of interview | |
| Consent to the interview | |
| Confirmation of voluntary participation | |
| Approval for audio recording | |

### Demographic Information:

| | NOTE |
|---|---|
| Age | |
| Province of birth | |
| Education | |
| Experience | |
| Occupation | |

| | |
|---|---|
| Duties | |
| Duration of employment | |

**Main Questions:**

| | NOTE |
|---|---|
| What do you think about the personal protective equipment provided to you for safety? Is it, ok? | |
| What about the sanitary facilities provided to you for use? Are the toilets in good standard? | |
| What has been your experience when using the personal protective equipment? Anything that you are willing to share? | |
| What about using the sanitary facilities? Anything that you are comfortable to share? | |
| Raise questions based on observations, that relate to the deep focus (i.e. tell me why were you only wearing the top part of your overall?). | |

**Follow-up Questions:**

| | NOTE |
|---|---|
| From what you have raised about the personal protective equipment, what can you suggest that would correct this? | |
| And about the sanitary facilities, what can you suggest that would correct this? | |
| From what you have experienced with using personal protective equipment, what can you suggest that would correct this? | |
| And about using the sanitary facilities, what can you suggest that would correct this? | |

**Possible Future Research:**

| | NOTE |
|---|---|
| Are there any other health and safety issues that you feel need to be prioritised? | |

## Appendix B: Observation Instrument

### Observation Instrument

The research will use some of the components of the AEIOU framework proposed by Berkeley et al., (2012). The framework helpfully arranges the observation process mnemonically, which suits this study. The first task is to understand the activities at the sites. The main focus will be on the kind of construction work carried out, in order to determine the suitability of required equipment. Simultaneously, observation of the environment in which the workers work, is vital to understanding how the workers operate. The focus will be on the culture at particular sites. In assessing the activities and the environment, the research will pay attention on the objects and the users. That being, sanitary facilities and the personal protective equipment.

---

**Site Name: …….**

**Site Visit Date: …….**

**Site Visit Time: …….**

**Observation of the provision of personal protective equipment:**

| | YES/NO | NOTE |
|---|---|---|
| Are the workers given personal protective equipment? | | |

**Use of personal protective equipment:**

| | YES/NO | NOTE |
|---|---|---|
| Do the workers wear the personal protective equipment? | | |
| Does the personal protective equipment adequately protect them? (Does it fit properly?) | | |
| Does the personal protective equipment align with the trade? | | |

**Observation of the provision of sanitary facilities:**

| | YES/NO | NOTE |
|---|---|---|
| Do the workers have sanitary facilities? | | |

**Observation of sanitary facilities:**

| | YES/NO | NOTE |
|---|---|---|
| Cleanliness:<br>Does it flush?<br><br>Is the waste disposal hygienic?<br><br>Is there access to water?<br><br>Is there access to soap? | | |
| Privacy:<br>Does it have a door?<br><br>Does the door close?<br><br>Is the door facing away from people?<br><br>Is the facility separated from the male facilities? | | |
| Safety:<br>Can the door lock?<br><br>Is facility not secluded?<br><br>Is the path to the facility without obstructions? | | |

## Appendix C: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

**SCHOOL OF MECHANICAL, INDUSTRIAL AND AERONAUTIAL ENG. ETHICS COMMITTEE**
**CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)**

| | |
|---|---|
| **CLEARANCE CERTIFICATE** | **PROTOCOL NUMBER: MIAEC 092/21** |
| **PROJECT TITLE** | Provision of Personal Protective Equipment and Sanitary Facilities to Female Construction Site Operatives. |
| **INVESTIGATOR** | Mr. Simphiwe Nene |
| **SCHOOL/DEPARTMENT OF INVESTIGATOR** | Mechanical, Industrial and Aeronautical Engineering |
| **DATE CONSIDERED** | 7 October 2021 |
| **DECISION OF THE COMMITTEE** | Approved unconditionally |
| **EXPIRY DATE** | Date of submission of the project report |

**ISSUE DATE OF CERTIFICATE** 29 October 2021 **CHAIRPERSON** _____ (Dr. Emwanu)

cc: Supervisor : Prof. Obinna Ozumba

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**DECLARATION OF INVESTIGATOR**

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/~~we~~ undertake to resubmit the protocol to the Committee.

