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Master of Philosophy

**Psychological Conditions of
Construction Workers: Key Determinants
for Safety Perceptions and Behaviors**

August 2015

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Abstract

Psychological Conditions of Construction Workers: Key Determinants for Safety Perceptions and Behaviors

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The Korean construction industry has experienced a high level of industrial accidents and the consistently increasing accident rate. Many safety studies have focused on investigating factors which influence safety incidents and identifying the causal relationships between factors: components, determinants, and antecedents. Although many safety research emphasized that the 3E (Enforcement, Education, and Engineering) approach is a potential solution to enhance workplace safety, there should be benefits to consider psychological (i.e., Emotional) effects on the safety performance since most construction works are human-oriented. Thus, understanding construction workers' psychological conditions can be a priority. This research aimed to explore stress (job stress and stress coping style), personal temperament,

emotional disturbance (depression and trait anxiety), and drinking habit (alcohol use disorder) that can influence worker's safety. The research conducted a survey of 396 respondents from road, bridge, tunnel, subway, and apartment construction sites by using the measurement tools in clinical psychology and the safety models developed by Griffin and Neal (2000). The research first analyzed the overall psychological tendency between different personal background of construction workers including demographic information, employment status, work types, working experiences, and wage conditions. The study then investigated highly-related psychological factors which influenced both safety perception and safety behavior, and identified mediating effects among psychological conditions, safety perception, and safety behavior. The research findings are expected to promote awareness of psychological problems in the construction industry and suggest opportunities for on-site safety enhancement through psychological intervention.

Keywords: Construction Worker, Psychological Condition, Personal Background, Psychological Factor, Safety Behavior, Safety Performance

Student Number: 2013-23155

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Chapter 1. Introduction

1.1 Research Background

Construction injuries take a large portion of the total industrial injuries in Korea. According to the accident report from Korea Occupational Safety and Health Agency (KOSHA), 27.70% of injuries were originated from the construction industry and the ratio of fatalities took the highest proportion of 29.39% of the total fatalities in 2013. The accident rate in construction has also continuously increased from 0.64 to 0.92 since 2008 in contrast to the whole industry's decreasing accident rate from 0.71 to 0.59 during the same period (KOSHA, 2014a, 2014b) (Figure 1.1).



Figure 1.1 Accident Rate in the Korean Construction Industry (2006-2013)

Many safety studies have emphasized that 3E approaches firstly claimed by Harvey (1923)—which included giving safety training (Education), managing worksite safety through regulatory intervention (Enforcement), and applying technologies to proactive risk monitoring and accident prevention (Engineering)—have true potential to reduce workplace injuries and improve safety (Kim and Park, 2002; Ann et al, 2011; Porter, 2011, Park, 2013). They explained that 3E can change safety climate to enhance motivation, knowledge, and behavior of workers and thus perform better safety.

In addition to such extrinsic 3E approaches, psychological aspects of construction workers were also reported as a critical driver for occupational injuries since construction activities are human-oriented and mental conditions affected by stress, depression, anxiety, or alcoholism can cause abnormal behaviors (Haslam et al. 2005; Glasscock et al., 2006; Son, 2011).

1. Work conflicts between general contractors and subcontractors, supervisors and employees, or colleagues, and unfair rewards can lead to stress, and such stress can increase a probability of causing risk behaviors and accidents (Leung et al., 2010).

2. Personal dispositions, such as overconfidence, intolerance, and aggression, can also influence risk-taking behavior (Iverson and Erwin, 1997; Son, 2008; Suh, 2010).

3. Haslam et al. (2005) pointed out that depression and anxiety can cause poor concentration, emotional distress, lack of motivation and difficulties with decision making, and argued that emotional

disturbance needs to be relieved to improve workplace safety.

4. Alcohol abuse is a negative factor on safety (Leung et al., 2010; Son, 2011): alcohol impairment can increase the risk of accidents being fatal (Li and Bai, 2008).

In one of the earliest accident causation studies, Heinrich (1936) suggested five sequential dominos contributing to an accident injury: (1) social environment and ancestry, (2) inherent fault of a person, (3) unsafe act and mechanical or physical hazards, (4) accident, and (5) injury (Figure 1.2). Each domino falls over one another and causes a chain reaction subsequently giving rise to an accident leading up to worker injuries (Chi and Han; 2013). The 3E approaches mostly deal with the third domino: preventing accidents by controlling working environment and unsafe behaviors of workers. The psychological approach is more related to the second domino “the inherent fault of a person” and the possibility of having accidents might decrease double if both second and third dominos are considered to be eliminated (Lim and Chi, 2014). Thus, investigation of psychological, that is “Emotional”, factors will explain more inherent accident causes from the human being’s point of view and 4E approaches will benefit to safety enhancement by enriching the concept of 3E.

