



Psychological Distress Among South African Civil Engineers

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Abstract

The construction industry is notoriously associated with work-related stress and time pressures. The repercussions of stress are experienced by both employees and organisations. The focus on the mental health and overall well-being of workers has been more prevalent in the public consciousness in recent years. Research focused on psychological distress has become popular in recent studies due to its close relationship with workload issues and work-life conflict among employees.

This study investigates the determinants of psychological distress among South African civil engineers. Specifically, the occurrence of availability of resources and communication, job control, (un)balanced workload, work relationships, job security and change, and working conditions are studied to determine the association between these factors and psychological distress. The research method comprised a critical review of the existing literature on psychological distress, workplace stressors, and the distribution of an online survey questionnaire to civil engineer members of the South African Institution of Civil Engineering (SAICE).

Using the 142 survey responses, multiple regression analysis was employed to assess the relationship between availability of resources and communication, job control, (un)balanced workload, work relationships, job security and working conditions, and psychological health. The results indicate that psychological distress is determined by all the workplace stressors, except job control.

Interventions aimed at reducing psychological distress among civil engineers in South Africa should focus on the development and promotion of mental health programmes and general support to employees by organisations.

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Glossary of Terms

ASSET	A Shortened Stress Evaluation Tool
CIOB	Chartered Institute of Building
FIW	Family Interference with Work
FWC	Family-Work Conflict
HSE	Health and Safety Executive
JDC	Job Demand-Control
JD-R	Job Demands-Resources
JDCS	Job Demand-Control-Support
SAICE	South African Institute of Civil Engineers
WFC	Work-Family Conflict
WIF	Work-Interference with Family
WLB	Work-Life Balance

Chapter 1: Background to the Study

1.1. Introduction

According to the Health and Safety Executive (HSE), stress is known as the adverse reaction people have to excessive pressure or other types of demands placed on them (HSE, 2012). Workplace stress (or job stress) refers to the negative physical and emotional strain-effect responses that are caused by job requirements that exceed a worker's capabilities, resources or needs (Bowen *et al.*, 2013). Lazarus (1990) stated that workplace stress is caused when employees suffer an imbalance between work-demands and the management thereof due to the lack of resource availability. Workplace stress is strongly associated with low productivity, high absenteeism, and poor job performance (McShane and Von Glinow, 2005).

Mental health and well-being problems are becoming more prevalent in the public consciousness (Cattell *et al.*, 2017). It was found that one in every six working-age adults suffers from depression, anxiety, or stress in any given week in England and Wales (Cattell *et al.*, 2017). Moreover, between 2010 and 2015, there were more suicides among construction employees than any other profession and the Office for National Statistics (ONS) in the UK reported that people working in the sector are 63% more likely to die by suicide than the national average (Cattell *et al.*, 2017).

Love and Edwards (2005) noted the need to develop a better understanding of the extent to which stress is experienced in the construction industry. Stress is prevalent in the construction industry due to the complexity and demands of construction projects, specifically: tight schedules, poor working and dangerous environments, complicated technical problems, and co-ordination issues. Furthermore, there is a high risk of work-related stress (Lingard and Francis, 2004; Pocock *et al.*, 2007; Love *et al.*, 2010) arising from the uncertainty and adversarial nature associated with construction projects, thus contributing to the stressful nature of the industry (Asquin *et al.*, 2010; Mohr and Wolfram, 2010). It is for these reasons, *inter alia*, that construction professionals have been found to experience excessive stress levels (Loosemore and Waters, 2004; HSE, 2007; Leung *et al.*, 2015) compared to other industries.

A survey conducted by the Chartered Institute of Building (CIOB) in 2006 in the United Kingdom (UK) found that 68% of construction professionals reported suffering from stress, anxiety, or depression as a result of working in the construction industry. It was further found that 58% of the participants felt that the industry was more stressful than it was five years prior to the survey (CIOB, 2006). Stress is thus a matter of considerable concern to the construction industry (Bowen *et al.*, 2013).

Employees who experience chronic stress typically suffer from psychological and physiological symptoms, including musculoskeletal disorders (MSDs), psychological distress such as depression, injuries, and cardiovascular disease (HSE, 2007).

According to Zucker and Landry (2007), workplace stress has been linked to excessive drinking and smoking due to psychological distress. Similarly, it has been found that work-related stress and a variety of physical and mental disorders are linked (Bowen *et al.*, 2014), reduced productivity or effectiveness at work, diminished relationship satisfaction (Schaufeli and Enzmann, 1998; Maslach *et al.*, 2001), and lower levels of job satisfaction and organisational commitment (Schaufeli and Enzmann, 1998; Maslach *et al.*, 2001).

1.2. Background to the Study

Poor physical and mental health are considered results of prolonged or excessive stress (Health and Safety Executive, 2001). Consequently, both employees and organisations experience the repercussions of stress that have been found to affect one in five employees (Johnson and Cooper, 2003). Similarly, organisations incur indirect costs as a result of stress such as low job satisfaction, erroneous decision-making, and aggression amongst staff (Johnson and Cooper, 2003).

In order to explore this problem, a one-factor model was introduced by Selye (1975), which investigated how problematic stress at work can be if it exceeds acceptable levels. Thereafter, a two-factor model relating to job control was proposed by Karasek (1979). However, a popular tool used by organisations to measure and monitor stress was formulated by Cooper *et al.* (1988), namely, the Occupational Stress Indicator (OSI). Nevertheless, it was found that the OSI's intended use was for white collar and managerial workers and was tedious to complete (Johnson and Cooper, 2003).

Hence, A Shortened Stress Evaluation Tool (ASSET) was developed to measure stress and is considered more concise and applicable to all occupations (Cartwright and Cooper, 2002). Furthermore, ASSET assesses an employee's possible stress exposure based on a variety of occupational stressors, including health care and transportation (Johnson and Cooper, 2003).

Marchand *et al.* (2005) noted that psychological distress can be viewed as an unintended consequence of social structures and constrained resources. These constraints have the potential to influence an individual's adaptability (Pearlin and Schooler, 1978; Pearlin, 1999; Thoits, 2017) which, consequently, leads to an imbalance in their physiological and mental system (D'Auria, 1997).

Inadequate information regarding an employee's work role is considered as role ambiguity (Cox *et al.*, 2000). In other words, the employee does not know how they fit into the organisation and is not sure of any rewards regardless of how well they perform (Warshaw, 1979). This sense of role ambiguity develops due to lack of clear expectations and objectives, and uncertainty about the scope and responsibilities pertaining to their job (Marchand *et al.*, 2005).

Role ambiguity negatively influences job satisfaction and professional fatigue (Chang and Hancock, 2003; Shen, 2005). Furthermore, in order to work efficiently, people require constructive feedback and effective communication (Faragher *et al.*, 2013). Receiving a lack of feedback is found to be experienced by employees and managers, but was more prominent in employees (Cattell *et al.*, 2017). Hence, feedback can be viewed as a significant moderator of stress (Bakker *et al.*, 2005).

The job demands-resources (JD-R) model noted the importance of assessing job-related demands and resources (Bakker and Demerouti, 2007). The Job Demand-Control (JDC) model (Karasek, 1979) predicts that individuals with high demands and low control experience a greater amount of stress (Franche *et al.*, 2006).

According to the strain hypothesis of the JDC model, employees who work in highly strained jobs (high demands - low control) experience low well-being (Karasek, 1979). The buffer hypothesis states a level of control allows the negative effects of high demands on well-being to be moderated (Karasek, 1979). Job Demand-Control-Support (JDCS) Model (Karasek and Theorell, 1990) hypothesises that low social

support in the workplace causes an increase in the relationship between decision latitude and psychological demands (Marchand *et al.*, 2005). A new dimension was then added and named the JDCS model (Johnson and Hall, 1988). It notes that the iso-strain hypothesis predicts the most negative outcomes among workers in an iso-strain job (high demands - low control - low social support/isolation), while the buffer hypothesis states that social support is able to moderate the negative impact of high strain on well-being (van der Doef and Maes, 1999). Campbell (2007) noted that long work hours may be described as working more than 40 hours per week, whereas very long hours constitute working 50 or more hours per week. Research conducted in the UK found that those working long hours also have a shorter sleep duration and sleep which is not restorative, impacting negatively on the quality of work and performance of the individual (Brown *et al.*, 2011).

Long working hours is common in many countries (Bannai and Tamakoshi, 2014). Moderately long working hours and their effect on health have been linked to family financial stress as breadwinners are likely to be forced to work long hours in order to increase the family income (Artazcoz *et al.*, 2007). Long work hours has been found to be linked to acute and chronic health outcomes (Caruso *et al.*, 2004).

Employees who experience an imbalance between work demands and their personal resources experience stress responses which can include physiological, emotional, and behavioural reactions. Therefore, those who are highly time-pressured at work may experience lower life satisfaction, less happiness, poorer quality relationships, low morale, and poor job performance (Roxburgh, 2002; Brown *et al.*, 2011). Family is an important resource that contributes to the way an individual may cope with work stressors, therefore supportive family relationships can possibly reduce psychological distress (Cramer, 1998).

Workers are experiencing that there are not enough hours in the day to complete their work and that they are working harder than ever before (Menzies, 2005). As a result of this, job stress has been attributed to health-related issues among workers as well as having caused organisational problems such as absenteeism, job dissatisfaction, and low productivity (Parker and DeCotiis, 1983). According to quantitative research, technological advancements, employer productivity demands, and employee job security uncertainty have resulted in professionals putting more time and effort in

their employment than ever before (Davis and Meyer, 1998; Christensen and Gomory, 2003; Schieman *et al.*, 2009; Christensen and Schneider, 2011).

Schieman and Young (2013) stated that work-related contact refers to the frequency with which workers send and receive work-related communications outside their regular working hours (Voydanoff, 2007; Schieman and Glavin, 2008). Due to the incorporation of communication technologies in the workplaces, new challenges have developed as a result of perceived permanent availability of the workers (Batt and Valcour, 2003; Chesley *et al.*, 2003). Such challenges have impacted the nature and character of work, effectively altering when, where, and how people work (Boswell and Olson-Buchanan, 2007).

The increase in the use of computers in the workplace and the ability to easily connect with others has caused more workers to experience pressure as a result of technology (Harris *et al.*, 2011). Technology-related pressure was previously known as techno-invasion and is defined as “the imposition of work-based technologies into an employee’s personal life” (Tu *et al.*, 2005: 78). Tu *et al.* (2005) conducted a survey in China which revealed that the majority of employees felt overwhelmed in their personal lives and experienced anxiety and eventual unproductivity due to an increase in workload from new technology.

Work-family blurring may be described as a subjective and cognitive phenomenon involving the perceived integration of work life and home life that is situated in a highly interdependent work-family context (Desrochers *et al.*, 2005). Consequently, when pressures from work life are incompatible with, and undermine the quality of family life i.e., when the boundaries separating these two domains are crossed (known as boundary permeability), work-to-family conflict can occur (Greenhaus and Beutell, 1985).

Greenhaus and Beutell (1985: 77) explain work-to-family conflict (WFC) as a “form of conflict in which role pressures from work and family domains are mutually incompatible in some respect”. WFC is seen as bi-directional; work interfering with family life and family life interfering with work life (Mesmer-Magnus and Viswesvaran, 2005). However, Frone (2003) argues that work interference with family life (WIF) is considered to have a greater negative impact on home life than family interference has on work activities. Research has shown that individuals who

experience high levels of WIF tend to reduce social interaction with their families (Ilies *et al.*, 2007). Notwithstanding the existence of these two domains, due to the evidence presented by Frone (2003), the focus of this study centres on WIF.

WIF caused by long working hours has been associated with job dissatisfaction, life dissatisfaction, turnover intention, diminished general well-being, psychological strain, psychiatric disorders, and substance abuse (Lingard and Francis, 2006). It has been reported that WIF has significant consequences for the individual's health and well-being (Hughes and Parkes, 2007). Lower levels of job and home satisfaction, as well as higher levels of psychological distress, have been associated with the presence of work-to-family interference (Hughes and Parkes, 2007). However, providing a work environment that is supportive of a worker's family role could alleviate the effects of stressors that lead to psychological distress (Lingard and Francis, 2002).

According to Schieman and Young (2010), allowing schedule control as an incentive to balance work-family life could possibly lead to work-family role blurring. Schedule control is the degree to which workers have control over the start and end-times of work (Golden, 2008). As a result, individuals who work at home experience high integration and boundary permeability thus allowing them to easily switch between their work and family roles as needed (Desrochers *et al.*, 2005).

The degree to which integration can take place is influenced by flexibility and boundary permeability (Schieman and Young, 2010). High permeability is considered to be the degree to which aspects of one domain can enter another domain (Voydanoff, 2007). Integrating communication technologies into the workplace has created challenges in managing the borders that exist between work life and family life (Chesley *et al.*, 2003). The convenient access to communication devices increases flexibility and allows individuals to work from remote locations (Schieman and Young, 2010). Therefore, according to Lewis and Cooper (1999), these communication technologies create greater flexibility but higher permeability and role blurring. Frequent work-related contact caused by role-blurring processes results in the depletion of resources, thereby giving rise to work-to-family conflict and psychological distress (Schieman and Young, 2013).

Over the past few decades, working life has been influenced by organisational change, including large-scale retrenchments (Schreurs *et al.*, 2010). Consequently,

employees who question the long-term viability of their career will seek new work opportunities (Wittekind *et al.*, 2010). Job insecurity is defined as “the subjectively perceived likelihood of involuntary job loss” (Bartley and Ferrie, 2001; Sverke *et al.*, 2002: 243) and has significant consequences for employees and managers alike (Schreurs *et al.*, 2010). For employees, the perceived threat of becoming jobless may result in harmful effects on psychological well-being and health outcomes (Ashford *et al.*, 1989). On the other hand, managers experiencing job insecurity may cause negative job and organisational attitudes among employees, thus resulting in reduced effort, commitment, and job performance (Sverke *et al.*, 2002). However, few studies have researched the remedies of job insecurities on the health of employees (Sverke *et al.*, 2002).

Job insecurity has been acknowledged as one of the significant stressors that exist in the workplace (De Witte, 1999). The stressful nature of job insecurity can be understood in three ways: firstly, by its harmful impact caused by uncertainty which is considered as a noteworthy feature of job insecurity due to an individual’s perceived inability to accurately predict the outcomes of their decisions (Milliken, 1987).

Secondly, job insecurity can be explained by Jahoda’s (1982) latent deprivation model which explains the needs which can be resolved by employment, such as income, social contacts besides family, time management, and social development (Schreurs *et al.*, 2010). It is implied that job insecurities causes frustration in achieving these needs, and thus compromises future prospects of the individual (Schreurs *et al.*, 2010).

Lastly, psychological contract theory can be used to state the consequential effects of job insecurity as it refers to the perceived mutual responsibilities between employer and employee (Rousseau, 1995). Traditionally, the exchange of security (employer) and loyalty (employee) is crucial and thus employees perceive job insecurity as a breach in the psychological contract with their employer (De Cuyper *et al.*, 2008). Consequently, the well-being of the employee and their commitment to the organisation may be negatively impacted (Wanous *et al.*, 1992).

Moreover, studies have found job insecurity to be linked with health-related issues such as psychological distress, anxiety and depression (Roskies *et al.*, 1993).

Marchand *et al.* (2005) stated that job insecurity and fear of redundancy can lead to anxiety, especially when organisations expect commitment from their staff. Similarly, poor pay may cause health issues (Warr, 1992). In addition, it was found that the long-term effects of job insecurity include adverse physiological outcomes such as increased blood pressure and decreased body mass index (Ferrie *et al.*, 2001; Ferrie *et al.*, 2002).

Initial research pertaining to the notion that social relationships at work affects employee health has advanced (Viswesvaran *et al.*, 1999). Moreover, it has been found that positive social interactions in the workplace can positively impact an employee's immune, cardiovascular, and neuroendocrine systems (Heaphy and Dutton, 2008).