_____ **Signature** **Date** 29 / 10 / 2021

**PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES**

## Appendix D: Coding and Interpretation

| Q1 | | | | |
|---|---|---|---|---|
| **What do you think about the personal protective equipment provided to you for safety? Is it, ok?** | **Codes** | **Themes** | **Comparison** | **Interpretation** |
| No issues, received everything that fits | Fitting PPE | PPE fits Adequately | The expectation was to receive negative responses regarding the fit of the PPE. Such as, the female workers are forced to navigate through men sizes, to get the least bad fitting sizes. | The results indicate that manufacturers have improved on accommodating female workers, in terms of PPE sizes that is easily accessible. |
| Fits well | Fitting PPE | PPE fits Adequately | | |
| Yes, it is safe, it is ok. The items all fit properly. No issues with size. However, sizes are clearly men sizes. | Fitting PPE | PPE fits Adequately | | |
| They are fine | Fitting PPE | PPE fits Adequately | | |
| Fit well. Gave sizes before orders were placed. | Fitting PPE | PPE fits Adequately | | |
| No issues, fits very well. | Fitting PPE | PPE fits Adequately | | |
| Proper fit | Fitting PPE | PPE fits Adequately | | |
| Fitting is well. But it can be an issue if you gain weight i.e. pregnancy | Fitting PPE | PPE fits Adequately | | |
| Good fit | Fitting PPE | PPE fits Adequately | | |
| Proper fit | Fitting PPE | PPE fits Adequately | | |
| The PPE is not ok, the frequency of supply to replace the old PPE is not set (it takes time). One has to first complain before it is supplied. The quality is an issues. Get supplied with two pairs of the same size, from the same supplier but the pairs are different. | ill-fitting PPE | PPE fit is inadequate | | |

| Q2 | | | | |
|---|---|---|---|---|
| **What about the sanitary facilities provided to you for use? Are the toilets in good standard?** | **Codes** | **Themes** | **Comparison** | **Interpretation** |
| They are fine | Good standard | Toilets are appropriate | The expectation was for the female site workers to express concerns on sanitary facilities. | The female site workers do not think sanitary facilities at developing construction sites, are appropriate. There is no positive perception about the facilities. |
| Good condition, they are clean. | Good standard | Toilets are appropriate | | |
| They are Good | Good standard | Toilets are appropriate | | |
| No toilets were provided on site | Bad standard | Toilets are inappropriate | | |
| Has no input. She has only worked at a site that is fully established. The site had no sanitation issues. | abstain | | | |
| They are Good | Good standard | Toilets are appropriate | | |
| Not at all | Bad standard | Toilets are inappropriate | | |
| No, not at all | Bad standard | Toilets are inappropriate | | |
| Currently the work done is at existing offices, therefore there are no issues with sanitation. However, at previous unestablished sites, they use mobile toilets and the standard is bad. Not hygienic. | Bad standard | Toilets are inappropriate | | |
| At some sites, toilets are not provided at all. At other sites, one day, a toilet will be there, the next day, it won't be there. | Bad standard | Toilets are inappropriate | | |
| They are Good | Good standard | Toilets are appropriate | | |

| **Site Observation** | | | **Codes** | **Themes** | **Triangulation** |
|---|---|---|---|---|---|

**Use of personal protective equipment:**

| | YES/NO | NOTE | | | |
|---|---|---|---|---|---|
| Does the personal protective equipment adequately protect them? (Does it fit properly?) | YES | PPE observed seemed to fit well. | Fitting PPE | PPE fits Adequately | The independent observation corroborates with the responses of the female workers, regarding the fit of the PPE. |
| Does the personal protective equipment align with the trade? | YES | PPE for electrical and bricklaying were observed | Appropriate PPE | Adequate PPE | The independent observation corroborates with the responses of the female workers, regarding the relevance of the PPE. |

**Observation of the provision of sanitary facilities:**

| | YES/NO | NOTE | | | |
|---|---|---|---|---|---|
| Do the operatives have sanitary facilities? | YES | Operatives were working at an established site | Unisex | privacy | The independent observation corroborates with the responses of the female workers, regarding the provision of sanitary facilities. |

**Observation of sanitary facilities:**

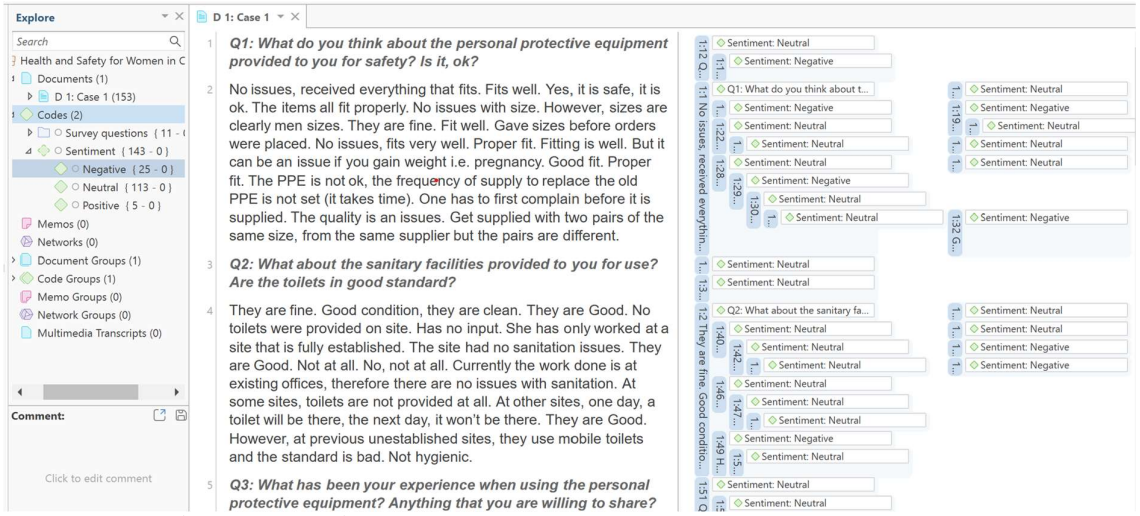
| | YES/NO | NOTE | | | |
|---|---|---|---|---|---|
| <u>Cleanliness</u>: | | | | | |
| Does it flush? | | | | | |
| Is the waste disposal hygienic? | N/A | Observation was made from a distance. | | | |
| Is there access to water? | | | | | |
| Is there access to soap? | | | N/A | N/A | N/A |
| <u>Privacy</u>: | | | | | |
| Does it have a door? | Yes | | | | The independent observation corroborates with the responses of the female workers, regarding the privacy of |
| Does the door close? | Yes | | | | |
| Is the door facing away from people? | N/A | | Unisex | privacy | |