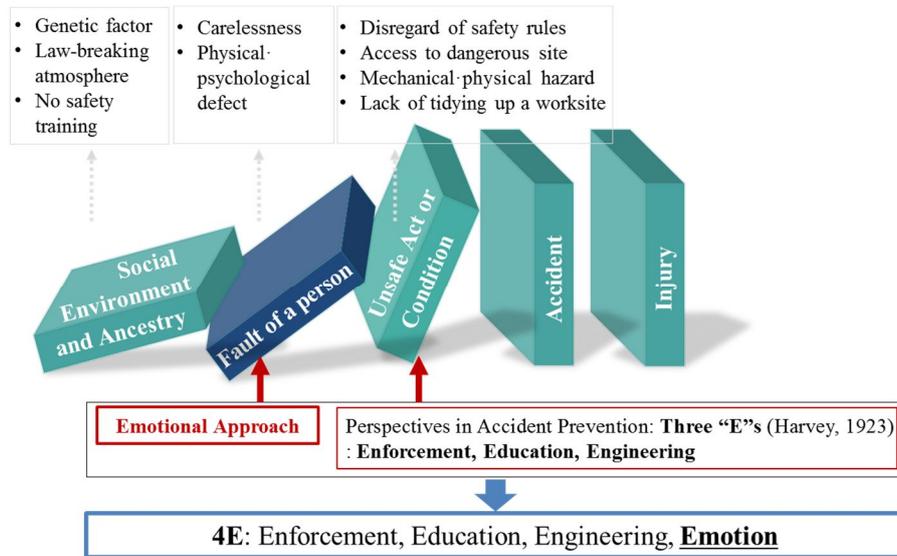


Figure 1.2 Importance of 4E in Domino Theory

1.2 Problem Statement

To understand the workers' psychological conditions that can impact on the safety performance, it is very important to develop reliable monitoring or measurement tools of workers' mental health.

The previous research mostly used a survey approach by using a self-developed questionnaire for the mental health analyses. However, such studies showed difficulties to investigating the specific or unique mental conditions of construction workers due to lack of global standards for the comparison with general public or other industries. Also, the self-developed questionnaire was normally less reliable since the construction researchers have limited

psychological knowledge. Therefore, it is important to investigate more scientific and trustable approaches to develop a questionnaire in clinical psychology to compare with other cases and figure out a construction workers' position of mental conditions.

Second, the previous researchers mainly focused on environmental conditions that nurture mental health and thus influence workers' safety perception (Figure 1.3). There are specific personal "dispositions" which are vulnerable to accident (Jin and Lee, 2013), but still "characteristics" are used despite its nurtured property. Thus, it is needed to consider natural psychologies including stress coping style and temperament, and identify their relationships with personal safety performance.

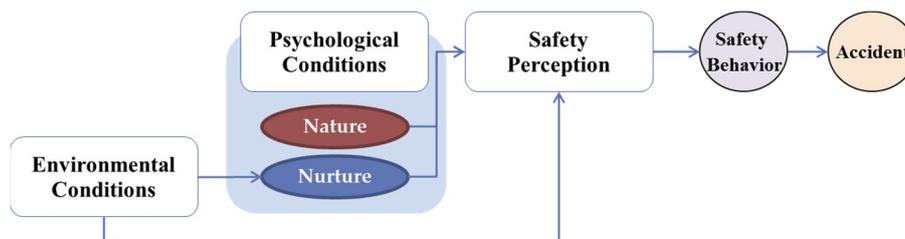


Figure 1.3 Natural and Nurtured Psychological Conditions

1.3 Research Objectives and Scope

The primary purpose of this study is to analyze the psychological conditions of construction field workers in Korea and identify the relationships between psychological conditions and personal safety

performance. Specific research objectives are:

1) Understand the level of psychological conditions of construction field workers in Korea using four categories from the field of clinical psychology (Figure 1.4): (1) stress (job stress and stress coping style), (2) personal temperament, (3) emotional disturbance (depression and trait anxiety), and (4) drinking habits (alcohol use disorder).

1-1) Understand average mental conditions of construction workers.

1-2) Explain mental conditions based on different personal background.

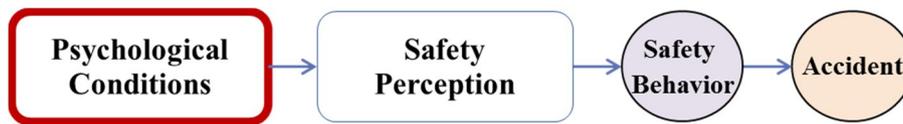


Figure 1.4 The First Purpose of the Research: Understand the Level of Psychological Conditions

2) Investigate relationship between psychological conditions and individual safety of construction field workers (Figure 1.5).

2-1) Figure out psychological factors which influence safety-related factors (e.g., safety perception and safety behavior).

2-2) Identify mediating effects between psychologies and safety performances.

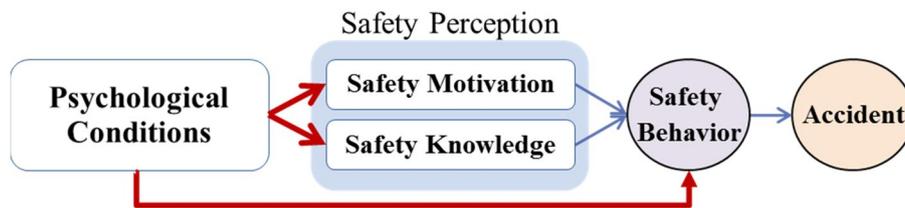


Figure 1.5 The Second Purpose of the Research: Investigate Relationship between Psychological Conditions and Safety-related Factors

The research is limited to construction field workers in Korea specifically workers in road, tunnel, bridge, subway, and apartment construction projects.