Studies have found that management behaviour and supervisory styles have a significant influence on the emotional well-being of workers (Corey and Wolf, 1992; Landy, 1992). The role of an employee in an organisation, their role overload, role insufficiency, and responsibility for other people have been identified as significant predictors of psychological health (French *et al.*, 1982).

Specifically, it has been argued that good relationships between workers and members of work groups are essential for individual and organisational health (Cooper, 1981). Previous research has found that supervisors who trust their employees and have a positive relationship with them, reward them with greater degrees of freedom i.e., impose fewer restrictions on their daily tasks (Vecchio and Gobdel, 1984). A survey in Japan found that 52% of the women participants had experienced anxiety and stress due to unsatisfactory interpersonal relationships at work (Cox *et al.*, 2000).

In addition, Jones *et al.* (1998) found that workers who reported high levels of work-related stress and stress-related illnesses were more likely to report a lack of support from supervisory colleagues compared to the general working population. The attitudes and behaviours of the immediate manager therefore have a direct impact on an employee's ability to maintain a sense of WLB (Glynn *et al.*, 2002). It has been demonstrated that supervisors influence an employee's state of WLB in addition to their work-life practices (Fiksenbaum, 2014).

Similarly, Lobban *et al.* (1998) found that the supervisory style of communication with employees is related to the stress they experience. In other words, the communication relationship between employees and their supervisors can have a significant effect on occupational stress (Cox *et al.*, 2000).

Employees who experience poor interpersonal support at work experience high anxiety, emotional exhaustion, job tension, low job satisfaction, and an increased risk of cardiovascular disease (Warr, 1992). A Swedish study found that support from supervisors and co-workers reduced the effects of job demands on depression and job satisfaction (Karasek *et al.*, 1982).

It has been found that work can threaten the mental health of employees through exposure to unsatisfactory working conditions (Wieclaw *et al.*, 2008; Nieuwenhuijsen *et al.*, 2010; Lahelma *et al.*, 2012). Thus, stress endured from unfavourable working conditions may lead to mental disorders (Lunau *et al.*, 2013; Szeto and Dobson, 2013). Theoretical viewpoints such as the Job-Demand Control model (Karasek, 1979) and the effort-reward imbalance model (Siegrist and Pieter, 1996) have linked the exposure to unfavourable working conditions to stress (Nieuwenhuijsen *et al.*, 2015).

However, the reactions to stress on workers depends on objective working conditions in addition to how an individual employee appraises the situation (Ursin and Eriksen, 2004). Work and safety regulations in the workplace play an important role in shaping job quality and promoting mental health issues across countries (Cottini and Lucifora, 2013).

Studies relating to job conditions have focused on skill utilisation, decision authority, psychological and physical demands, social support in the workplace, and gratifications from work (Marchand *et al.*, 2003). In addition, research has found a direct relationship between poor working conditions and mental distress (Cottini and Lucifora, 2013). In other words, jobs with tight working conditions with high demands, and low support and low interpersonal support, are associated with worse health conditions (Warren *et al.*, 2004; Robone *et al.*, 2011; Cottini, 2012).

Similarly, an employee's perception of their organisation's function comprises the task environment, the problem-solving environment, and a development environment

(Cox and Howarth, 1990). Evidence suggests that if employees perceive their organisation's environment poorly, they are likely to experience increased levels of stress (Cox *et al.*, 2000). However, despite the literature and studies available, there is a lack of knowledge regarding the effects of work conditions and psychological distress (Marchand *et al.*, 2005).

Psychological issues at work are reportedly increasing (Schermuly and Meyer, 2016). A study of the United States' labour force found that 9% of respondents suffer from major depression (Doshi *et al.*, 2008). Psychological health issues at work can cause early retirement (Doshi *et al.*, 2008) and an increase in suicide (Hawton *et al.*, 2013). Therefore, issues surrounding mental health contribute significantly towards personal and financial burdens for employees, organisations, and societies (Schermuly and Meyer, 2016).

Mental health is often linked to psychological distress relating to psycho-physiological and behavioural symptoms such as anxiety, depression, irritability, tiredness, and work absenteeism (Dohrenwend *et al.*, 1980; Ross *et al.*, 1990). Marchand *et al.* (2005) state that psychological distress that remains untreated may lead to psychosomatic diseases, high blood pressure, acute depression, and suicide. In other words, experiencing psychological distress means that there is something wrong with an individual's psyche (Marchand *et al.*, 2005).

Facey *et al.* (2015: 995) note that psychological distress is "an umbrella term that encompasses stress, burnout, depression, anxiety and other related mental health problems". It has been assumed that psychological distress is linked to employee absenteeism (Hardy *et al.*, 2003) and that it is also characterised by feelings of unhappiness (Watson *et al.*, 1988; Warr, 1990). Facey *et al.* (2015) note that there are reasons that suggest psychological distress influences absence more than job satisfaction: firstly, psychological distress is an affective state and, secondly, it is linked to health issues which warrants taking time off work.

It is noted that depression in the workplace is becoming a focus in the occupational health field as a main cause of disability (Franché *et al.*, 2006). Studies have stated that human resources personnel are now more attentive in addressing workplace risk factors for depression (Baba *et al.*, 1998). Radloff (1977) reported that work-to-family and family-to-work conflict are significantly linked with symptoms of depression.

Studies have found that many chronic stressors and resources resulting from the workplace and family have been considered as determinants of workers' mental health and possible catalysts of the psychological distress inequality between women and men (Beauregard *et al.*, 2011; Lodge and Umberson, 2014; Harvey *et al.*, 2017).

Work-related contact refers to the frequency that workers send and receive work-related communications outside of regular work hours (Schieman and Glavin, 2008). According to Schieman and Young (2013), work-related contact is positively linked to work-to-family conflict, psychological distress and sleep problems. In South Africa, job pressures and after-hours work-related contact were found to directly influence work-to-family conflict, thus causing psychological distress and sleep problems (Bowen *et al.*, 2018).

1.3. Problem Statement

From the above literature review in the background to this study, it is clear that workplace stress is a widespread problem. In particular, workplace stress in construction professionals is a specific area of interest in this study as it has been found that construction industry professionals incur high levels of workplace stress due to the nature of their work and the industry as a whole. Civil engineers are a subset of the construction industry professionals' group who, arguably, experience more, or a different type of workplace stress as opposed to the other professionals in the sector because they are liable for structural design and the consequences of design failure such as possible deaths and high professional indemnity insurance.

To date, there are various studies about the workplace stress of construction professionals in general, including civil engineers, in other countries. However, there are no studies available that are specific to South African civil engineers using a psychometrically validated scale such as ASSET.

Thus, the problem to be examined in this study is that little is known of the nature and extent of workplace stress experienced by South African civil engineers, and the impact these workplace stressors have on the psychological health of civil engineers. This study aims to address this shortcoming.

1.4. Research Question

The following research question to be addressed may be stated as follows:

What is the nature of the relationship between workplace stressors and the psychological health of South African civil engineers?

1.5. Research Aim

The aim of this research study is to:

Determine the nature of the relationship between workplace stressors and the psychological health of South African civil engineers.

1.6. Research Hypotheses

The research tested the following hypotheses:

H₁: Poor job resources and communication is positively associated with strain on the psychological health of South African civil engineers.

H₂: Low job control is positively associated with strain on the psychological health of South African civil engineers.

H₃: Unbalanced workload is positively associated with strain on the psychological health of South African civil engineers

H₄: Job insecurity and change is positively associated with strain on the psychological health of South African civil engineers.

H₅: Poor work relationships is positively associated with strain on the psychological health of South African civil engineers.

H₆: Poor job conditions is positively associated with strain on the psychological health of South African civil engineers.

1.7. Research Objectives

The research objectives to be achieved are to:

- a) Determine if poor communication and lack of organisational resources results in psychological distress.
- b) Investigate how job control reduces psychological distress.
- c) Examine the way that an unmanageable workload causes psychological distress.
- d) Analyse how job security reduces psychological distress.
- e) Assess how positive work relationships decrease psychological distress.

- f) Examine the way in which poor job conditions result in psychological ill-health.

1.8. Research Methodology

The above objectives will be achieved by adopting the following research methodology:

- a) Conduct a critical review of the relevant English literature.
- b) Conduct a stress audit among South African civil engineers using selected scales from the “A Shortened Stress Evaluation Tool” (ASSET) model.
- c) Examine the dataset for abnormalities and missing values.
- d) Apply multiple regression analysis to test the postulated hypotheses.
- e) Discuss the findings in the context of the extant literature, and
- f) Draw conclusions and make recommendations.

1.9. Limitations

The study is subject to the following limitations:

- a) The cross-sectional nature of the survey, and
- b) The self-selecting nature of the responses.

1.10. Structure of Research

The research report will be structured as five chapters:

Chapter 1 provides an overview of the research topic, followed by the problem statement, research question, and the research hypotheses. The aim and objectives of the research are defined and are followed by a brief description of the research methodology and limitations.

Chapter 2 provides a review of the extant literature relating to the 6 essentials and psychological distress with particular focus on civil engineering professionals.

Chapter 3 describes the research methodology used in order to address the research question:

What is the nature of the relationship between workplace stressors and the psychological health of South African civil engineers?

Chapter 4 develops the multiple regression model and analysis and interprets the quantitative data collected from the questionnaire survey, followed by a discussion of the findings in the context of the extant literature.

Chapter 5 concludes and makes recommendations for addressing the effects of the 6 essentials and psychological distress experienced by civil engineering professionals.

Chapter 2: Literature Review

2.1. Introduction

This literature review critically examines the extant literature with the regards to the nature of the relationship between workplace stressors and the psychological health of civil engineers registered with SAICE. This chapter discusses workplace stress in general, followed by a discussion of workplace stress in the construction industry, and in South Africa. This is followed by a review of theoretical models of stress and factors specific to the ASSET model i.e., social support, workload and time pressures, work-life balance, job insecurity, workplace relationships, working conditions, and psychological distress. Finally, the chapter is summarised.

2.2. Models of Workplace Stress

Situations in the work environment that an employee finds threatening result in workplace stress (Antonovsky, 1979; Kyriacou, 1989). It is estimated that stress can affect one in five employees in the UK which results in 6.5 million sick days being taken each year (Johnson and Cooper, 2003).

Moreover, it has been found that organisations can also experience additional indirect costs as a result of stress, such as low morale, job dissatisfaction, human error, and workplace hostility among colleagues (Johnson and Cooper, 2003). The effect of stress at work was initially proposed as a one-factor model by Selye (1975) and followed up by more analytical models by Karasek (1979). These models are discussed in detail later in this chapter.

Workplace stress is normal, but can have serious consequences on employee efficiency and company profit (Mauss *et al.*, 2017). The World Health Organization has considered work-related stress to be one of the most significant challenges of the twenty-first century (Houtman *et al.*, 2007). Job (or workplace) stress is considered as the negative strain-effect responses that occurs when job requirements exceed the capabilities, resources, or needs of employees (Bowen *et al.*, 2013). In addition, job stress can lead to poor health and even injury (Love *et al.*, 2010). Furthermore, job stress is predicted by poor workgroup relationships, work overload, and inter-role conflict (Leung *et al.*, 2010).

Studies have found that construction workers, especially construction-site managers, estimators, and onsite operatives, are subjected to significant work-related stress, despite empirically-based studies that have been conducted (Love *et al.*, 2010). The context of the source of this stress is construction professionals' responsibility for the efficient delivery of projects of good quality, within budgets, and within the completion dates (Lingard and Francis, 2004).

Lingard and Francis (2004) reported that the Australian construction industry is a demanding work environment and demands longer working hours compared to other industries, with construction sites typically operating six days a week, and many professionals and managers working unpaid overtime. Similarly, construction professionals in South Africa experience high levels of stress and are concerned about their own wellbeing, as well as the continued efficacy of their contributions to the industry (Bowen *et al.*, 2013). Moreover, Lingard and Francis (2004) explained that the tendering process for new projects in Australia is highly competitive, which can be challenging and stressful for employees and their long-term job security (Lingard and Francis, 2004).

Long and irregular hours are common as professionals and managers are expected to be readily available (Lingard and Francis, 2004). White and Keith (1990) noted that irregular working hours is linked to strained marriages among shift workers. Similarly, stressful work experiences are linked to marital and family dysfunction (Barling *et al.*, 1998) as well as job insecurity and high staff turnover (Larson *et al.*, 1994). Grimm-Thomas and Perry-Jenkins (1994) found that the experiences that employees experience at work can negatively affect their family life, such as their parenting and marital quality (O'Neil and Greenberger, 1994). On the other hand, Lingard and Francis (2004) stated that an employee's ability to manage work demands is greatly influenced by family functionality.

The findings of a study by Leung *et al.* (2010) found that construction workers who experience accidental injuries are mainly affected by emotional stress which can be predicted by work overload, inter-role conflict, poor physical environment, unfair reward and treatment, and inappropriate or lack of safety equipment (Leung *et al.*, 2010).

2.2.1. Job Demands-Resources Model

The JD-R model is a framework that explains how job resources and job demands could be related to personal, social and organisational outcomes (Bakker and Demerouti, 2007). This model identifies the physical, psychological and organisation elements of work that are necessary to complete work responsibilities (Bakker and Geurts, 2004). A core component of this model is the identification of the job resources assumed to undermine the negative consequences of job demands (Bakker and Demerouti, 2007). Hakanen *et al.* (2008) found that demands and resources would influence individual well-being. Bakker and Geurts (2004) noted that the JD-R model explains that job-related resources might be linked to work engagement or motivation when job demands are high.

The JD-R model suggests that the development of burnout comprises two processes: firstly, overbearing job demands leads to exhaustion, and secondly, the inability to meet job demands is caused by a lack of resources (Demerouti *et al.*, 2001). This eventually leads to further withdrawal behaviour and long-term disengagement of work (Demerouti *et al.*, 2001).

Bakker and Demerouti (2007) noted that job resources are related to the nature and rewards of the work itself. This relates to the JDC model which theorised job control as the “working individual’s potential control over his tasks and his conduct during the working day” (Karasek, 1979: 289). Tausig and Fenwick (2011) explained that job autonomy relates to the extent to which an individual decides when, where and how to complete their work, and this concept is the most significant job resource. In addition, Golden (2001) supported the notion that schedule control is a valuable resource. Collectively, job autonomy and schedule control are viewed as the biggest contributing work resource as they assist in the negation of work-life conflict and inter-role conflict (Voydanoff, 2007; Schieman and Glavin, 2008).

Bakker and Geurts (2004) stated that the manner in which resources are used helps achieve certain goals or objectives at an organisational level. Kahn and Byosiene (1992) support this by stating that these processes may help eradicate the demand associated with work-related contact and the added stress linked to

work-family interference and health-related issues. In addition, Kahn and Byosiére (1992) suggest that job resources should assist in work-related contact becoming more predictable, understandable, or controllable. It is therefore hypothesised that:

H₁: Poor job resources and communication is positively associated with strain on the psychological health of South African civil engineers.

2.2.2. Job Demand-Control Model

The JDC model (Karasek's (1979) job strain model) is noted to be one of the most influential models in research regarding the relationship between work and health (van der Doef and Maes, 1999). This model focuses on job demands and job control and identifies these as significant factors in the workplace (Karasek, 1979). In addition to this, the JDC model proposes that high demands and low job control results in stress (Karasek, 1979) and thus produces high levels of strain and health complaints (De Lange *et al.*, 2004).

Job demands are defined as the “physical, psychosocial, or organisational aspects of the job that require sustained physical and/or mental effort” and are, therefore, associated with certain physiological and/or psychological costs (Bakker and Geurts, 2004: 348). Tausig and Fenwick (2011) found that job pressure is subjective and related to workplace conditions. Workers who experience high levels of job pressure are subject to feeling overwhelmed by work and when the number of simultaneous tasks that must be completed exceeds the time allocation (Schieman and Young, 2013). Hakanen *et al.* (2008) linked these job pressures to burnout and distress, whilst Bakker and Demerouti (2007) linked them to exhaustion and sleep problems.