| | | | | | |
|---|---|---|---|---|---|
| Is the facility separated from the male facilities? | No | | | | sanitary facilities. |
| Safety:<br>Can the door lock?<br>Is facility not secluded?<br>Is the path to the facility without obstructions? | Yes<br>No<br>N/A | | Good standard | Toilets are appropriate | The independent observation corroborates with the responses of the female workers, regarding the standard of toilets at developed sites. |

## Appendix E: CAQDAS – Atlas.ti Cloud and Sentiment Analysis Reports

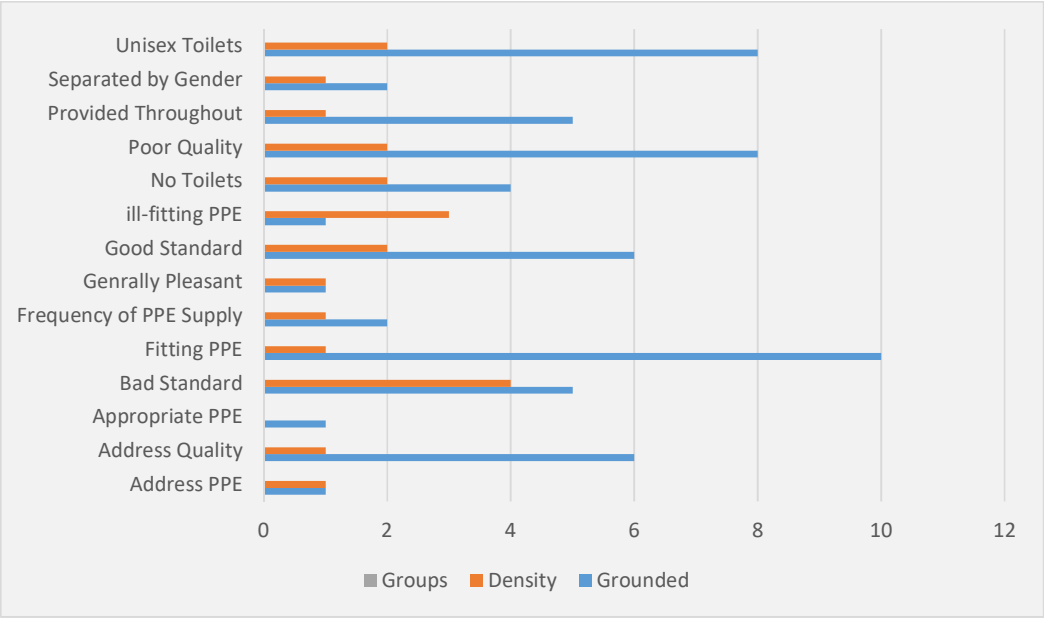



*Word cloud of raw data*
*Source: Report from Atlas.ti 22*

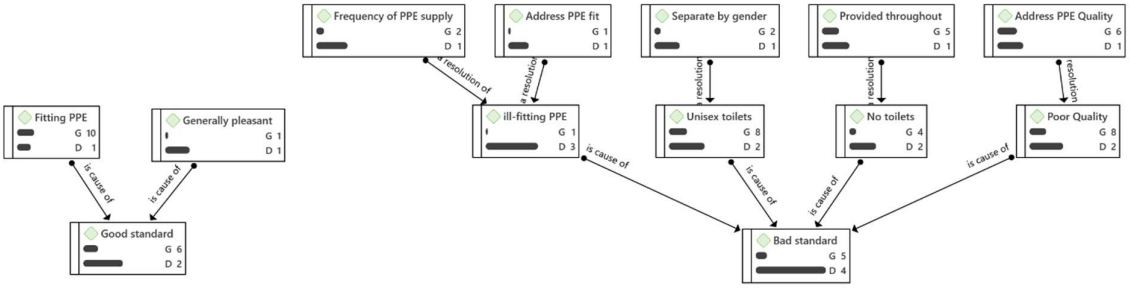



*Sentiment analysis on raw data*
*Source: Report from Atlas.ti 22*

## Appendix F: CAQDAS – Atlas.ti Codes and Network Analysis Reports




*Codes from data analysis*
*Source: Report from Atlas.ti 22*




*Network to answer Research Question*
*Source: Report from Atlas.ti 22*