This paper is organized into six chapters. Following this introduction, Chapter 2 describes the developed research methodology. Chapter 3 then presents the results of construction field workers' psychological conditions along with the statistical analyses. The relationships between psychological conditions and safety performance are explained in Chapter 4, and significant results are discussed in Chapter 5. Chapter 6 concludes the research with contributions and future research opportunities.

Chapter 2. Research Methods

The overview of research methods is described in Figure 1.6. Based on literature review, we found four psychological categories which can influence construction workers' safety behaviors, and developed the questionnaire for personal backgrounds of construction field workers, psychological conditions, and safety-related. Each part had categories and subcategories, such as employment status and work position in personal backgrounds. The smallest classes were named as "Option" in personal backgrounds and "Subscales" in psychological conditions and safety-related factors.

Next, the authors conducted survey in target respondents from road, tunnel, bridge, subway, and apartment sites, and analyzed data to understand the average psychological conditions of construction workers using comparison with other case studies and cutoff scales. ANOVA and Homogeneity Test were used to compare psychologies based on personal backgrounds. We also investigate relationships between psychological conditions with using correlation analysis, multiple linear regression, and mediating effects analysis.

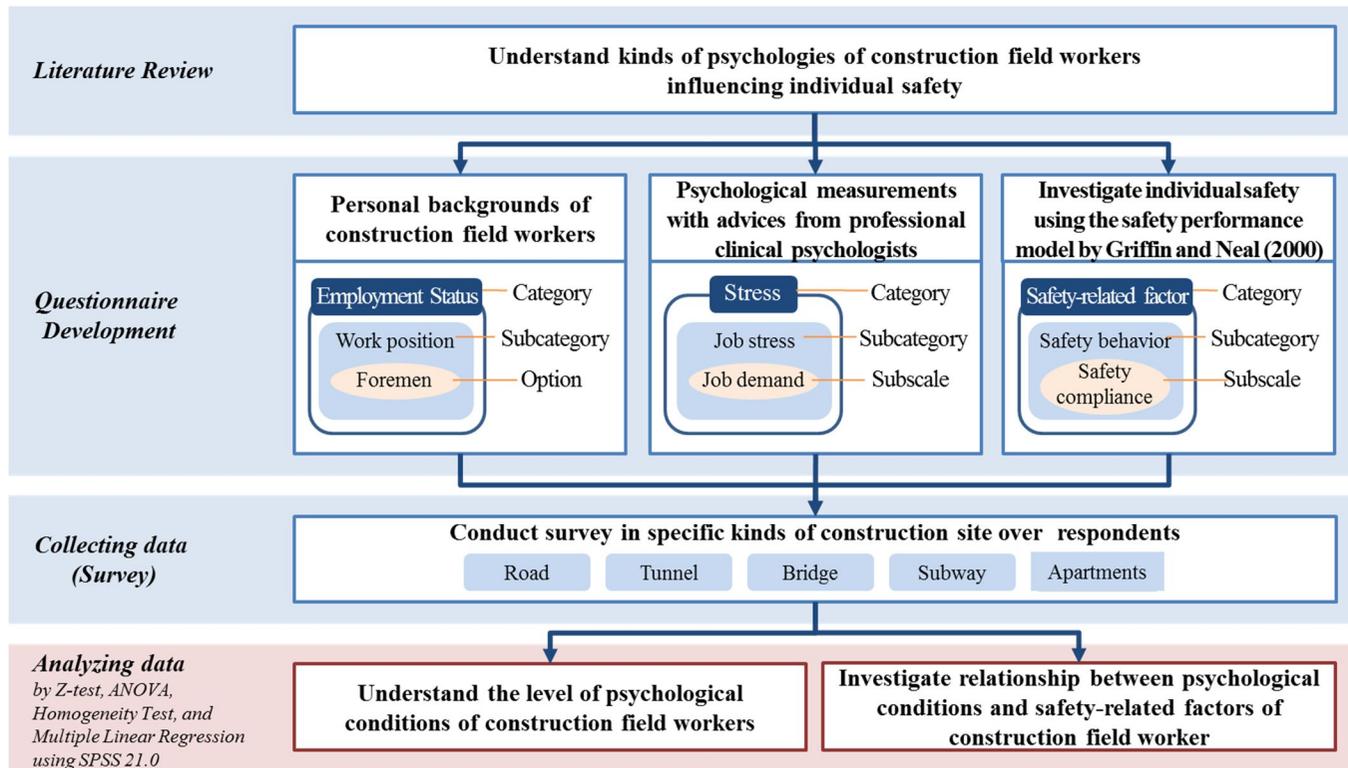


Figure 1.6 The Overview of Research Methods

2.1 Questionnaire Development

The research explored stress, personal temperament, emotional disturbance, and drinking habit that can influence safety behavior or cause incidents. The measurement tools verified by clinical specialists were employed to understand the level of mental health of construction field workers and its seriousness. The instruments were verified their internal reliability acquired by the Cronbach's alpha which is larger than 0.6 (You, 2013). The credibility and reliability of the measurements made it possible to compare the results with workers in other industries or general populations. To analyze workers' safety performance including safety perception and behavior, the model developed by Griffin and Neal (2000) was adapted.