Work time control is defined as an individual's “autonomy regarding issues, such as starting and finishing times, breaks, days off, vacations and the number of work hours” (Geurts *et al.*, 2009: 231). Job control (a measure of decision latitude) refers to one's ability to control one's work activities (van der Doef and Maes, 1999). This includes skills discretion and decision authority which, according to the JDC model, allows workers to reduce stress and increase learning, while psychological demands increase learning in addition to increasing stress (van der Doef and Maes, 1999).

Karasek (1979) noted that the JDC model explains that work stress is mainly caused by the structural or organisational factors of the work environment, as opposed to the personal characteristics or demographics. This model explains that strain is a result from the “joint effects of the demand of the work situation (stressors) and environmental moderators of stress, particularly the range of decision-making freedom (control) available to the worker facing those demands” (Dollard, 2001: 16). Moreover, strain is a result of high job demand and low control over an employee’s work and not necessarily personal factors (Dollard, 2001). In addition to this, high demand jobs causes an increased heart rate, adrenalin and breathing in order for the body to respond to high demands (Karasek, 1979).

Moreover, unresolved strain may develop into anxiety, depression, psychosomatic complaints, and cardiovascular disease (Dollard, 2001). The JDC model explains that high strain jobs (for example, assemblers and service-based chefs and waiters) experience the highest levels of stress, whereas high status workers (for example, executives and professionals) have the resources to manage a high level of job demands (Karasek, 1979).

Dollard (2001) noted that the JDC model has substantial empirical support based on large-scale multi-occupational studies which provide support for the hypothesis that the relationship between demands and control predicts strain. Similarly, longitudinal studies of working men with over ten years of experience have presented that job strain predicts heart attacks (Dollard, 2001).

On the other hand, Moen *et al.* (2013) expressed that the *Healthy Work* publication by Karasek and Theorell (1990) undervalued the significance of job strain (high job demands and low job control) contributing as a major occupational stressor and high risk factor for cardiovascular disease and other health issues (Moen *et al.*, 2013). It is therefore hypothesised that:

H₂: Low job control is positively associated with strain on the psychological health of South African civil engineers.

2.2.3. The Job Demand-Control-Support Model

Social support is referred to as supervisory and colleague support assistance, as well as the existence of positive relationships at work (Franche *et al.*, 2006). Poor social support in the workplace is strongly linked to depression (Dormann and Zapf, 1999; Stansfeld *et al.*, 1999) and general psychological distress (Bourbonnais *et al.*, 1999). Similarly, social structures and constrained resources can lead to psychological distress (Marchand *et al.*, 2005). Therefore, constrained resources influence employee adaptability (Pearlin and Schooler, 1978) and hence, an imbalance between their physiological and mental systems (D'Auria, 1997).

According to a review of 81 studies focused on emotional support, it was found that it had beneficial effects on aspects of the cardiovascular and immune systems (Dollard, 2001). In addition to this, other health-related behaviours did not influence the associations. It was found that jobs that possess high demands, low control, and low support from supervisors or co-workers carry the highest risk for psychological or physical disorders associated with high strain-isolated jobs (Dollard, 2001).

Role ambiguity refers to the poor communication of an employee's role in the workplace (Cox *et al.*, 2000). Regardless of how well they do, this is where employees are unsure as to how they fit into the organisation and have no assurance that they will be rewarded (Warshaw, 1979). Due to a lack of clear goals and priorities, as well as confusion about the nature and responsibilities of their work, employees create a sense of position ambiguity (Marchand *et al.*, 2005). In addition, it has been found that blood pressure and higher pulse rates is linked to role ambiguity (French and Caplan, 1970), as are depression, low job motivation, and resignation intentions (Margolis *et al.*, 1974).

Internal communication is an important organisational environment (Robertson, 2004) that affects an organisation's ability to involve workers (Kress, 2005). Internal communication is the key to a company's ability to generate worker-based value (Quirke, 2017). The skills and interrelationships of an organisation's employees are assets in the information age. Organisations should therefore aid

the process of developing employee creativity and intellectual assets in order to create value (Quirke, 2017).

Successful internal communication occurs within organisations and includes informal chats, in addition to formal, managed communication (Welch and Jackson, 2007). Hence, internal communication issues are a significant source of concern for businesses as they lead to inefficiency in the workplace (Welch and Jackson, 2007).

2.2.4. Boundary Theory

It is widely recognised that employees aim for job satisfaction and good performance at work and at home, with the least amount of role conflict as possible (Clark, 2000). A sense of balance is considered essential to health, well-being and overall performance (Kreiner *et al.*, 2009). However, employees can find it difficult to fulfil both their personal and professional roles if their non-work time is consumed by work-related obligations, emotions, and low energy levels (Carlson and Frone, 2003).

Boundaries can be defined as the “physical, temporal, emotional, cognitive, and/or relational limits that define entities as separate from one another” (Ashforth *et al.*, 2000: 474). Thus, boundary theory (Nippert-Eng, 1996) is used to examine work-family interface and is considered a theory of social classification (Zerubavel, 1991; Allen *et al.*, 2014) that acknowledges how individuals develop boundaries to manage their environment (Allen *et al.*, 2014).

Hence, according to boundary theory, individuals should identify an optimal way to balance all aspects of their life to minimise internal psychological preoccupation with work issues (Nippert-Eng, 1996; Ashforth *et al.*, 2000; Carlson and Frone, 2003; Kreiner *et al.*, 2009).

Therefore, boundary theory provides insight into the ways in which individuals set boundaries between work and home (Clark, 2000). The main assumption of boundary theory is that workers strive to manage the border between work and unrelated work activities and find a suitable balance (Schieman and Young, 2013).

Work-related contact is a challenge connected to separating work from everyday life (Schieman and Glavin, 2008) which is considered as a potential stressor (Schieman and Young, 2013). Voydanoff (2007) explains that role blurring occurs when aspects of one role overlaps with roles of another. Similarly, Lewis and Cooper (1999) found that communication technologies increase the role blurring as workers are assumed to be available at any given time. As a result of this, an increase in other stressors such as work-family conflict may occur (Schieman and Glavin, 2008).

2.3. Scales that Measure Stressors

Sound psychometric analysis is required for sound scale score interpretation and application in research and workforce practice (De Ayala, 2013; Bandalos, 2018). In other words, it is considered essential that workforce studies provide empirical proof that scale scores are accurate and trustworthy reflections of the psychological characteristics they intend to measure (Tetrick, 2017). The measurement of occupational health psychology dimensions plays a critical role in enhancing our understanding of occupational health and well-being, as well as in the design, assessment, and implementation of interventions aimed at improving the well-being of individuals and organisations (Tetrick, 2017; Depaoli *et al.*, 2018). This section addresses this issue.

2.3.1. Occupational Stress Indicator

The Occupational Stress Indicator (OSI) was developed by Cooper *et al.* (1988) and is a collection of scales based on a structural model of occupational stress outlined by Robertson *et al.* (1990). It comprises seven questionnaires with 25 subscales (Lyne *et al.*, 2000). Three questionnaires assess moderating variables for type A behaviour patterns and a further three focus on mental ill-health, physical ill-health, and job satisfaction (Lyne *et al.*, 2000). The OSI is focused on a transactional model of stress and coping (Folkman and Lazarus, 1984) and its theoretical underpinnings are widely accepted (Goh *et al.*, 2010). It is used for detecting and managing occupational stress (Lyne *et al.*, 2000).

In tests on the reliability of the OSI scales, it was found that the locus-of-control scale failed to reach acceptable levels, and the type A scale was described as weak (Davis, 1996). However, the health scales pertaining to work pressure, job

satisfaction and physical health were found to be consistently reliable (Lyne *et al.*, 2000). Similarly, the measures of the effects of stress, such as job satisfaction, mental health, and physical health were found to be reliable, however, the construct validity of the locus-of-control and type A scales was uncertain (Robertson *et al.*, 1990; Cooper and Williams, 1991; Cunha *et al.*, 1992).

Stress models seek to link stress causes to outcome measurements (Lyne *et al.*, 2000). Issues surrounding OSI measures are found to be confounded due to pressure scales being the main indicator of predicting stress (Lyne *et al.*, 2000). Another problem with the OSI is its dependence on self-reporting questionnaires which may be overstated by common method variance, or shared variance with a third variable such as negative affect (Watson *et al.*, 1987). Lastly, the OSI model has been found to be problematic in predicting effective coping strategies to moderate the pressures of stress (Lyne *et al.*, 2000).

The OSI attempted to provide a complete risk assessment of stress, but it was found that the questionnaires were too long and detailed and did not cover all the stressors typically experienced in organisations (Faragher *et al.*, 2004). Because employees were required to complete a very long survey that took a lot of their time (Faragher *et al.*, 2004), response rates were often low. This raised concerns about how representative they were of the working population (Faragher *et al.*, 2004). Response rates could have been increased by allowing employees to complete the questionnaires during working hours, but the cost implications to organisations would have been unfavourable (Faragher *et al.*, 2004). It was also found that the OSI stress evaluation questionnaires were often created for white-collar professionals in the UK and US which are thus validated for only those working populations (Faragher *et al.*, 2004). Hence, using the OSI scales outside these parameters is considered problematic due to the psychometric properties associated with non-white collar populations (Faragher *et al.*, 2004).

2.3.2. A Shortened Stress Evaluation Tool (ASSET)

The problems with the OSI clearly indicated a need for a stress risk assessment tool that could be quickly and easily completed. Therefore, a shortened stress evaluation tool (ASSET) (Faragher *et al.*, 2004) was developed, based on a

previous model by Cooper and Marshall (1976). The revised approach used a two-phased method to assess risk.

Phase one of the ASSET questionnaire analyses an organisation to identify work-related stress problems (Faragher *et al.*, 2004). As ASSET questionnaires can be completed quickly and easily, organisations incur minimal costs (Faragher *et al.*, 2004). Potential causes and consequences of stress are identified with an initial estimate using average ASSET factor scores by employees in various positions in an organisation (Faragher *et al.*, 2004). ASSET factor scores accurately indicate areas that an organisation should focus on when developing stress prevention programmes (Faragher *et al.*, 2004).

Phase two is a more detailed risk assessment using the results of the ASSET scores derived in phase one (Faragher *et al.*, 2004). A more detailed questionnaire is then completed by employees who are found to be in the problematic sections of the organisation, i.e., high average ASSET factor scores. Average or low ASSET factor scores may require other sections of the organisation to undergo a more detailed evaluation at a later stage (Faragher *et al.*, 2004). Upon the completion of Phase two, recommendations are given for changes in workplace practices, organisational features required to address the specific difficulties found, and a report comprising advice and support is issued to employees who were found to experience high levels of stress (Faragher *et al.*, 2004).

The two-phased process is considered beneficial to organisations and employees alike as it is easy to administer and complete the ASSET questionnaires, thus producing a high response rate (Faragher *et al.*, 2004).

2.4. Workload and Time Pressures

Love (2006) explained that the idea behind the traditional 40-hour work week is eight hours of labour, eight hours of rest and eight hours of recreation. Roberts (2007) and La Valle *et al.* (2002) stated that opportunities for a long break (such as a weekend) have been negatively affected by work demands, longer working hours, split shifts, and casual employment. Campbell (2002) elaborated on this to say that employees who experience these situations are unable to enjoy recreational activities. Lingard and Francis (2004) noted that the construction industry typically works long hours,

but that unions had previously lobbied against this (Love, 2006). The construction industry is notorious for its six-day work weeks which has resulted in employees requiring longer recreational time to recover (Lingard and Francis, 2004). As a result of this, employees struggle to balance their work and personal life (Geurts *et al.*, 2009).

Brown *et al.* (2010) noted that there is a direct relationship between work hours and work-life balance. Work-life balance (WLB) pertains to one's ability to manage demands from the various aspects of one's life (Hill *et al.*, 2001; Marks *et al.*, 2001). Similarly, Tausig and Fenwick (2011) found that employees' work-life balance declined as their working hours per week increased. Therefore, in the Australian construction industry, where employees work more than 60 hours over a six-day work week, there is a need to improve their work-life balance by evaluating their working time commitments (Brown *et al.*, 2010).

Factors that contribute to a negative work-life balance include long and extended working hours, irregular shifts and working on the weekends (Brown *et al.*, 2010). Working on the weekends is known to have a negative effect on family time and recreational activities (Bittman, 2005). Further, Bittman (2005) found that employees who work on Sundays spend less time on their personal care (such as sleeping, bathing, and grooming), were less involved in community activities, were behind on their domestic work, and were unable to enjoy their social and recreational activities.

In Britain, a study that examined long working hours found that employees who worked long hours were likely to experience a shorter sleep duration (Chatzitheochari and Arber, 2009). Dawson *et al.* (2001) stated that sleep disruption and deprivation may have harmful effects on an employee's work performance as the sleep they do get is not restorative.

Trade unions have actively been involved in trying to reduce working hours for their members (Campbell, 2002). Specifically, the Trade Union Council in the United Kingdom has campaigned to address the high expectations of working hours (Kersley *et al.*, 2006). Similarly, trade unions in France successfully campaigned for a 35-hour work-week which led them to determining work-time controls (Alis, 2003). A cross-national study found that the roles of trade unions have an impact on the processes concerning work-life policies (Gregory and Milner, 2009). This is due to unions being

dependent on leveraging opportunities relating to legislation that pertains to working hours, social policies and organisational initiatives (Townsend *et al.*, 2011).

Lingard and Francis (2004) found that site-based employees in the construction industry work, on average, 62.5 hours per week (Lingard and Francis, 2004). Even though unions try to address issues surrounding workplace health and safety, construction industry employees still experience extended working hours which cause poor work-life balance. Despite these issues, a study by Lautsch and Scully (2007) found that employees would rather work overtime to meet their financial responsibilities than reduce their working hours (Brown *et al.*, 2010).

Research by Brown *et al.* (2010) found that the majority of employees support a compressed work week which would result in an overall improvement in work-life balance. This is complimented by an Australian study which found that compressed working hours assist in employee recovery time, an increase in satisfaction pertaining to work time arrangements, improvement in family time, and workplace safety (Townsend *et al.*, 2011).

International studies have found that an improvement in work-life balance was not necessarily caused by reducing working hours (Fagnani and Letablier, 2004; Wooden *et al.*, 2009). An absence of longer recreation time in addition to long working hours contributes to a work-life imbalance and thus a compressed working week allows individuals to enjoy their weekends and thus improve their overall work-life balance (Brown *et al.*, 2010).

Rook and Zijlstra (2006) argued that weekends are essential for employee recovery time and organisations should acknowledge this (Brown *et al.*, 2010). Brown *et al.* (2010) noted that participants who work a six-day week experience fatigue, and a lack of time for recreation and personal activities, which are important for employees. In addition to this, the study found that employees who are able to participate in outside-work activities have an improved work-life balance and overall well-being (Brown *et al.*, 2010).

Sonnentag *et al.* (2008) argued that leisure activities have a significant impact on employees' mental health and well-being. However, changes in leisure time are influenced by flexible work schedules (Perrons, 2003) and an increase in work

intensity (Green, 2006). Consequently, there is an interference between work and life which impacts work organisation (Perrons, 2003). Personal circumstances and internal organisational factors contribute to the balance of work and leisure activities (Brown *et al.*, 2011).

Time pressure refers to “*the extent to which employees feel they have insufficient time to finish their work tasks*” (Ohly and Fritz, 2010: 544). It is considered as a challenge stressor (Cavanaugh *et al.*, 2000; Crawford *et al.*, 2010) which means it has negative effects on strain variables (Crawford *et al.*, 2010; Widmer *et al.*, 2012). Studies have found that the assumption of time pressure can be both motivating and demotivating (Chong *et al.*, 2010; Schmitt *et al.*, 2015; Reis *et al.*, 2017).