All questions were scored using a Likert scale from one (not at all) to four or five (very much) and high scores indicated that a respondent had a high tendency of the corresponding psychology. Some questions were intentionally customized that a high score meant a low inclination for the corresponding psychology to obtain participants' consistent responses. The detailed overview of the developed questionnaire is summarized in Table 2.1.

The questionnaire was also ethically approved by the Institutional Review Board (IRB, Approval No. E1403/001-005) since the research analyzed personal psychological conditions.

2.1.1 Construction Workers' Personal Backgrounds

For strategic analyses, the personal background information was important to be collected: it covered (1) demographic information, (2) employment status, (3) work types, (4) working experiences, and (5) wage conditions. More specifically, demographic information included gender, age, educational background (e.g., under middle school, high school, junior college, or university), and marital status (e.g., unmarried, married, or divorced). Employment status consisted of type of employment (e.g., full-time worker, contract worker, or daily worker), position of company (e.g., general contract and subcontract), work position (e.g., foremen, craftspeople, or assistants). In addition, construction trades (e.g., iron workers, carpenters, earth workers, equipment installers, welders, electricians, construction machine operators, or safety managers (Construction Association of Korea, 2005)) and type of construction (e.g., road, tunnel, bridge, subway, or apartments) composed work types. Working experiences explained both working experience in years and working experience on present work site. Wage conditions described the type of pay (e.g., daily or monthly) and amount of income.

2.1.2 Psychological Conditions

(1) Stress

To investigate job stress, the Korean Occupational Stress Scale Short Form (KOSS-SF) developed by the Occupational Safety and Health Research Institute in Korea (Chang et al., 2005) was used. It includes seven subscales;

job demand (e.g., time pressure, increasing workload, insufficient rest, and multiple functioning), insufficient job control (e.g., non-creative work, skill underutilization, little or no decision making, and low level of control), interpersonal conflict (e.g., inadequate supervisor, co-worker support, and emotional support), job insecurity (e.g., uncertainty and undesirable changes of job status), organizational system (e.g., unfair organizational policy and support, inter-department conflict, and limitation of communication), lack of reward (e.g., unfair treatment and future ambiguity, and interruption of opportunity), and occupational climate (e.g., authoritarian culture, inconsistency of job order, and gender discrimination) (Kwak, 2009). The questionnaire was designed that the more stress a respondent suffers, the larger the score is (total score: 100).

In addition, the research selected the Ways of Coping Checklist (WCC) to understand stress coping style, which means personal sensitivity under stressful situations. According to Folkman (1984), “coping” is defined as cognitive and behavioral efforts to manage internal or external conditions for mental challenges: individuals feel differently about the level of stress under the same conditions. WCC was developed by Folkman and Lazarus (1985) to measure such individual coping styles. Cho (2009) transformed it to fit into the Korean context using a factor loading method: it contains problem-focused coping, seeking social support coping, emotion-focused coping, and wishful thinking coping. The first two elements are regarded as active coping strategies, while the latter two are considered as passive coping strategies. When someone has a strong problem-focused coping style the person might try hard to alter their stressful situation. A seeking social support style means

that a person wants to talk to others to clarify their problems. A person who has an emotion-focused coping style tries to isolate him or herself from stressful emotions. Last, wishful thinking coping fits with a person who imagines the end of their stressful situation without efforts or hope for a miracle (Vitaliano et al., 1985).

(2) Personal Temperament

Temperament is defined as the automatic emotional reactions by neurobiological responses to external stimulus (Cloninger et al., 1993). It varies with personal inheritance and is not easily changed during a person's lifetime (Kim et al., 2003; Lee and Hwang, 2009). This research adopted Temperament and Character Inventory Revised Short version (TCI-RS) developed by Goth et al. (2003), which was transformed to the Korean context by Min et al. (2007). TCI-RS consists of four main subscales: novelty seeking, harm avoidance, reward dependence, and persistence.

A person who gets high score in novelty seeking is impulsive, quick tempered, exploratory, and curious. Thus, they might suffer hardships performing a simple and structured task or following rules. Meanwhile, someone who has a high harm avoidance score is cautious, apprehensive, pessimistic, and fearful, and would prepare for danger carefully. With high reward dependence a person is sympathetic, moody, open, and dependent. This person can easily form relationships with other people and understand emotions in others. If a person has a high persistence score, they would be industrious, ambitious, overachieving, and flawless. Once they start doing a job, they might keep on until the end of the job. They also have a tendency to

stick to their successful experiences. (Cloninger, 1987; Cloninger and Svarakic, 1997; Kim et al., 2003; Min et al., 2007).

(3) Emotional Disturbance

The CES-D (Center for Epidemiologic Studies Depression Scale) first developed by Radloff (1977) is widely used to measure levels of depression. It explains how often the respondents experience a loss of appetite, irritation, fear, happiness, sadness, and other symptoms related with depression. This research adopted the CES-D (20 questions) Korean version transformed and verified by Chon and Rhee (1992).

Additionally, we used the State Trait Anxiety Index (STAI-T, or STAI-II by Kim and Shin (1978)), a transformed version of STAI that was originally developed by Speilberger et al. (1970). Trait anxiety is a disposition to perceiving one's circumstance as a threat on a day-to-day basis including tiredness, worry, and discomfort.

(4) Drinking Habit

The World Health Organization (WHO) developed the Alcohol Use Disorder Identification Test (AUDIT), and Kim (1999) transformed and verified the Korean AUDIT (AUDIT-K), which was adapted for this research. As a clinical assessment, the tool helps to detect a person with problematic alcohol use which has the high probability of developing into alcoholism. Drinking frequency and quantity, alcohol dependence symptoms, and alcohol-related troubles can be measured by AUDIT-K.

2.1.3 Safety-related Factors

The model of performance (Campbell, Gasser, & Oswald, 1996), in which work performance is composed of three elements including components, determinants, and antecedents, can be also applied to safety performance. “Components” of performance mean the actual behaviors, and they cover task performance and work performance (Borman and Motowidlo, 1993). In terms of safety, safety compliance can refer to task performance and safety participation can indicate contextual work performance (Griffin and Neal, 2000). Safety compliance is described as core safety activities that should be carried out by employees to maintain workplace safety. For instance, these behaviors explain following safety rules and wearing personal protective equipment. Safety participation embraces safety behaviors that help to develop a safety environment. Participating in voluntary safety activities and attending safety meetings are kinds of safety participation activities.

Safety motivation and safety knowledge are “determinants” of safety performance. These factors bring performance differences between individuals. Campbell et al. (1993) claimed that knowledge, skill, and motivation are the most critical determinants of individual performance. Thus, safety performance can be determined by the knowledge and skills essential for particular behaviors as well as by the motivation of individuals to lead to the behaviors (Griffin and Neal, 2000).

In this study, individual safety (i.e., safety-related factor) was measured

by two categories: safety perception (i.e., determinant) and behavior (i.e., component). Safety behaviors were investigated to identify relationships with psychological conditions (i.e., antecedent). Moreover, construction workers' individual perception of safety was measured to explore mediating effects between psychological conditions and safety behaviors. As discussed, safety motivation and safety knowledge were categorized as safety perception.

For the questionnaire development, the research adapted the Griffin and Neal (2000)'s model that was widely used to identify general workers' safety and also validated by the empirical results by Kim and Park (2002) and Shin (2012). All questions were scored as Likert scale from one (not at all) to five (very much) and higher score meant the higher level of safety perception or safety behavior.

Table 2.1 Developed Psychological Categories and Safety-related Factors

Categories	Subcategories	Subscales	Description	Internal reliability (Cronbach's alpha)
Stress	Job stress	1. Job demand	Time pressure, increasing workload, insufficient rest , and multiple functioning	0.71
		2. Insufficient job control	Non-creative work, skill underutilization, little or no decision making, and low level of control	0.66
		3. Interpersonal conflict	Inadequate supervisor, co-worker support, and emotional support	0.67
		4. Job insecurity	Uncertainty and undesirable changes of job status	0.61
		5. Organization system	Unfair organizational policy and support, inter-department conflict, and limitation of communication	0.82
		6. Lack of reward	Unfair treatment and future ambiguity, and interruption of opportunity	0.76
		7. Occupational climate	Authoritarian culture, inconsistency of job order, and gender discrimination	0.51
	Stress coping style	8. Problem-focused	Might try hard to change their stressful situation	0.88
		9. Seeking social support	Want to talk to others to clarify their problems	0.79
		10. Emotion-focuse d	Try to isolate themselves from stressful emotions	0.68
		11. Wishful thinking	Imagine the end of their stressful situation without efforts or hope for a miracle	0.65

Table 2.1 (Continued)

Categories	Subcategories	Subscales	Description	Internal reliability (Cronbach's alpha)
Personal temperament	Novelty seeking	12. NS1. Exploratory Excitability	Impulsive, quick tempered, exploratory, and curious → Suffer hardships performing a simple and structured task or following rules	0.84
		13. NS2. Impulsiveness		
		14. NS3. Extravagance		
		15. NS4. Disorderliness		
	Harm avoidance	16. HA1. Anticipatory Worry & Pessimism	Cautious, apprehensive, pessimistic, and fearful → Prepare for danger carefully	0.84
		17. HA2. Fear of Uncertainty		
		18. HA3. Shyness with Stranger		
		19. HA4. Fatigability		
	Reward dependence	20. RD1. Sentimentality	Sympathetic, moody, open, and dependent → Easily form relationships with other people and understand emotions in others	0.77
		21. RD2. Openness to warm communication		
		22. RD3. Attachment		
		23. RD4. Dependence		
	Persistence	24. P1. Eagerness of effort	Industrious, ambitious, overachieving, and flawless → Once start do a job, might keep it on until the end of the job. Have a tendency to stick to their keep on until the end of the job	0.85
25. P2. Work hardened				
26. P3. Ambition				
27. P4. Perfectionism				

Table 2.1 (Continued)

Categories	Subcategories	Subscales	Description	Internal reliability (Cronbach's alpha)
Emotional disturbance	-	28. Depression	How often experience a loss of appetite, irritation, fear, happiness, sadness, and other symptoms	0.89
		29. Trait anxiety	A disposition to perceiving one's circumstance as a threat on a day-to-day basis including tiredness, worry and discomfort	0.89
Drinking habit	-	30 Alcohol use disorder	Drinking frequency, quantity, alcohol dependence symptoms, and alcohol-related troubles	0.83
Safety-related factors	Safety perception	31. Safety motivation	Motivation to perform a job in a safe manner	0.89
		32. Safety knowledge	Employee's understanding of safe operating procedures and adequate safety training and instruction	0.90
	Safety behavior	33. Safety compliance	Core safety activities carried out by employees to maintain workplace safety, such as following safety rules and wearing personal protective equipment	0.88
		34. Safety participation	Safety activities to develop an environment that supports safety, such as participating in voluntary safety activities or attending safety meetings	0.90