Studies have found that individuals feel that there are not enough hours within the day to complete their work and that they are working harder and longer hours than before (Menzies, 2005). It is established that the stress and the feeling of being overworked that employees experience causes psychological stress (Gupta and Beehr, 1979).

Health-related and organisation problems such as employee dissatisfaction, isolation, low productivity, absenteeism and staff turnover are caused by job stress (Parker and DeCotiis, 1983). A study by Perlow (1999) found that stress was associated with the amount of time employers expect from their employees (DeVoe and Pfeffer, 2011).

It has been argued that working hours and time pressures have increased over the past few decades (Schor, 2008). On the other hand, Robinson and Godbey (1999) argued that lack of free time or an increase in time spent at work was not necessarily related to an increase in time pressures (DeVoe and Pfeffer, 2011). Nevertheless, an analysis of time diaries over the last five decades by Aguiar and Hurst (2007) found that the number of hours worked has remained fairly constant.

It is unclear if working hours have actually changed due to time pressures (DeVoe and Pfeffer, 2011). This was also found in an earlier study by Rastegary and Landy (1993) who stated that time pressure can arise from how the individual copes with various demands and expectations or how an individual responds to their situation, or that time pressure can be experienced by individuals who feel they lack a sufficient amount of time to complete their objectives (DeVoe and Pfeffer, 2011). In an earlier study by Robinson and Godbey (1999), it was stated that time pressure arise due to

high aspirations by an individual to complete their tasks in a period of time and thus time pressure is possibly perpetual.

The relationship between organisation of working time and work intensity is rarely explored (Piasna, 2018). The general approach is to assume that shorter working hours are preferable to workers while long hours are unfavourable (Piasna, 2018). This approach prevents an understanding the extent of work intensity workers experience (Askenazy, 2013).

Studies that have investigated the relationship between long working hours and health have found that working long hours is considered a health risk (Bannai and Tamakoshi, 2014; Virtanen *et al.*, 2018). Due to increasing work intensity and job demands (Lohmann-Haislah, 2012), the relationship between long working hours and job demands might increase the risks to workers' health (Müller *et al.*, 2018). Research has found that stress and burnout are linked to long working hours (Amlinger-Chatterjee and Wöhrmann, 2017). Employees who work 50 hours a week or more were more likely to suffer from burnout and higher alcohol consumption and use of sedatives (Müller *et al.*, 2018).

A study by Moen *et al.* (2013) surveyed 550 employees in a white-collar organisation to test the relationship between work-time demands and control, and self-reported health outcomes. Moen *et al.* (2013) found that increases in psychological time demands and time adequacy predicted expected positive and negative results. It was found that psychological time demands, and control were related to health.

Long working hours have been found to have a relationship with physical and psychological health risks (Müller *et al.*, 2018). Surveys conducted by Wirtz (2010) showed that cardiovascular symptoms increased by weekly hours worked. These findings are supported by a meta-analysis which also confirmed the relationship between long working hours and coronary heart disease (Kivimäki *et al.*, 2015).

In addition, technological advances contribute towards increasing job demands and pressures for employees to work longer hours to complete tasks and to appear invaluable and committed members of staff (Blair-Loy, 2009). Furthermore, a 2004 U.S. study found that 69% of adults reported feeling overworked, while 78% reported 'often' or 'very often' needing to work on too many simultaneous tasks (Galinsky,

2005). Similarly, Moen *et al.* (2013) found that time demands and time control impact physical health and home strain.

The concept of workaholism is a term used to describe “individuals who are addicted to work” (Aziz and Cunningham, 2008: 1). Due to technology and flexible work schedules, it is assumed that the number of hours worked is reduced (Burke and McAteer, 2007). However, it was found that working time varied by gender, race, occupation, and period of time (Aziz and Cunningham, 2008). Studies in North America showed that there was an increase in the number of hours worked in highly educated individuals and professionals as a result of a rise in workload (Aziz and Cunningham, 2008).

Hence, workaholism can negatively impact interpersonal relationships and thus cause marital problems (Aziz and Cunningham, 2008). A study found that women married to workaholics reported higher levels of marital dissatisfaction towards their spouse (Carroll *et al.*, 2002). Likewise, a study by Porter (2001) found that the spouse of a workaholic experienced loneliness and abandonment (Aziz and Cunningham, 2008).

Moreover, workaholism is often linked to poor physiological and psychological health (Worrall *et al.*, 2000), as well as increased exhaustion (Rosa, 1995) and burnout (Barnett *et al.*, 1999). It has been found that workaholics, especially managers, have behavioural habits that can have an impact on those in the company, such as constantly monitoring their employees' performance (Graves *et al.*, 2006). Hence, conflicting experiences with workaholics can cause co-workers to avoid them; even worse, interactions with workaholics, especially managers, can have a ripple effect, spreading the same behaviour patterns across the organisation (Seybold and Salomone, 1994; Graves *et al.*, 2006). It is therefore hypothesised that:

H₃: Unbalanced workload is positively associated with strain on the psychological health of South African civil engineers.

2.5. Work-Life Balance

Work-family conflict (WFC) relates to the conflict between work and family (Greenhaus and Beutell, 1985). However, Wise and Bond (2003) noted that people have responsibilities outside of work that extend beyond the life domain, which has led to WLB becoming a popular term (Bradley *et al.*, 2010).

Employees who are stressed as a result of work-life conflict feel less in control of their work and non-work demands, experience low productivity, and feel unsatisfied with their organisations, leading to absences from their workplaces, or resignation (Adams *et al.*, 1996; Boles *et al.*, 2001; Frye and Breugh, 2004). Allen (2001) found that organisations which support their employees' WLB receive improved commitment to the organisation, see an increase in employees' job satisfaction (Bedeian *et al.*, 1988), and a reduction in absenteeism (Baltes *et al.*, 1999). Managers who support WLB cause their staff to feel more in control of their workloads and their lives outside of work, leaving them feeling more uplifted (Bradley *et al.*, 2010).

The purpose of social support is to assist an individual to make use of existing resources and find new resources (Seiger and Wiese, 2009). The role of social support and how it influences job demands and control was examined by Karasek and Theorell (1990). This model was analysed by Butler *et al.* (2005) who found that WFC is influenced by the extent to which employees experience significant demands and less control at work.

Research by Lu *et al.* (2009) found that family-friendly supervisors and co-workers positively influenced employees' level of WFC. The absence of a supportive work environment was also negatively linked to WFC (Lingard *et al.*, 2012). Furthermore, Janssen *et al.* (2004) found that employees negatively experience WFC and burnout as a result of an absence of social support.

Similarly, research suggests that social support in the workplace reduces WIF, whereas support received from family reduces family interference with work (Seiger and Wiese, 2009). In the construction industry, Lingard and Francis (2006) noted that social support received from supervisors and co-workers reduced the extent to which WFC results in burnout.

Greenhaus and Beutell (1985) explained that WFC occurs when workplace responsibilities interferes with family-related role quality (Schieman and Young, 2013). A contributing factor to WFC is work-related contact in which an individual receives communications about work after hours and thus disrupts his or her leisure time with family and inhibits psychological detachment from work (Schieman and Young, 2013). Consequently, frequent work-related contact can result in issues surrounding self-control, depletion of resources, and exhaustion (Muraven and

Baumeister, 2000; Sonnentag and Fritz, 2007; Freeman and Muraven, 2010). This is supported by research studies which found a positive relationship between work-related contact and WFC (Voydanoff, 2007; Schieman and Young, 2013). Furthermore, managing WFC is critical due to the effect that it has on employees' health and performance (Van Steenbergen and Ellemers, 2009).

The construction industry is notorious for high workloads, time constraints and tight deadlines (Sutherland and Davidson, 1989). A study by Leung *et al.* (2008) found that construction project managers experience lower levels of performance due to work stress (Lingard *et al.*, 2012). In addition to this, Ng *et al.* (2005) noted that construction professions found that long working hours, high workload and lack of time spent with family were found to be the most significant work stressors experienced by construction managers in Australia compared to WFC (Haynes and Love, 2004).

The number of hours employees work has a significant negative influence on their health and well-being (Hughes and Parkes, 2007). More specifically, working overtime has a negative impact on WLB (Jansen *et al.*, 2004). This is supported by Hosking and Western (2008), who found that working non-standard hours increases WFC, reduces levels of family functioning, increase feelings of depression and parenting, as opposed to traditional working hours (Strazdins *et al.*, 2006). The effect of long working hours was noted by Wayne *et al.* (2006), who reported that time demands from work are inversely related to employees' experience of work-to-family enrichment, in addition to long hours positively predicating WFC (Lingard *et al.*, 2012).

The ability to control work time allows workers to positively manage role-demands at work and home (Grzywacz *et al.*, 2008). This aligns with Moen *et al.* (2008) who found that work time control results in reduced WIF. Lingard *et al.* (2012) reported that a reduction in WIF is achieved by a reduction in work time demands and an increase in work time control.

Spill-over theory focuses on the impact that attitudes and emotions from one domain have on another domain i.e., how work and home domains influence one another (Chesley, 2005). Employees who experience technology-related pressures tend to carry their work domain into their family domain (Lambert, 1990). Technology

allows supervisors and team members to maintain contact after hours and thus spills over into the home domain (Scholarios and Marks, 2004). More recently, it was found that there is a complex inter-relationship between the amount work-related contact experienced by construction professionals, and the levels of work–family conflict, psychological distress and sleep problems they experience (Bowen *et al.*, 2018). Therefore, construction professionals are advised to reinforce their boundaries between work and family life in order to preserve their wellbeing (Bowen *et al.*, 2018).

WFC is associated with hypertension, coronary heart disease, peptic ulcers, and cancer (Edwards and Rothbard, 2005), as well as job and life dissatisfaction, chronic depression, and anxiety (Wolff *et al.*, 2013). Similarly, Greenhaus *et al.* (2006) reported a link between WFC and emotional and physical distress. Poor WLB results in low morale, poor performance and physical health (Townsend *et al.*, 2003; Mesmer-Magnus and Viswesvaran, 2006). Studies have found that not finding a balance between the demands of work and family can result in worse health (Frone *et al.*, 1997) and career outcomes (Eby *et al.*, 2005), as well as decreased job satisfaction and performance (Netemeyer *et al.*, 1996), and higher levels of strain, absenteeism and turnover (Grandey and Cropanzano, 1999).

WLB initiatives are found to reduce absenteeism and improve job performance and productivity (Konrad and Mangel, 2000; Perry-Smith and Blum, 2000; Allen, 2001). In a study performed by Perry-Smith and Blum (2000), it was found that firms with work-family policies have a higher overall level of task performance (Brown *et al.*, 2010). A study by Konrad and Mangel (2000) supports this as they found that WLB programmes resulted in a positive influence on employee productivity in the workplace (Brown *et al.*, 2010).

Examples of WLB initiatives includes a shortened work week while maintaining the number of working hours, known as a compressed work week (CWW) (Brown *et al.*, 2010). It was found that the majority of research on CWWs indicates that it results in a reduction in work stress and fatigue (Pierce and Dunham, 1992; Freer and Murphy-Black, 1995; Vega and Gilbert, 1997; Townsend *et al.*, 2003)

2.6. Job Insecurity

Job insecurity is defined as the “subjectively perceived likelihood of involuntary job loss” (Sverke *et al.*, 2002: 243). As job insecurity pertains to employed persons who are threatened with unemployment, the topic of work insecurity falls between employment and unemployment (De Witte, 2005). Organisational change and large-scale retrenchments have become the focus of working life in many countries (Schreurs *et al.*, 2010). As a result, an increase in job insecurity among employees has been found (Davy *et al.*, 1997).

From the perspective of the employee, the notion of losing their job may have a negative effect on both their psychological well-being and overall health (Ashford *et al.*, 1989; Ferrie *et al.*, 2002; Hellgren and Sverke, 2003). From the employer’s point of view, job insecurity may present as negative job and organisational attitudes, resulting in decreased effort, commitment, and overall job performance (Sverke *et al.*, 2002). Nevertheless, research has not found solutions to buffer the negative effects of job insecurities (Sverke *et al.*, 2002).

De Witte (1999) stated that job insecurity is recognised as one of the major workplace stressors (Schreurs *et al.*, 2010). Schreurs *et al.* (2010) explained that the stressful nature of job insecurity can be understood, theoretically, in three ways. Firstly, by the impact of uncertainty (Schreurs *et al.*, 2010). Uncertainty pertains to an individual’s perceived (in)ability to anticipate the repercussions of their decisions or choices (Milliken, 1987). Therefore, uncertainty provokes feelings of powerlessness and lack of control, contributing towards ill health (Bordia *et al.*, 2004).

Secondly, Jahoda’s latent deprivation model (Jahoda, 1982; Batinic *et al.*, 2010) can explain the negative results of job insecurity (Schreurs *et al.*, 2010). The model explains the various needs that can be met by employment e.g., earning an income, socialising outside the family, and developing time management (Schreurs *et al.*, 2010). Therefore, job insecurity pertains to the frustration of achieving these needs, compromising the future abilities of individuals (Schreurs *et al.*, 2010).

Lastly, psychological contract theory may be used to understand the negative effects of job insecurity (Schreurs *et al.*, 2010). The mutual obligations between employees and their employers is referred to as the psychological contract (Rousseau, 1995). Traditionally, the psychological contract pertains to the exchange between security

(on the employer's behalf) and loyalty (on the employee's behalf) (Schreurs *et al.*, 2010). When the psychological contract is compromised, employees experience a sense of job insecurity with their employer (De Cuyper *et al.*, 2008). Consequently, the overall well-being of the employee and commitment to the employer becomes a concern (Wanous *et al.*, 1992).

Hence, job insecurity is associated with health-related issues such as psychological distress, anxiety, depression (Roskies *et al.*, 1993), as well as mental, physical, and emotional exhaustion (Dekker and Schaufeli, 1995). In addition, it has been found that psychosomatic complaints (Ashford *et al.*, 1989) and medically-certified sickness absence may be caused by job insecurity (Ferrie *et al.*, 2001; Ferrie *et al.*, 2002). Further, studies have showed that the long-term health effects of job insecurity include increased blood pressure and decreased body mass index (Schreurs *et al.*, 2010). Longitudinal studies have found that consistent exposure to psychological work stressors like job insecurity is linked to long term general health deterioration (Carayon, 1993; Spector *et al.*, 2000). It is therefore hypothesised that:

H₄: Job insecurity and change is positively associated with strain on the psychological health of South African civil engineers.

2.7. Workplace Relationships

Studies surrounding social relationships at work and their effect on employees' health have advanced over the years (Viswesvaran *et al.*, 1999). Additionally, positive social interactions at work have been found to have a positive influence on the immune, cardiovascular, and neuroendocrine systems (Heaphy and Dutton, 2008). The modern work environment is increasingly incorporating teams to complete tasks, and thus the workplace has become more interdependent, causing relationships to be considered as a more important part of the work environment (Chiaburu and Harrison, 2008; Grant and Parker, 2009).

According to a Japanese survey, 52% of women have encountered anxiety and tension at work as a result of poor interpersonal relationships (Cox *et al.*, 2000). Additionally, employees who indicated elevated levels of stress and stress-related illnesses were more likely than the general working population to experience a lack of support from supervisory colleagues (Jones *et al.*, 1998).

Studies have found that high anxiety, emotional fatigue, job stress, low job satisfaction, and an increased risk of cardiovascular disease are all symptoms of inadequate interpersonal support at work (Warr, 1992). Management behaviour and supervisory styles have a direct impact on employees' emotional well-being (Corey and Wolf, 1992; Landy, 1992).

Employee function in an organisation, role overload, role insufficiency, and obligation for others, have all been shown to be important predictors of psychological health (French *et al.*, 1982). Furthermore, workers' stress levels are linked to the supervisory style of contact with them (Lobban *et al.*, 1998), which means that the relationship between workers and their managers has a huge impact on workplace stress (Cox *et al.*, 2000).

Earlier studies have found that employees who work with considerate supervisors are less stressed at work (Buck, 1972). This is supported by a Swedish study which found that support from supervisors and co-workers reduced the effects of job demands on depression and job satisfaction (Karasek *et al.*, 1982). A study by Colbert *et al.* (2016) showed that workplace relationships foster personal development, provide opportunities for companionship, and allow employees to give back to the community. Workplace relationships can, therefore, increase job satisfaction, encourage meaningful work, foster positive emotions at work, support life satisfaction, which benefits both individuals and organisations (Colbert *et al.*, 2016).

It is therefore hypothesised that:

H₅: Poor work relationships is positively associated with strain on the psychological health of South African civil engineers.

2.8. Working Conditions

Gerber *et al.* (1998) explains that working conditions are created by the interaction of employees with their organisational climate, and includes psychological as well as physical working conditions. Marchand *et al.* (2005) states that studies fail to account for social environment factors (workplace, family, social network) or the broad range of working conditions and occupations. Due to the limitations of existing research, the contribution of occupation and work conditions to psychological distress is an issue that requires further investigation (Marchand *et al.*, 2005). A study found that

legislation in that country does not enforce organisations to regulate mental health in the workplace (Marchand *et al.*, 2005). An example in the study explained that workers who have reported that mental health issues experienced from their work may be covered by their employer's health insurance plans (such as sick leave) while others do not, thus forcing them to rely on the free healthcare system to find support (Marchand *et al.*, 2005). Moreover, for workers to be compensated for these issues in Canada, they have to prove that their work conditions are the cause of their illness, which is likely to be unsuccessful (Marchand *et al.*, 2005).

It has been found that work can pose a threat to the mental health of workers through unfavourable conditions (Wieclaw *et al.*, 2008; Nieuwenhuijsen *et al.*, 2010; Lahelma *et al.*, 2012; Stansfeld *et al.*, 2012). Moreover, working in jobs with low psychosocial quality (i.e., how social factors influence mental wellbeing and behaviour) influences mental health similarly to being unemployed (Butterworth *et al.*, 2013). The JDC model and the ERI model found links between unfavourable working conditions and stress (Nieuwenhuijsen *et al.*, 2015). Nevertheless, stress reactions of workers pertain to the objective working conditions they are exposed to, in addition to how an individual assesses that situation (Ursin and Eriksen, 2010).

Unfavourable working conditions cause withdrawal behaviours like physical removal from the workplace due to voluntary employee lateness, absenteeism, and turnover, which are very costly to organisations (Hulin, 1991; Koslowsky, 2000; Johns, 2001). Other consequences of withdrawal behaviours on employee morale and work motivation have been identified, from two perspectives (Jamal, 1984; Koslowsky *et al.*, 1997):

The first perspective evaluates how unfavourable working conditions, such as job dissatisfaction and organisational commitment impact voluntary lateness, absenteeism, and turnover (Rosse and Hulin, 1985; Hulin, 1991). The second perspective analyses each of the withdrawal behaviours (Price and Mueller, 1981; Steers and Mowday, 1981). Similarly, Mobley (1982) found that employees exercise the abovementioned work behaviours to avoid work, in addition to other means such as social gatherings. It is therefore hypothesised that:

H₆: Poor job conditions is positively associated with strain on the psychological health of South African civil engineers.

2.9. Psychological Distress

Poor mental health is characterised by psycho-physiological and behavioural symptoms relating to anxiety and depression reactions, irritability, reduced intellectual capacity, tiredness, sleepiness, and overall work absenteeism (Dohrenwend *et al.*, 1980; Ross *et al.*, 1990). Psychological distress has been classified as a minor mental health problem (Goldberg, 1972) and is related to job satisfaction and linked to feelings of unhappiness, depression, and anxiety (Watson *et al.*, 1988; Warr, 1990). Psychological distress is, therefore, defined as “an umbrella term that encompasses stress, burnout, depression, anxiety and other related mental health problems” (Facey *et al.*, 2015: 995).

Similarly, psychological strain includes cognitive and psychological effects such as the inability to concentrate, job dissatisfaction, anxiety, depression, anger, headaches, perspiration and dizziness (Dollard, 2001). Psychological distress is a notable sign that there is an issue with an individual’s psyche (Marchand *et al.*, 2005) and the long-term psychological outcomes may include mental illness and suicide (Greenhaus and Beutell, 1985), psychosomatic diseases, and high blood pressure (Marchand *et al.*, 2005).

It is assumed that absence from work is a result of employees’ dislike towards their jobs (Johns, 1997). In addition, the level of job satisfaction is assumed from the frequency of absences as opposed to the total number of days absent, as this is linked more to physical and mental illness (Johns, 1997). It is expected that psychological distress affects work absence (Hardy *et al.*, 2003). However, psychological distress has been found to be a greater influence of employee absenteeism than job satisfaction (Hardy *et al.*, 2003). Firstly, psychological distress has a stronger affective state and secondly, it is highly associated with illness and thus has more justified reasons for taking a leave of absence (Hardy *et al.*, 2003).

White- and blue-collar workers, semi-professionals, supervisors and unskilled workers have been found to be a greater risk for psychological distress (Niedhammer *et al.*, 1998; Vermeulen and Mustard, 2000). It is well known that the construction industry is high risk for work-related stress (Lingard and Francis, 2004; Pocock *et al.*, 2007; Love *et al.*, 2010). Industry professionals are tasked with projects being completed on time, within budget and to the required standards (Bowen *et al.*, 2018).

Construction projects involve high levels of uncertainty, interpersonal and inter-role conflict, which all lead to stress (Leung *et al.*, 2007; Loosemore and Galea, 2008; Lingard *et al.*, 2010; Mohr and Wolfram, 2010).

As a result of job pressures, behavioural and psychological symptoms such as burnout and psychological distress (Hakanen *et al.*, 2008) as well as exhaustion and sleep problems (Bakker and Demerouti, 2007) become evident. Similarly, work-family interference influences psychological strain (Kinnunen *et al.*, 2006), poor physical health (Frone *et al.*, 1997), higher levels of fatigue (Jansen *et al.*, 2003), depression and anxiety (Frone *et al.*, 1996) and poor quality of sleep (Williams *et al.*, 2006).

Psychological detachment refers to an individual's sense of being away from work (Etzion *et al.*, 1998) and requires employees to mentally distance themselves from thinking about work (Sonnentag and Krueger, 2006). Leisure and recovery time outside of working hours is necessary to maintain employee health, well-being and performance (Sonnentag, 2001) and to allow employees to fully overcome work-related stress (Bowen *et al.*, 2018). Therefore, psychological detachment and periods of recovery reduces work-family interference (Derks and Bakker, 2014) and experience a greater sense of life satisfaction, well-being (Sonnentag and Fritz, 2007) and perform better at their jobs (Demerouti *et al.*, 2009).

In Sweden, a study found that women in senior positions at work experience increased minor health issues, stress, conflict due to demanding work, and an overall higher workload than their male colleagues (Berntsson *et al.*, 2006). Similarly, another study reported that women who work in male-dominated industries are at a higher risk of myocardial infarction as opposed to their male colleagues and with women who worked in female-dominated jobs (Hammarström *et al.*, 2006).

2.10. Summary

This chapter reviewed and analysed literature pertaining to the relationship between workplace stressors and psychological health. The various stress models were discussed, as well as workload and time pressures, work-life balance, job insecurity, work relationships, and job conditions.

The literature review revealed that a relationship exists between psychological distress and workplace stressors and led to the development of the hypotheses, which

aimed to analyse the relationship between psychological health and the various workplace stressors of the ASSET model, namely: resources and communication, job control, unbalanced workload, job insecurity and change, work relationships, and job conditions.

Chapter 3: Research Methodology

3.1. Introduction

This chapter describes the development of the survey-based research design utilised in this study pertaining to the relationship between workplace stressors and the psychological health experienced by South African civil engineers. For this study, quantitative research techniques were used. This chapter is structured to introduce a critical analysis of extant survey-based methods with focus on their usefulness, appropriateness, and limitations. This is followed by an explanation of the selected survey-based approach to be used, followed by the chosen research methodology employed. Thereafter, the methods used to obtain the population and sample data are discussed. The questionnaire design is then described, and the development of the ASSET scales is tabulated. The chapter is then concluded by describing the statistical techniques employed to analyse the data in Chapter 4.

3.2. Methodological Approach of the Study

The research question of the current study is as follows:

What is the nature of the relationship between workplace stressors and the psychological health of South African civil engineers?

The current study used quantitative analysis techniques in the form of an online survey questionnaire. The methodology is exploratory as a validated and reliable instrument has been used to measure psychological distress in civil engineers seeking to explain how the psychological health of the respondents is related to the stressors in their work and workplace.

Primary data is data that has been generated by the researcher themselves, through surveys, interviews, or experiments, specially designed for understanding and solving the research problem at hand. On the other hand, secondary data uses existing data, such as, for example, that generated by large government institutions, healthcare facilities etc. as part of organisational record keeping. In this study, part of the data (i.e., obtained from civil engineer members of SAICE) previously collected by others via an online survey questionnaire that had been undertaken in 2018/2019 among construction professionals was used.

In order to determine the most suitable approach to answering the research question using quantitative data, previous surveys were analysed and discussed below. The data obtained in this study is related to the variables in the validated ASSET scales. This approach is deemed the most suitable based on the previous studies discussed below.

3.2.1. An Overview of Methods used in Previous Surveys

The quantitative research approach using a survey instrument with good reliability and validity allows the findings to be generalized to the whole of the civil engineering profession in South Africa. Generalisability adds considerable value to the potential reach and impact that the research can have.

In order to determine the appropriateness of the approach adopted for the current study, it is necessary to review studies similar to the current study and assess their strengths and limitations.

Bowen *et al.* (2018) studied work-related contact, work-family conflict, psychological distress, and sleep problems experienced by South African construction industry professionals and found that psychological distress was determined by work–family conflict, work experience, and job pressure. An appropriate research method for this study was used, which included the distribution of an online questionnaire survey to construction industry professionals and sought demographic and professional background information from the respondents, in addition to questions pertaining to perceived psychological, physiological, and sociological effects of workplace stress (Bowen *et al.*, 2018). In this study, 942 responses were received, but only 864 were suitable for analysis. The gender balance was skewed as only 19% of respondents were female. The main limitation of this study is that the results do not provide insight into as to how or why individuals experienced and responded to work-related contact and work–family conflict in the specific and individual ways that they did (Bowen *et al.*, 2018).

Facey *et al.* (2015) performed a meta-analysis study by examining titles and abstracts of articles that focused on first-year doctors and stress. Of the 1523 articles found, 17 studies were deemed suitable and examined. The gender balance was not analysed. The purpose of the study was to identify the factors

influencing work-related psychological distress. Inconsistencies in this study included the participants' career progression, and their roles. A significant limitation in this study is the small number of studies that met the inclusion criteria thus deriving fixed conclusions from the analysis was challenging.

A study conducted by Hardy *et al.* (2003) analysed 323 organisational records of staff absence from four National Health Service (NHS) Trusts. The four Trusts were part of a sample of 19 Trusts who took part in a questionnaire survey, which was repeated 2 years later. Each survey comprised over 11,000 respondents, with an estimated response rate of 61–65%. The gender balance was skewed towards females (71.8%). The aim was to investigate the extent to which psychological distress is linked to absence from work, job satisfaction, depression, and anxiety in the UK. This study found that depression predicted absence from work. The main limitation in this study was dependence on cross-sectional research designs using self-report data.

Schieman and Young (2013) examined the extent to which work-related contact is associated with psychological distress and sleep problems. The research method included using data that was sampled from the 2011 Canadian Work, Stress, and Health (CAN-WSH) study (a nationally representative survey of the Canadian workforce), using a national telephonic survey of working persons. The purpose of the study was to investigate how work-related contact is related to higher levels of work-to-family conflict, distress, and sleep problems. The study found that job autonomy, schedule control, and challenging work were negatively associated with work-related contact and distress or sleep problems. The sample was 6004 (effective sample size was 5729), with a response rate of approximately 40%. Gender balance was not mentioned. A limitation of this study is the use of cross-sectional data.

A study performed by Melamed *et al.* (1995) analysed the relation of objective work conditions to job satisfaction, psychological distress, and sickness absence of 1278 blue-collar workers (885 male and 393 female) using free screening at their place of work. It was found that job satisfaction and psychological distress were largely linked to subjective monotony. In addition, an equal relationship was found between sickness absence with work conditions and subjective

monotony. It was also noted that women experienced higher levels of sickness absence relating to the work conditions than did men. A significant limitation of this study was the high exclusion rate of participants (29.8%) due to the inability to classify their work conditions into one of the five provided categories.

Mertler (2002) noted that online data collection is considered efficient and a convenient alternative to other traditional methods of gathering information from respondents. In addition, online surveys provide a guarantee of a marginally shorter time frame for the collection of responses and thus saves time and costs (Lefever *et al.*, 2007).

A study by Lingard and Francis (2002) collected data using a questionnaire distributed to 600 employees via an email from the Human Resources Director of a large construction firm. Despite how conducting a survey within a single organisation may result in a generalisation of its findings, advantages include controlled organisational culture, policies and procedures, which was deemed to be appropriate for the study (Lingard and Francis, 2002).

Research using questionnaires is often considered limited if surveys are cross-sectional, because it is often not possible to ascertain the direction of causal relationships in general. It is possible for the direction of causal relationships to actually be the reverse (Sedgwick, 2014). Lingard and Francis (2006) recommended that studies using questionnaires should allow a follow-up with a longitudinal study. Bowen *et al.* (2013) noted that studies which focus on workplace stress and its influence often detail the scales in the survey but do not explain the extent to which participants experience and respond to stressors.

The current study analyses a relevant subset of data which had been obtained in an ASSET online questionnaire survey, and it is anticipated that similar strengths and limitations will occur. The cross-sectional nature of the data, in addition to the sample bias and sample size are notable limitations to the data of the current study. The primary data collection used from the ASSET online survey had been gathered by emailing the membership of the South African Institute for Civil Engineering (SAICE).

3.2.2. Ethics

Participants had been required to provide their full consent in order to initiate the survey. This had been presented as the first question in the questionnaire. In order to comply with the ethics requirements at the university, ethics clearance was obtained from the Faculty of Engineering and the Built Environment at the University of Cape Town. The ethics clearance for this study may be found in Annexure B.

3.3. Methods of Data Collection

3.3.1. Population and Sampling

Professional registration is mandatory in South Africa, and thus lists compromising registration of members are excellent proxies for full populations. The total population of professional engineers (Pr. Eng) registered with SAICE at the time of the survey was 4000 ($N = 4000$). The SAICE had assisted by emailing the online survey URL and a letter explaining the purpose of the research to all registered members, requesting their participation in the survey. One hundred and forty-two responses had been obtained ($n = 142$), i.e., 3.6% of the total population of professional engineers registered with SAICE.

3.3.2. The Survey Instrument

It is to be noted that the author of this study may be contacted if any information pertaining to the research instrument is required, which will be provided, subject to copyright restrictions. The survey took place in 2018/2019 and comprised the following sections:

A. Section A: Demographic Information

Demographic information collected from respondents had included gender, date of birth, marital status, mother tongue, organisation's sector, years of work experience in the construction industry, years of work experience in current organisation, employment basis, number of people in the organisation, working hours, and travel time per day.

B. Section B: ASSET

The most commonly used tools in the measurement of stress are based on the one-factor model by Selye (1975), and the JDC models (Cooper and Marshall, 1978; Karasek, 1979; Johnson and Hall, 1988; Johnson *et al.*, 1989; Lazarus,

1995). The Occupational Stress Indicator (OSI) (Cooper *et al.*, 1988) is considered a popular stress measurement tool for conventional risk assessments (Cattell *et al.*, 2018). Nevertheless, it has some limitations and was considered too lengthy and thus the ASSET tool was developed (Johnson and Cooper, 2003).