2.2 Data Analysis Methods

The main objective of this study is to understand construction workers' psychological conditions and explore relationships between psychological conditions and safety-related factors. To accomplish the first objective, we used the methods including comparison with other case studies and with cutoff scales. ANOVA and the homogeneity test were applied to identify different psychological conditions based on construction workers' personal backgrounds. The second objective was achieved by correlation and multiple linear regression analyses, and mediating effects showed more specific relationships between psychological conditions and safety. For strategic analysis, SPSS 21.0 for Windows was utilized.

2.2.1 Comparison with Other Case Studies

Job stress, stress coping style and temperament are not absolutely abnormal mental states, so they are relative values. Thus, we compared mental conditions of construction workers with conditions of other industry workers (e.g., harsh working conditions: firefighters; normal working conditions: general office workers and Korean adult males). The averages of the construction field workers' data were compared with other industries' data using Z-test by considering the sample size. The test statistic at a 0.05 significance level was:

$$z = \frac{\bar{x}_1 - \bar{x}_2 - 0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (\text{Eq. 1})$$

\bar{x} : the average stress from each cause of occupational stress

subscription 1: construction worker (target data)

subscription 2: respondents in the other cases

s: standard deviation of the data

n: number of the target population.

The critical point of this one-tailed test at the 0.05 significance level was 1.645. If the z value is larger than 1.645, construction workers suffer more than people in the comparison groups; whereas if the z value is smaller than -1.645, the comparison target tends suffering more in the given psychological condition than the construction workers.

2.2.2 Comparison with Cutoff Scales

Since the inventories of depression, trait anxiety, and alcohol use disorder provide evaluation scales for problem measurement, the results will be analyzed based on the provided threshold scores to screen people who experience bad psychological conditions.

2.2.3 ANOVA and Homogeneity Test

This research used the F-test in ANOVA to compare psychological scores with different personal backgrounds because ANOVA is effective for the discrete independent variables (i.e., personal background) and continuous dependent variables (i.e., job stress, stress coping style, and temperament). A

prior assumption for ANOVA is equal variance of the comparison target, so the results which did not satisfy this assumption were eliminated even if p-values were significant.

On the other hand, depression, trait anxiety, and alcohol use disorder provide the number of respondents in divided classes who experience different severity of symptoms. Therefore, the chi-square test was used with a significance level of 0.05 for homogeneity using cross tabulation since both independent (i.e., personal background) and dependent (i.e., depression, trait anxiety, and alcohol use disorder) variables are discrete. Rejecting hypothesis of homogeneity means that personal backgrounds show different distribution of disorders. This research also used Fisher's exact test when expected responses of less than five people are more than 20% of the total category group cells (Lee, 1997).

2.2.4 Correlation Analysis and Multiple Linear Regression

Psychological conditions influence safety incidents (Goldenhar et al., 2010; Leung et al., 2010; Abbe, 2011; García-Herrero et al., 2012). This study measured such relationship by investigating safety behavior. Pearson's correlation analysis was first conducted to find out interrelationships between psychological factors and safety perception or safety behavior. If some independent variables have a high level of correlation, it is hard to distinguish the effect on dependent variables of each independent variable. To guarantee that this multi-collinearity does not occur, the research checked variance of inflation factor (VIF). The larger than 10 VIF value means the existence of

multi-collinearity (Pallant, 2001).

Next, multiple linear regression analysis was performed to identify explanatory power (i.e. contribution for the linear model) of each psychological variable. Since this research had a property of explanatory study, the stepwise selection method was selected for implementation (Park, 2004). Variables are added in the order of significance, and the explanatory power is recalculated when a new variable is added. As a result of recalculation, if a variable's increment of coefficient of determination, R^2 , is not significant, that variable is eliminated in the model. Following these steps, the number of variables in the model can be minimized (Brace et al., 2012).

2.2.5 Mediating Effects Analysis

When a relationship or direction between independent variables exists, mediators explain how or why such influences occur (Baron and Kenny, 1986). To identify the effects of such mediators, Baron and Kenny (1986) suggested three-step mediated regression analysis. There are three components: a predictor (X) as an independent variable, mediator (M), criterion variable (Y) as a dependent variable. The first step is to conduct regression analysis with a psychological condition as a predictor (X) and one of the safety perception variables as a mediator (M) (Figure 2.1a). Next, do the same approach with one of the psychological conditions variables as a predictor (X) and a dependent variable (Y) (Figure 2.1b). Finally, input the predictor (X) and the mediator (M) simultaneously as independent variables to the regression model (Figure 2.1c). The letters (i.e., a, b, c, and c') on the each

route indicate the standardized coefficient, and all routes should be significant. When c' is not zero and smaller than c , it represents partial mediation; whereas the model shows full mediation or complete mediation if c' is zero. On the other hand, there is another method provided by Sobel (1982) to verify significance of a mediating effect. The test statistic at a 0.05 significance level was:

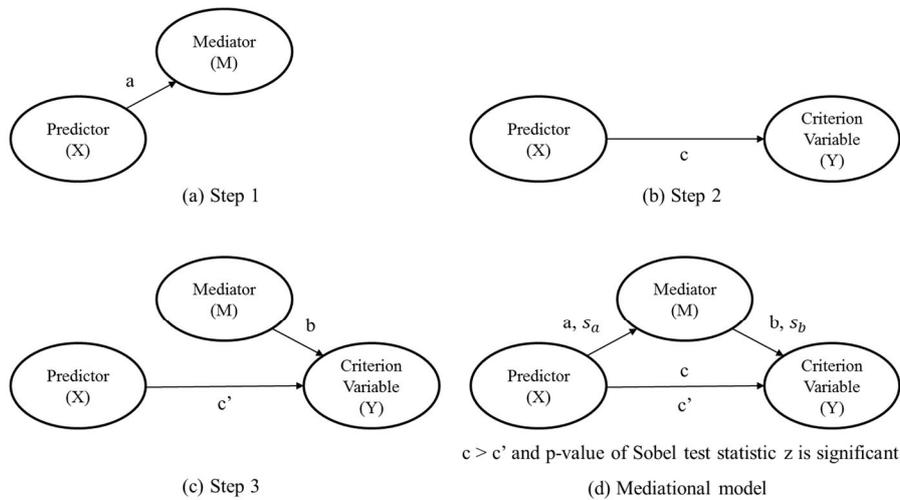
$$z = \frac{ab}{\sqrt{b^2 s_a^2 + a^2 s_b^2}} \quad (\text{Eq. 2})$$

a, b : the standardized coefficient of the each regression route

subscript a, b : the each regression route

s_a, s_b : standard error of the route.

Not only comparing c with c' , but also the Sobel test was used to verify the mediation results (Sobel, 1982; Soper, 2015).



† a, b, c, c': the standardized coefficient (β) of the each regression route
 † s_a, s_b : standard error of the route
 † $c > c' \neq 0$: partial mediation
 † $c > c' = 0$: complete mediation or full mediation

Figure 2.1 The Three-Step Mediated Regression Analysis by Baron and Kenny (1986)

To investigate mediating effects, some hypotheses set as below. The hypotheses did not consider psychological conditions which have natural or genetic properties such as stress coping style and temperament since those innate conditions cannot be easily changed by external intervention such as safety motivation or knowledge.

H1. Safety perception mediates between subscales of job stress and safety behaviors.

H2. Safety perception mediates between subscales of depression or trait anxiety and safety behaviors.

H3. Safety perception mediates between subscales of alcohol use disorder and safety behaviors.

Chapter 3. Construction Workers' Psychological Conditions

The target respondents were divided into five groups: workers in road, tunnel, bridge, subway, and apartment projects. To attain reliable statistical results, the research calculated the minimum number of respondents using G*Power developed by Heinrich-Heine-Universität Düsseldorf (Park, 2013): the sample size of 304 was estimated to satisfy conditions for statistical analyses. The specific input variables for the test included an effect size of 0.08, a significance level of 0.05, and a maximum number of options for processing analysis at once of 9 and the detailed information of G*Power analysis can be found from the provided reference.

The research collected the total of 430 responses: 59 respondents from road, 73 from tunnel, 51 from bridge, 64 from subway, and 183 from apartment sites. Some responses that had no answer were eliminated from the analysis sample (Shin, 2013). Consequently, we analyzed 59, 62, 44, 62, and 169 responses respectively (total 396 responses).

Site condition is important to be preset for reliable analyses. The road construction sites did not include tunnel or bridge section and the tunnel sites represented the ongoing boring stage. For bridge construction sites, the length of the bridge required to be over 1 km. The subway sites were to be over 1-km

underground and included more than one station. For the apartment sites, it was determined that each apartment complex accommodated more than 600 households and respondents needed to be working on the main construction stage (i.e., after earthwork and before finishing the exterior and interior).

3.1 Distributions of Data

The personal background information of the collected data is visualized in Figure 3.1. The majorities of the respondents were male (98.2%), over 50 years old (50.8%), and married (68.9%). For the educational background, 58.3% of respondents completed high school. The type of employment comprised of full-time (11.6%), contract (23%), and daily (64.6%) workers. The ratio between general contractors and subcontractors was 15.9% to 84.1% and the work position included 31.8% foremen, 52% craftspeople, and 16.2% assistants. The respondents also included a range of different types of workers (e.g., 32.1% carpenters, 14.4% iron workers) from five different construction sites. Workers in the 10-20 years (30.3%) and over 20 years (34.8%) working experiences were the majorities. Respondents' working experience on the present work site varied: 3-6 months (20.2%), 6-12 months (25.8%), and over 1 year (24.2%). Most workers were paid monthly (70.7%) and earned over 2,500,000 Korean won (US\$2,500) per month.