The ASSET scales had been used to measure stressors and strain on the psychological health experienced by civil engineers. The structure and content of the questionnaire are discussed below. In addition to the demographic questions, the ASSET scales used are shown in Figure 1.

The ASSET questionnaires that had been used were the ‘6 Essentials’ and ‘Your Health’. The 6 Essentials scales include: resources and communication; control; balanced workload; job security and change; work relationships; and job conditions. The ‘Your Health’ scale measured strain on psychological health.

The ‘6 Essentials’ survey items used a 6-point (strongly disagree, disagree, disagree, slightly agree, agree, strongly agree) response option, whereas the ‘Your Health’ scale items employed a 4-point (never, rarely, sometimes, often) response option. In all cases higher scores represent higher levels of the construct of interest.

Due to the proven reliability and validity of ASSET as a measurement tool for stress (Johnson and Cooper, 2003), it has been deemed a valid and appropriate measurement tool for the current study.

Figure 1:
(Johnson



The ASSET model
and Cooper, 2003)

Table 1: Sample scale Items for Composite Variables

	Construct	No. of Items	Sample Items
1	Resources and Communication (Scale score range = 4-24)	4	I am troubled that I do not have the proper equipment or resources to do my job. I am troubled that I am never told if I am doing a good job.
2	Control (Scale score range = 4-24)	4	I am troubled that I have little control over many aspects of my job. I am troubled that I am not involved in decisions affecting my job.
3	Balanced Workload (Scale score range = 8-48)		
3.1	Work-life Balance (Scale score range = 4-24)	4	I am troubled that I work longer hours than I choose or want to. I am troubled that I work unsociable hours e.g., weekends, shift work etc.
3.2	Workload (Scale score range = 4-24)	4	I am troubled that the technology in my job has overloaded me. I am troubled that I am set unrealistic deadlines.
4	Job Security and Change (Scale score range = 5-30)	5	I am troubled that my job is not permanent. I am troubled that my job skills may become redundant in the near future.
5	Work Relationships (Scale score range = 8-48)	8	I am troubled that I feel isolated at work e.g., working on my own or lack of social support from others. I am troubled that I do not receive the support from others (boss/colleagues) that I would like.
6	Job Conditions (Scale score range = 7-42)	7	I am troubled that I do not enjoy my job. I am troubled that my work is dull and repetitive.
7	Strain on Psychological Health (Scale score range = 11-44)	11	Feeling unable to cope. Having difficulty concentrating.

3.4. Methods of Analysis

3.4.1. Software Used

The analysis of the data collected from the survey was performed using IBM SPSS Statistics V26.0 for Windows (IBM Corp., 2019). The full dataset was subjected to within-scale and across-scale missing value analysis using Little's MCAR test (discussed more fully below). Subsequently, the data were cleaned within the context of the focus of the current study, creating a final dataset. Finally, descriptive statistics, and multivariate analysis was used to examine the relationships between the '6 Essentials' and 'Your Health' scales. Additionally, the mean values and standard deviations were computed individually for all scale items (see Appendix A). Unless otherwise stated, the percentages stated relate to the responses to individual questions.

3.4.2. Statistical Tests

The preparation of the data prior to analysis per se (e.g., missing value analysis, assessment of the underlying assumptions of multiple regression analysis) is described more fully in Chapter 4. The following tests were performed on the data set:

C. Correlation Analysis

Correlation analysis is used to “describe the strength and direction of the linear relationship between two variables” (Pallant, 2011: 128). In this study bivariate correlation analysis (Pearson's correlation coefficient (r)) was used to measure the strength of the relationship between the 6 Essentials and Your Health scales. The threshold levels of the magnitude of the associations were trivial ($<.10$), small ($.10-.29$), medium ($.30-.49$) and large ($\geq .50$) (Cohen, 1988).

D. Internal consistency of the ASSET Scales

The reliability (internal consistency) of the scales was assessed using Cronbach's alpha (α), Cronbach's alpha if an item is removed from the scale, and the corrected item-total correlations. Higher values of alpha indicate better internal consistency and Cronbach's alpha $>.70$ is considered acceptable (Hair et al., 2014). The corrected item-total correlation values provide an indication the degree to which each item correlates with the total scale score. Low values ($<.30$) indicate that the item is measuring something different from the scale as a whole

(Pallant, 2011). Ideally corrected item-total correlation values should not be less than $<.50$ (Hair et al., 2014).

E. Regression Analysis

The current study employed multiple linear regression analysis to test the strength of the interrelationship between the 6 Essentials (independent variables) and the dependent variable (strain on psychological health). Prior to the multiple regression analyses per se being performed, the underlying assumptions of regression analysis were checked, namely: absence of outliers, normality, linearity, homoscedasticity, and independence of the residuals (see Pallant, 2011).

3.4. Summary

This chapter describes the research methodology employed, the survey instrument, and the data analysis techniques that were employed, namely, correlation analysis, an assessment of scale internal consistency, and multiple regression analysis. Chapter 4 discusses the research findings using the methods and analysis detailed in this chapter.

Chapter 4: Data Analysis and Interpretation

4.1. Introduction

This chapter presents the analysis of the survey response data drawn from the sample of 142 civil engineers registered with SAICE. An analysis of the relationship between the dependent variable, Psychological Health, and the independent variables, i.e., workplace stressors (measured by the ASSET scales ‘Your Health’ and ‘6 Essentials’, respectively) was performed using Pearson’s correlation and multiple linear regression. Lastly, a discussion relating the results to the extant literature is presented.

4.2. Data Cleaning and Missing Values

The data set was examined for anomalies. No cases were removed as none of the respondents selected responses such as “other” and/or “not applicable” response options. The data set of 142 cases was subject to within-scale and across-scale missing value analysis. The analysis indicated that the extent of missing values was low for all individual variables (less than 2.1%).

Traditional approaches to missing data in statistical analyses are initiated with the assumption that the absent data is missing completely at random (MCAR) (Little *et al.*, 2014). Little’s MCAR test indicated that the assumption that all item missing values were missing completely at random was tenable as follows: Resources and communication ($\chi^2 = 5.35$, $df = 8$, $p = .72$, range 0 – 1.4%); Control ($\chi^2 = 5.39$, $df = 4$, $p = .25$, range 0 – 1.4%); Balanced workload ($\chi^2 = 12.42$, $df = 13$, $p = .49$, range 0 – .7%); Job-security and change ($\chi^2 = 3.76$, $df = 4$, $p = .44$, range 0 – .7%); Work relationships ($\chi^2 = 28.03$, $df = 22$, $p = .18$, range 0 – 2.1%); Job conditions ($\chi^2 = 9.97$, $df = 14$, $p = .77$, range 0 – .7%); and Strain on psychological health ($\chi^2 = 22.83$, $df = 30$, $p = .82$, range 0 – .7%).

Little’s MCAR test was also performed on all items across all measures simultaneously ($\chi^2 = 409.81$, $df = 405$, $p = .42$, range 0 – 2.1%), again indicative that item missing values were missing completely at random, and were imputed using the expectation-maximization (EM) algorithm.

4.3. Sample Size Sufficiency

The sample size of this study is one hundred and forty-two ($n = 142$), which is 3.6% of the total population of engineers registered with SAICE. Tabachnick *et al.* (2007) provide a formula for calculating sample size requirements, based on the number of independent variables that one wishes to use: $N > 50 + 8m$ (where m = number of independent variables). In terms of this formula, the recommended sample size is 98, therefore, the sample size of the current study is deemed sufficient.

4.4. Demographics of the Final Dataset

The demographic breakdown of the sample is 86.6% ($n=123$) men and 12.7% ($n=18$) women. In summary, 80.3% ($n=114$) were married, 4.9% ($n=7$) were living with a partner, 4.2% ($n=6$) were divorced, .7% ($n=1$) were separated, 1.4% ($n=2$) were widowed, and 8.5% ($n=12$) had never married.

The profile of respondents pertaining to their number of years' experience in industry comprised 1.4% between 0-5 years ($n=2$), 10.6% with 6-10 years ($n=15$), 14.8% with 11-15 years ($n=21$), 9.2% between 16-20 years ($n=13$), 9.2% between 21-25 years ($n=13$), 10.6% with 26-30 years ($n=15$), and lastly, 44.4% with 31+ years of industrial experience ($n= 63$).

Finally, the breakdown of respondents relating to their role within their organisation comprised 46.5% ($n=66$) being a director/partner/owner or manager, 54.4% ($n=73$) being a registered professional employee, .7% ($n=1$) being registered professional technicians, and lastly 1.4% ($n=2$) indicating "other".

4.5. Data Analysis

4.5.1. Descriptive Statistics

The descriptive statistics (mean and standard deviation) for each item of the various ASSET scales are presented in Appendix A. Given that the focus of this study is to establish the *nature of the relationship between workplace stressors and the psychological health of South African civil engineers*, these descriptive statistics *per se* are not central to the analysis and are presented in Appendix A for information only.

By way of explanation, the questions within each of the '6 Essentials' scales begin with "I am troubled" which indicates the direction of the answers and the meaning

of the scores. The mean indicates how strong the disagreement or agreement with the statement is (disagreement is 1 to 3, agreement is 4 to 6). The standard deviation indicates the spread about the mean which indicates the extent to which the respondents “slightly agree” / “agree” and “slightly disagree / disagree” with the questions.

When interpreting these descriptive statistics, it is important to note the direction of scale questions. For example, in Table 7 of Appendix A, for the first item (Lack of information about what is going on in the organisation), the mean is 3.19 and the SD is 1.60. This SD indicates that 68% of the responses were 3.19 plus or minus 1.60 – so they range from 1.59 to 4.79. Therefore, some are in the “slightly agree” / “agree” end of the range, but mostly they show varying levels of disagreement with the statement – “I am troubled that I do not feel I am informed about what is going on in this organisation”. Most respondents are saying that they disagree with the statement that they are troubled because they are not told enough about what is going on. In essence, they are mostly not troubled.

All items within the various Asset scales should be similarly interpreted *mutatis mutandis*.

4.5.2. Correlation Analysis

A 1-tailed correlation analysis using Pearson’s correlation coefficient was applied to all the 6 independent variables and the dependent variable (refer to Table 2).

As depicted in Table 2, all relationships are significant at the $p < .01$ level, with the exception of the relationship between balanced workload and job security which is significant at $p < .05$. All associations were found to be positive. The magnitude of the relationships varied between small (.10 to .29), medium (.30 to .49) and large ($\geq .50$) (see Table 2).

Notably, the strongest relationships were found between control and each of work relationships ($r = .754$) and resources and communication ($r = .720$). Equally notable is that approximately 50% of the associations may be categorised as large. Conversely, the smallest magnitude (.10 to .29) was found to be between balanced workload and job security and change ($r = .187$).

Table 2: Pearson's Correlation Coefficients between the Scales

	RC	C	BW	JSC	WR	JC	PH
Resources and Communication (RC)	1						
Control (C)	.720**	1					
Balanced Workload (BW)	.462**	.448**	1				
Job Security and Change (JSC)	.499**	.467**	.187*	1			
Work Relationships (WR)	.689**	.754**	.543**	.525**	1		
Job Conditions (JC)	.429**	.556**	.441**	.537**	.592**	1	
Strain on Psychological Health (PH)	.543**	.480**	.617**	.240**	.577**	.488**	1
Mean	11.054	12.313	26.213	13.921	21.020	22.951	26.086
SD	4.084	4.683	8.561	4.947	8.049	7.033	7.189
*p < .05, ** p < .01, ***p<.001							

Briggs and Cheek (1986) recommend the optimal range for the inter-item correlation as .2 to .4. All the items align with the minimum recommendation, with the exception of balanced workload and job security and change ($r = .187$). In this instance, this means that the behaviour of the items in these two scales is inconsistent with the others. In essence, the strength of association between these two scales is weak.

Correlations greater than .70 can lead to redundancy and it can be questioned whether the items are measuring the same thing. The inter-item correlation between resources and communication and control ($r = .720$), and between control and work relationships ($r = .754$) are strong and are marginally higher than the

recommended threshold – pointing to the possible presence of multicollinearity. The presence of multicollinearity is tested more fully below.

4.5.3. Internal Consistency of Scales

The internal consistency of the seven scales was assessed using Cronbach's alpha (see table 3). The analysis indicated satisfactory-to-good internal consistency: Control (4-items) ($\alpha = .824$), Balanced Workload (8-items) ($\alpha = .862$), Work Relationships (8-items) ($\alpha = .874$), and Strain on Psychological Health (11-items) ($\alpha = .915$) all possess strong internal consistency ($\alpha > 0.8$). Conversely, Resources and Communication (4-items) ($\alpha = .718$), Job Security and Change (5-items) ($\alpha = .702$), and Job Conditions (8-items) ($\alpha = .751$) all possess satisfactory internal consistency ($\alpha > .7$).

For the Control, Work relationships, and Strain on psychological health scales the corrected item-total correlation values all exceeded .50 (indicative of very good discrimination). The remaining four scales all indicated at least two items with corrected item-total correlations below .5, with the exception of Balanced workload which indicated only one such item. Notably, two scales, namely, Balanced workload (i.e., excessive travel time) and Job conditions (i.e., dealing with difficult clients) reflected corrected item-total correlations below the .3 threshold (one in each case), indicating that such items may be measuring something different from the scale as a whole.

Five of the six scales indicated an improvement in internal consistency occasioned by the removal of one or more items from that scale, with the notable exception of the Control and Balanced workload scales. Specifically, the alpha value would increase marginally by the removal of "Lack on control over aspects of the job" and "Excessive travelling time", respectively.

The length of these scales should be taken into consideration when interpreting the above results. To increase alpha, more related items testing the same concept should be added to the test, but that was not possible in this study. To conclude, all the scales in the current study may be considered to be internally consistent (i.e., reliable).

Table 3: Reliability of Scale Items

	Construct	No. of Items	Sample Item	Cronbach's Alpha (α)
1	Resources and Communication	4	I am troubled that I do not have the proper equipment or resources to do my job. I am troubled that I am never told if I am doing a good job.	.718
2	Control	4	I am troubled that I have little control over many aspects of my job. I am troubled that I am not involved in decisions affecting my job.	.824
3	Balanced Workload	8	I am troubled that I am given unmanageable workloads. I am troubled that I work longer hours than I choose or want to.	.862
4	Job Security and Change	5	I am troubled that my job is not permanent. I am troubled that my job skills may become redundant in the near future.	.702
5	Work Relationships	8	I am troubled that I feel isolated at work e.g., working on my own or lack of social support from others. I am troubled that I do not receive the support from others (boss/colleagues) that I would like.	.874
6	Job Conditions	7	I am troubled that I do not enjoy my job. I am troubled that my work is dull and repetitive.	.751
7	Strain on Psychological Health	11	Feeling unable to cope. Having difficulty concentrating.	.915

4.5.4. Testing the underlying Assumptions of Regression Analysis

Multicollinearity Test

Multicollinearity exists when the independent variables are highly correlated ($r > .70$) (Pallant, 2011). As was noted in the correlation analysis described above, the

strong associations between resources and communication and control ($r = .720$), and between control and work relationships ($r = .754$) need further examination with respect to possible multicollinearity. Tolerance indicates the extent of variability of the independent variables that is unexplained. A small tolerance level ($<.10$) indicates a high likelihood of multicollinearity. A Variance Inflation Factor (VIF) value greater than 10 indicates multicollinearity (Pallant, 2011). The results of the multicollinearity tests are shown in Table 4.

Table 4: Multicollinearity Test

Dependent Variable	Independent Variable	Collinearity Statistics	
		Tolerance	VIF
Strain on Psychological Health			
	Resources and Communication	.396	2.527
	Control	.338	2.957
	Balanced Workload	.627	1.595
	Job Security and Change	.574	1.742
	Work Relationships	.317	3.158
	Job Conditions	.518	1.931

The VIF (Variance Inflation Factor) for all the variables is <10 , again indicative of the absence of multicollinearity.

Normality, Linearity, Homoscedasticity, Independence of Residuals

As noted above, the underlying assumptions of linear regression analysis include an absence of outliers, normality of the data, linearity, homoscedasticity, and

independence of residuals (Pallant, 2011). No outliers in the data were detected. The Normal P-Plot for the current study shows the observed points in a reasonably straight line. This indicates that there are no significant deviations from normality. The normal p-plot is shown in Figure 2.

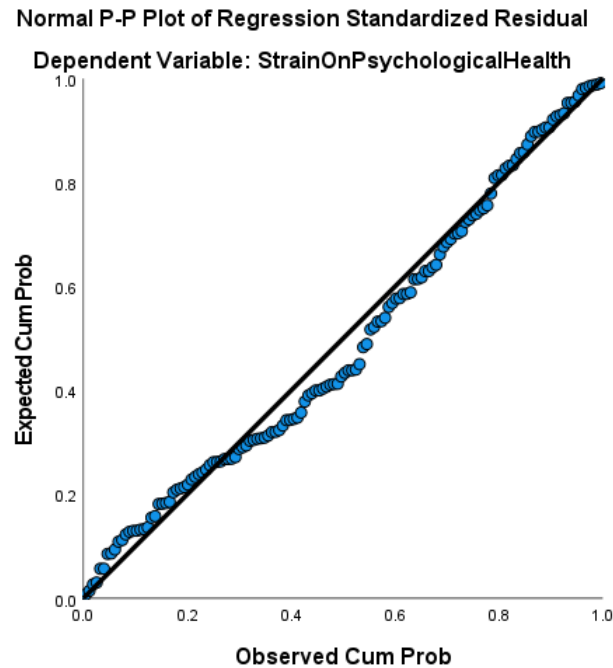


Figure 2: Normal P-Plot Diagram

The Scatterplot of the standardised residuals shows that the data are roughly rectangularly distributed and there is no clear pattern to the residuals. A straight line could be drawn through the main cluster of observed points, which means that the relationship between the data is linear and Pearson's inter-item correlation can be used. The shape of the cluster is distributed fairly evenly from one end to the other, which means that heteroscedasticity is not a concern. The scatterplot is shown in Figure 3.

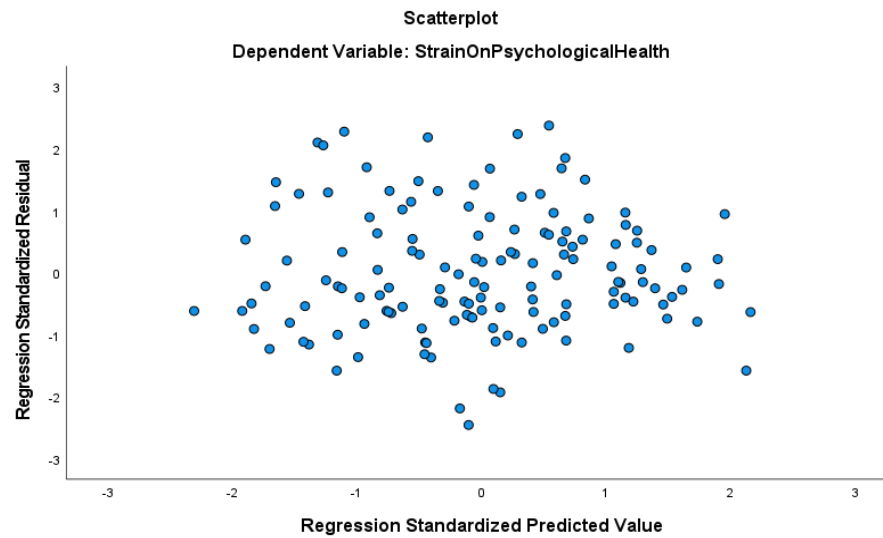


Figure 3: Scatterplot Diagram

4.5.5. Regression Analysis on the Scales

Multiple Linear Regression analysis was used to assess the ability of the 6 Essentials scales (independent variables) to predict levels of Strain on Psychological Health scale (dependent variable). The model is discussed below, and the result of the multiple regression analysis is presented in Table 5.

A positive and significant relationship was found between all of the independent variables (except for control) and strain on psychological health. Of these, the independent variable that made the strongest unique contribution to the model, when all variables are controlled for, is balanced workload ($B=.340$), followed by resources and communication ($B=.287$), followed by balanced workload. Job security and change ($B=-.156$) contributed the least (excluding Control).

The overall model was found to be significant at $F(6, 135) = 24.086, p = .000$ and explains 51.7% of the variance in strain on psychological health.

Table 5: Multiple Linear Regression Analysis

Dimension	Dependent Variable	Independent Variable	B	S.E.	<i>B</i>	<i>t</i>	<i>p-value</i>	<i>R</i>	<i>R</i> ²	<i>F</i>	95% Confidence Intervals	
											Lower Bound	Upper Bound
	Strain on Psychological Health		8.654	1.792		4.829	.000	.719	.517	24.086***	5.110	12.197
1		Resources and Communication	.505	.167	.287	3.017	.003*				.174	.836
2		Control	-.142	.158	-.093	-0.902	.369				-.455	.170
3		Balanced Workload	.286	.063	.340	4.507	.000***				.160	.411
4		Job Security and Change	-.227	.115	-.156	-1.979	.050*				-.454	.000
5		Work Relationships	.192	.095	.215	2.026	.045*				.005	.380
6		Job Conditions	.228	.085	.223	2.682	.008**				.060	.396
*p<.05; **p<.01; ***p<.001												

4.6. Discussion of the Findings

This section discusses the results presented above in the context of the extant literature. It is structured to, firstly, discuss the correlation analysis of the 6 Essentials, and, secondly, to discuss the regression model analysis. Within this discussion, the relevant literature is linked to the discussion, as well as to whether the hypotheses offered *a priori* are accepted or rejected.

The correlation analysis found that resources and communication was positively associated with all the factors, including strain on psychological health. This means that civil engineers who experience higher levels of job control, balanced workload, job security, good work relationships, and appropriate job conditions are more likely to enjoy better resources and communication at work than are their less fortunate colleagues. This is consistent with the JD-R model which found that the inability to meet job demands is caused by a lack of resources (Demerouti *et al.*, 2001).

The regression model found that resources and communication have a significant relationship with strain on psychological health. This is consistent with the JD-R model which found that physical, psychological, and organisation elements of work are necessary to complete work responsibilities (Bakker and Geurts, 2004).

Consequently, this means that Hypothesis 1 (H_1) which states that poor job resources and communication is positively associated with strain on the psychological health of South African civil engineers, is supported.

Job control was found to be positively associated with all the other factors, including strain on psychological health. This means that participants who felt that they were struggling with a diminished sense of control in their job, also experienced poorer levels of resources and communication, higher workload imbalance, higher levels of job insecurities, unhealthier work relationships, and poorer working conditions, than did their more fortunate colleagues. These employees also experience an overall increase in strain on their psychological health. This finding is consistent with the JDC model which proposes that high demands and low job control results in stress (Karasek, 1979) and therefore contributes to higher levels of strain and health complaints (De Lange *et al.*, 2004).

However, the regression model found that job control did not have a significant unique relationship with strain on psychological health. This was an unexpected

finding due to the positive (medium strength) correlation between these two variables. This is possibly due to the nature of work of the participants, and this aligns with the JDC model which explained that high status workers (for example, executives and professionals) have the resources to manage a high level of job demands (Karasek, 1979). Therefore, Hypothesis 2 (H₂) which states that low job control is positively associated with strain on the psychological health of South African civil engineers, is not supported.

Balanced workload has a positive and significant relationship with job security and change, work relationships, job conditions, resources and communication, control at work, and strain on psychological health. This means that employees who felt they worked long hours and experience high levels of interference with their family, were more inclined than their colleagues to suffer from time pressures, unrealistic deadlines, toxic relationships with their boss and/or colleagues, endure poor working conditions, and distress with their psychological health. These findings are consistent with Menzies (2005) who stated that employees feel that unbalanced workload can be associated with other job-related stressors and strain on psychological health. Research which has investigated the relationship between long working hours and health found that working long hours is considered a health risk (Bannai and Tamakoshi, 2014; Virtanen *et al.*, 2018).

The regression model found a positive and significant relationship between unbalanced workload and strain on psychological health. This is consistent with a study by Hughes and Parkes (2007) who found that the number of hours employees work has a significant negative influence on their health and well-being. Consequently, Hypothesis 3 (H₃) which states that unbalanced workload is positively associated with strain on the psychological health of South African civil engineers, is upheld.

The results indicate that participants who felt higher levels of insecurity and uncertainty with their job were more inclined than more secure colleagues to experience poorer resources and communication, less control, greater workload imbalance, strained work relationships, perceive their working conditions as unfavourable, and experience higher levels of strain on their psychological health. A positive and significant correlation was found between job insecurity and strain of

psychological health, indicative that employees who felt of higher degree of insecurity with their job and organisation experienced an increase in lack of commitment and obtaining their goals, and well as a decrease in their overall enthusiasm and contentment, than did their more secure colleagues. This is consistent with studies that found that the thought of an employee losing their job may have a negative effect on both their psychological well-being and overall health (Ashford *et al.*, 1989; Ferrie *et al.*, 2002; Hellgren and Sverke, 2003).

The regression model found a positive and significant relationship between job insecurity and strain on psychological health. This is consistent with studies which found that continuous exposure to psychological work stressors like job insecurity is linked to long-term general health deterioration (Carayon, 1993; Spector *et al.*, 2000). Consequently, Hypothesis 4 (H₄) which states that job insecurity is positively associated with strain on the psychological health of South African civil engineers, is upheld.

Work relationships have a positive and significant relationship with all the other factors, including psychological health. In essence, lower levels of resources and communication, control, and workload balance, as well as poorer job conditions, are associated with poorer work relationships and indeed higher levels of strain on psychological health. This is consistent with a study which found that workplace relationships increases job satisfaction, encourages meaningful work, fosters positive emotions at work, supports life satisfaction, which benefits both individuals and organisations (Colbert *et al.*, 2016). Similarly, the regression model found a positive and significant relationship between work relationships and strain on psychological health. Dollard (2001) found that jobs which possess high demands, low control, and low support from supervisors or co-workers carry the highest risk for psychological or physical disorders associated with high strain-isolated jobs. Therefore, Hypothesis 5 (H₅) which states that poor work relationships are positively associated with strain on the psychological health of South African civil engineers, is upheld.

Job conditions was found to have a positive and significant relationship with all the other factors, including strain on psychological health. This means that employees who experience more unfavourable working conditions than do their counterparts are more likely to have struggled to cope with their work, experienced constant tiredness,

and mood swings. The results of this study are consistent with the Job-Demand Control model which found links between unfavourable working conditions and stress (Nieuwenhuijsen *et al.*, 2015).

The regression model in the current study found a positive and significant relationship between job conditions and strain on psychological health. This is consistent with studies which found that work can pose a threat to the mental health of workers through unfavourable conditions (Wieclaw *et al.*, 2008; Nieuwenhuijsen *et al.*, 2010; Lahelma *et al.*, 2012; Stansfeld *et al.*, 2012). Consequently, Hypothesis 6 (H₆) which states that poor job conditions is positively associated with strain on the psychological health of South African civil engineers, is upheld.

It is restated that the current study aims to answer the following research question:

What is the nature of the relationship between workplace stressors and the psychological health of South African civil engineers?

Table 6 provides a summary of the testing of the *a priori* hypotheses.

Table 6: Summary of Hypotheses Testing Results

Hypothesis		Results
H ₁	Poor job resources and communication is positively associated with strain on the psychological health of South African civil engineers	Supported
H ₂	Low job control is positively associated with strain on the psychological health of South African civil engineers.	Not supported
H ₃	Unbalanced workload is positively associated with strain on the psychological health of South African civil engineers.	Supported
H ₄	Job insecurity and change is positively associated with strain on the psychological health of South African civil engineers.	Supported
H ₅	Poor work relationships are positively associated with strain on the psychological health of South African civil engineers.	Supported
H ₆	Poor job conditions are positively associated with strain on the psychological health of South African civil engineers.	Supported

4.7. Summary

This chapter presented the analysis of the data that had been obtained from respondents to an online survey questionnaire distributed amongst civil engineering professionals in South Africa. Pearson correlation found that a positive and significant relationship exists between all the '6 Essentials'. The regression model in the current study found a positive and significant relationship between all the '6 Essentials' (excluding job control) and strain on psychological health. These findings were consistent with extant literature, with the exception of job control. The relationship between job control and strain on psychological health was not consistent with the literature, possibly due to the 'professional' work status of engineers and the design responsibility they shoulder and the need for them to have considerable latitude in their control function.

The final chapter will provide conclusions and recommendations based on the findings in this study and offer suggestions for future research.

Chapter 5: Conclusions and Recommendations

5.1. Introduction

The purpose of this study was to determine how workplace stressors cause South African civil engineers to experience psychological distress. The aim was to determine the relationship between various workplace stressors and psychological distress in civil engineers. Given the demanding and stressful nature of the construction industry, it is important to establish the extent to which this causes psychological distress in civil engineers.

The problems addressed by this study were that little is known of the nature of workplace stress experienced by South African civil engineers, and the impact these workplace stressors have on their psychological health.

The following hypotheses as stated in Chapter 1 are explored in this study:

H₁: Poor job resources and communication is positively associated with strain on the psychological health of South African civil engineers.

H₂: Low job control is positively associated with strain on the psychological health of South African civil engineers.

H₃: Unbalanced workload is positively associated with strain on the psychological health of South African civil engineers

H₄: Job insecurity and change is positively associated with strain on the psychological health of South African civil engineers.

H₅: Poor work relationships is positively associated with strain on the psychological health of South African civil engineers.

H₆: Poor job conditions is positively associated with strain on the psychological health of South African civil engineers.

In this chapter, the findings of the study are reviewed, which allows the research problems to be validated by discussing the findings of the study, the research questions to be answered, and the research objectives to be achieved. Furthermore, this chapter documents the achievement of the research aims and whether the

hypotheses postulated *a priori* were upheld or not. Thereafter, conclusions are drawn based on the findings emanating from this study, followed by recommendations for future studies on psychological distress at work.

5.2. Findings of Research Question

In this study, the following research question was asked:

What is the nature of the relationship between workplace stressors and the psychological health of South African civil engineers?

The relationships between the 6 Essentials, all potential stressors, and psychological health were examined. Five of them (resources and communication, balanced workload, job security and change, work relationships and job conditions) were all significantly positively associated with strain on psychological health. However, the sixth stressor, job control, while positively associated, was not significantly associated with strain on psychological health. This aligns with the JDC model which explained that high status workers (such as executives and professionals) have access to the necessary resources to manage a high levels of job demand (Karasek, 1979).

5.3. Research Hypotheses

The research hypotheses were as follows:

H₁: Poor job resources and communication is positively associated with strain on the psychological health of South African civil engineers.

This hypothesis is accepted.

H₂: Low job control is positively associated with strain on the psychological health of South African civil engineers.

This hypothesis is rejected.

H₃: Unbalanced workload is positively associated with strain on the psychological health of South African civil engineers.

This hypothesis is accepted.

H₄: Job insecurity and change is positively associated with strain on the psychological health of South African civil engineers.

This hypothesis is accepted.

H₅: Poor work relationships is positively associated with strain on the psychological health of South African civil engineers.

This hypothesis is accepted.

H₆: Poor job conditions is positively associated with strain on the psychological health of South African civil engineers.

This hypothesis is accepted.

5.4. Achievement of Research Objectives

The research objectives of this study are to:

- a) Determine how poor communication and lack of organisational resources results in psychological distress.
- b) Investigate how job control reduces psychological distress.
- c) Examine how an unmanageable workload causes psychological distress.
- d) Analyse how job security reduces psychological distress.
- e) Assess how positive work relationships decrease psychological distress.
- f) Examine the way in which poor job conditions results in psychological health.

The abovementioned objectives were all achieved via the analysis of the data obtained from respondents to an online survey questionnaire administered to civil engineers registered with SAICE. Clear relationships were identified between these stressors through the regression analysis of the data. The extent to which civil engineers experience psychological distress was discussed in Chapter 4. Objectives (a), (c), (d), (e) and (f) were achieved.

On the other hand, Objective (b) was not achieved as shown in the results of the study that were analysed in Chapter 4. It was found that job control does not significantly influence psychological distress due to the high-status work of the participants and the resources they have available to assist their high-level job demands.

The purpose of this study was to determine how workplace stressors cause South African civil engineers to experience psychological distress. This aim has been achieved.

5.5. Limitations to the Study

It is possible that, due to the length of the survey (15-20 minutes), respondents may have become fatigued while answering the questions. Thus, the data may consequently be distorted as some respondents did not complete all the questions or may have randomised their answers to accelerate their completion. Despite the length of the survey, missing data found from the respondents indicates that participants might have rushed their answers.

The positivistic approach adopted comes at the expense of not being able to capture qualitative data that might have shed light on how the respondents' specific contexts might have influenced their answers. This is not a specific limitation of this research in particular, but of all positivistic approaches in general.

Additionally, the standardised questions are limited in depth as respondents were only allowed to "rate" their experience, as opposed to providing a detailed explanation as a response. Thus, it was not established how or why individuals in the sample experience and respond to stress in a particular way. Despite this, it was found that an online survey questionnaire approach is the most appropriate method for the ASSET model.

5.6. Conclusions

This study examined the nature of the association between workplace stressors and the psychological health of South African civil engineers. It demonstrates that it is appropriate to examine each stressor (i.e., the 6 Essentials) to understand their effects on psychological health using multiple regression analysis.

Unbalanced workload is identified as a crucial determinant of strain on psychological health. This suggests that reasonable working hours and manageable workloads promote positive psychological health.

Poor communication and lack of resources was found to increase the strain on psychological health experienced by civil engineers. This finding suggests that having access to the necessary equipment and training facilities, and open communication channels reduces psychological ill-health.

The findings of the current study showed that workplace relationships influence psychological health. It is implied that collaborative and positive relationships

between civil engineers and their fellow colleagues and boss reduces the strain on psychological health.

The relationship between job insecurity and psychological health was identified as significant. This finding suggests that psychological distress is increased when civil engineers are faced with job redundancy and non-permanent roles.

Poor working conditions was found to increase psychological ill-health. This finding suggests that dull and repetitive tasks and lack of enjoyment of work causes civil engineers to experience a strain on their psychological health.

The relationship between job control and psychological health identified in this study is different from that reported in the literature. Further research into the association between job control and psychological health in the construction industry is warranted.

This study concerns civil engineers in South Africa and therefore broad trends cannot be extrapolated to other professions. The following recommendations are based on the findings that have been presented in Chapter 4 and the conclusions drawn in Chapter 5.

5.7. Recommendations

Possible areas for further inquiry into psychological distress using qualitative methods arose from this research in the current study i.e., how individuals respond to or why do they experience psychological distress. From a practical perspective, the professional associations (SAICE) and council (ECSA) could explore introducing CPD courses for their members in order to provide education in psychological distress, in addition to creating awareness by publishing research reports in newsletters and encouraging participation in research surveys for future publications.

On a microeconomic level, individual firms may also assist in mitigating psychological distress by creating a healthy work environment through workload and time management schemes, encouraging positive workplace relationships through team building activities, and providing workshops and training to prevent the fear of redundancy.

Research pertaining to the causes of weak communication and inadequate resources within organisations is recommended, and the necessary interventions thereof. In addition, it is suggested to investigate means to improve workplace relationships within an organisation, such as team building activities and structured quality management.

Further research could investigate how the promotion of mental health programmes and organisational support affects psychological distress and mitigates workplace stressors in the construction industry. The data in the current study did not allow these suggestions to be explored, and they remain speculations that must await further investigation.

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Appendix A: Descriptive Statistics

The mean indicates how strong the agreement or disagreement is where a mean score between 1 and 3 indicates disagreement, and a score between 4 and 6 represents agreement.

The standard deviation indicates the spread of the data which indicates the extent to which the respondents “slightly agree” / “agree” and “slightly disagree / disagree” with the questions.

This section discusses the mean and standard deviations of each question within the scales using the standard report generated by psychological well-being specialists, Robertson Cooper Ltd.

A. Resources and Communication

This scale measures how people are concerned about a lack of resources or poor communication.

Table 7: Resources and Communication Scale

Item		Mean	Standard Deviation
1	I am troubled that I do not feel I am informed about what is going on in this organisation	3.19	1.60
2	I am troubled that I am never told if I am doing a good job	2.92	1.31
3	I am troubled that I am not adequately trained to do many aspects of my job	2.11	1.19
4	I am troubled that I do not have the proper equipment or resources to do my job	2.83	1.44

The mean ($\bar{x}$) for items 2, 3, and 4 are less than 3 ($\bar{x} < 3$) which means that the respondents disagreed with the questions i.e. they felt that they are told that they are doing a good job, that they are trained to do their job, and have the proper equipment or resources to do their jobs. The mean for item 1 is greater than 3 ($\bar{x} > 3$) which means that, on average, felt that they do not feel informed about what is going on in their organisation.

The standard deviation results suggest that there is a level of concern about resources and communication. People need to believe that they have the necessary training, equipment, and resources to do their jobs well. They must also believe that they have been sufficiently educated and that they have received constructive feedback. In addition to be a significant source of inspiration and motivation, effective communication may also be a source of inspiration and motivation.

B. Control

This scale measures the degree to which people believe they have control over their work circumstances or can select how they work.

Table 8: Control Scale Items

Item		Mean	Standard Deviation
1	I am troubled that I have little control over many aspects of my job	3.73	1.46
2	I am troubled that I am not involved in decisions affecting my job	2.89	1.52
3	I am troubled that my ideas or suggestions about my job are not taken into account	2.84	1.39
4	I am troubled that I have little or no influence over my performance targets	2.85	1.43

The mean ($\bar{x}$) for items 2, 3, and 4 are less than 3 ($\bar{x} < 3$) which means that the respondents disagreed with the questions i.e. they felt that they are involved in the decisions affecting their job, their ideas and suggestions are recognised, and they have influence over their performance targets. The mean for item 1 is greater than 3 ($\bar{x} > 3$) which means that, on average, respondents agree that they have no control over many aspects of their job.

The standard deviation indicates that perceptions of control are linked to feelings of well-being and tension. People who believe they have control over their position are more likely to make active attempts to solve difficulties and to approach their

work in a positive manner. When people believe they have control and influence over their lives, it may protect them from other types of stress, such as work-life balance challenges and heavy workloads. People can better manage various work-related demands if they have control and feel able to make choices about how they manage their work and the working day. A sense of powerlessness, on the other hand, can be a huge source of stress.

C. Balanced Workload

Work-Life Balance

This subscale assesses the degree to which achieving a satisfactory work-life balance is a concern.

Table 9: Work-Life Balance Scale Items

Item		Mean	Standard Deviation
1	I am troubled that I work longer hours than I choose or want to	3.57	1.60
2	I am troubled that I work unsociable hours e.g. weekends, shift work etc	3.06	1.54
3	I am troubled that I spend too much time travelling in my job	2.56	1.46
4	I am troubled that my work interferes with my home and personal life	3.74	1.51

The mean ($\bar{x}$) for items 1, 2 and 4 are greater than 3 ($\bar{x} > 3$) which means that the respondents agreed with the question i.e. they feel troubled that they work longer hours than they want to, work unsociable hours, and that their work interferes with their home life. The mean for item 3 is less than 3 ($\bar{x} < 3$) which means that, on average, respondents disagreed that they travel far for work.

The standard deviation suggests that a healthy balance between employment and other elements of people's lives is critical to their overall psychological well-being. People may suffer a detrimental influence on their personal lives as job obligations (e.g., travel, workload, long hours) increase. People in such situations may feel torn between competing loyalties: on the one hand, they want to spend time with

their families and friends, and on the other, they want to meet the needs of the organisation.

Workload

This subscale assesses how concerned people are about their workload and the time constraints that come with it.

Table 10: Workload Scale Items

Item		Mean	Standard Deviation
1	I am troubled that the technology in my job has overloaded me	2.97	1.40
2	I am troubled that I am set unrealistic deadlines	3.28	1.52
3	I am troubled that I am given unmanageable workloads	3.35	1.53
4	I am troubled that I do not have enough time to do my job as well as I would like	3.68	1.48

The mean ($\bar{x}$) for item 1 is less than 3 ($\bar{x} < 3$) which means that the respondents disagreed that they are overloaded with the technology at their job. The mean for items 2, 3 and 4 are greater than 3 ($\bar{x} > 3$) which means that, on average, respondents felt that they do not feel informed about what is going on in their organisation.

The standard deviation shows that as long as the workload is viewed as manageable, a rigorous workload can be both challenging and motivating. Workloads can be concerning for a variety of reasons, such as having too much work, having too tough job, or having too tight deadlines.

D. Job Security and Change

This scale assesses the degree to which work changes and job insecurity are a source of anxiety.

Table 11: Job Security and Change Scale Items

Item		Mean	Standard Deviation
1	I am troubled that my job is insecure	3.29	1.67
2	I am troubled that my job is not permanent	2.52	1.53
3	I am troubled that my job is likely to change in the future	2.85	1.32
4	I am troubled that my job skills may become redundant in the near future	2.46	1.26
5	I am troubled that my organisation is constantly changing for change's sake	2.81	1.51

The mean ($\bar{x}$) for items 2, 3, 4 and 5 are less than 3 ($\bar{x} < 3$) which means that the respondents disagreed with the questions i.e. they felt that they are secure in the job, they believe their jobs are not likely to change, their skills are relevant, and that their organisation is not changing. The mean for item 1 is greater than 3 ($\bar{x} > 3$) which means that, on average, respondents felt that they are insecure about their jobs.

The standard deviation suggests that it is crucial to feel confident about one's employment, since this allows people to focus properly on their work and maintain high levels of well-being and performance.

E. Work Relationships

This scale assesses the level of concern you have about your work relationships.

Table 12 Work Relationships Scale Items

Item	Mean	Standard Deviation
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1	I am troubled that my boss behaves in an intimidating and bullying way towards me	2.13	1.39
2	I am troubled that I do not receive the support from others (boss/colleagues) that I would like	3.18	1.64
3	I am troubled that I feel isolated at work e.g. working on my own or lack of social support from others	2.87	1.56
4	I am troubled that I am not sure what is expected of me by my boss	2.33	1.21
5	I am troubled that other people at work are not pulling their weight	3.67	1.56
6	I am troubled that my boss is forever finding fault with what I do	2.08	1.18
7	I am troubled that others take the credit for what I have achieved	2.70	1.41
8	I am troubled that my relationships with colleagues are poor	2.06	1.01

The mean ($\bar{x}$) for items 1, 3, 4, 6 7 and 8 are less than 3 ($\bar{x} < 3$) which means that the respondents disagreed with the questions i.e. they felt that their boss is not intimidating, do not feel isolated, understand what is expected of them, their boss is not finding fault in their work, others do not take credit for their work, and they have healthy relationships with their colleagues. The mean for items 2 and 3 are greater than 3 ($\bar{x} > 3$) which means that, on average, they felt that they do not receive sufficient support from their boss/colleagues, and their colleagues do not work hard.

The standard deviation shows that workplace interactions may be energising and aid in achieving high levels of engagement and happiness. They can also assist people in dealing with work stress and maintaining performance in difficult situations. Relationships with supervisors, subordinates, and co-workers can be stressful, affecting health and performance.

F. Job Conditions

This scale assesses employee dissatisfaction with incentives, working environment, and job satisfaction.

Table 13: Job Conditions Scale Items

Item		Mean	Standard Deviation
1	I am troubled that my physical working conditions are unpleasant (e.g. noisy, dirty, poorly designed)	2.27	1.36
2	I am troubled that I may be doing the same job for the next 5 to 10 years	3.20	1.62
3	I am troubled that my job involves the risk of actual physical violence	2.52	1.59
4	I am troubled that my performance at work is closely monitored	2.30	1.19
5	I am troubled that my pay & benefits are not as good as other people doing the same or similar work	3.43	1.57
6	I am troubled that my work is dull and repetitive	2.53	1.32
7	I am troubled that I do not enjoy my job	3.01	1.53

The mean ($\bar{x}$) for items 1, 3, 4, and 6 are less than 3 ($\bar{x} < 3$) which means that the respondents disagreed with the questions i.e. they felt that their physical working conditions are pleasant, they are not at risk of physical violence, their performance is not closely monitored, and their work is not full and repetitive. The mean for items 2, 5 and 7 are greater than 3 ($\bar{x} > 3$) which means that, on average, they felt that their job is not evolving and repetitive, and they do not enjoy their work.

The standard deviation suggests that physical working conditions, pay and benefits equality, and the nature of the work itself can all contribute to stress and discontent.

People's overall enjoyment of work and psychological well-being are influenced by job satisfaction.

G. Strain on Psychological Health

This scale assesses the strain on employees' psychological health in the three months prior to the survey. The mean indicates how strong the agreement or disagreement is where a mean score between 1 and 2 indicates disagreement, and a score between 3 and 4 represents agreement.

The standard deviation indicates the spread of the data which indicates the extent to which the respondents “never”, “rarely”, “sometimes” and “often” experience the feelings described in the questions.

Table 14: Psychological Health Scale Items

Item		Mean	Standard Deviation
1	Feeling unable to cope	2.33	0.88
2	Constant tiredness	2.96	0.99
3	Panic or anxiety attacks	1.90	0.94
4	Having difficulty concentrating	2.44	0.88
5	Mood swings	2.23	0.87
6	Feeling or becoming angry with others too easily	2.66	0.88
7	Loss of sense of humour	2.32	0.89
8	Difficulty in making decisions	2.29	0.80
9	Avoiding contact with other people	2.33	0.91
10	Unable to listen to other people	2.04	0.77
11	Constant irritability	2.58	0.96

4.8.

The mean ($\bar{x}$) for item 3 is less than 2 ($\bar{x} < 2$) which means that the respondents disagreed with the questions i.e. they felt that they did not experience panic or anxiety attacks in the last three months. The mean for all the other items (1, 2 and 4 to 11) are greater than 2 ($\bar{x} > 2$) which means that, on average, they felt that they are not coping, felt constantly tired, struggle to concentrate, experience mood swings, are easily angry, have lost their sense of humour, struggle to make decisions, interact with and listen to others, and experience constant irritation.

The standard deviation indicates that employees experience a significant level of strain on psychological health. There are several possible explanations for any psychological health condition, some of which may be related to sources of pressure at home or at work. The ratings indicate the likelihood of developing more serious psychological health issues.

Appendix B: Ethics Clearance

ETHICS APPLICATION FORM

Please Note:

Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: <http://www.ebe.uct.ac.za/ebe/research/ethics1>

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Daniela Aldera
Department		Construction Economics and Management
Preferred email address of applicant:		alddan001@myuct.ac.za
If Student	Your Degree: e.g., MSc, PhD, etc.	MSc
	Credit Value of Research: e.g., 60/120/180/360 etc.	60
	Name of Supervisor (if supervised):	Professor Keith Cattell
If this is a research contract, indicate the source of funding/sponsorship		N/A
Project Title		Workplace stress experienced by civil and structural engineers in South Africa

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Daniela Aldera	Signed by candidate	09/05/2020
SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	Prof. KS Cattell		11/6/20

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).	Louie van Schalkwyk		25/09/2020
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.	Louie van Schalkwyk		25/09/2020