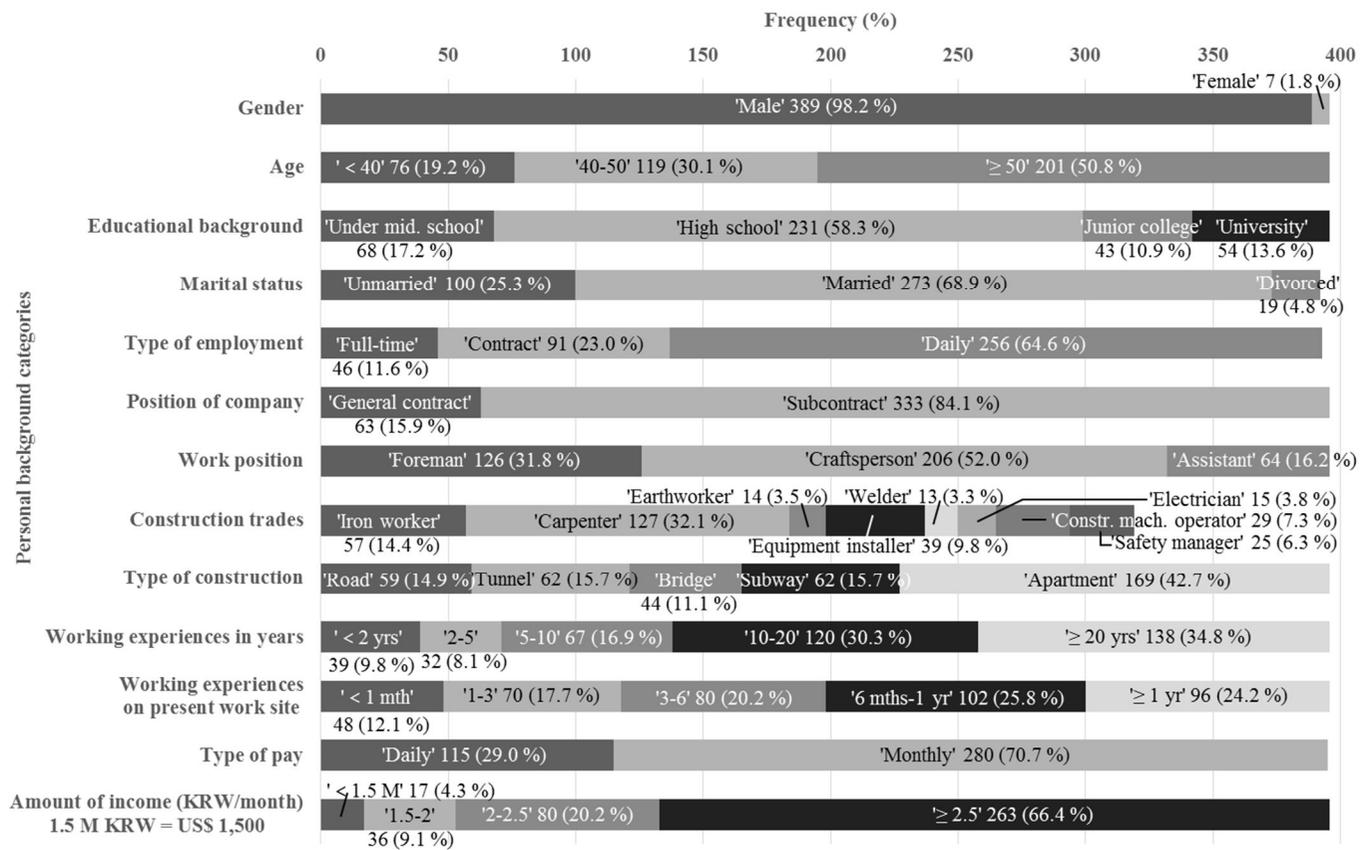


Figure 3.1 Distributions of Data

3.2 Average Psychological Conditions of Construction Workers

3.2.1 Stress

To understand the level of job stress of construction workers, we first analyzed construction workers' stress level measured by KOSS-SF against the one of firefighters (very harsh working conditions). The stress data of firefighters was provided by Cho (2010), who studied 456 firefighters' mental conditions in Korea using KOSS-SF. As shown in Table 3.1, the overall stress score of construction field workers showed a similar trend to that of firefighters when considering the p-values were not significant in both comparisons with the exception of stress by job demand and insufficient job control that had significant p-values. The exceptions meant firefighters suffered from stress more than construction workers. The stress from the insufficient job control (49.4) of construction workers was relatively higher than other stress factors and the stress from interpersonal conflict (37.6) and occupational climate (37.6) were comparatively low by ANOVA ($F = 31.57$, $p = 0.00$) (Figure 3.2).

Table 3.1 Comparisons of Job Stress Score between Construction Field Workers and Firefighters

Section	Subscales	Construction field workers		Firefighters		z	p	
		M	SD	M	SD		C > F ^a	C < F ^b
Job stress	Job demand	47.3	17.3	53.9	19.7	-4.83	1.00	0.00*
	Insufficient job control	49.4	15.7	53.7	15.7	-3.83	1.00	0.00*
	Interpersonal conflict	37.6	14.8	36.2	15.7	1.30	0.10	0.90
	Job insecurity	46.8	21.0	44.7	21.6	1.35	0.09	0.91
	Organization system	44.0	14.5	44.3	19.9	-0.24	0.60	0.40
	Lack of reward	45.8	15.7	43.9	18.6	1.47	0.07	0.93
	Occupational climate	37.6	16.2	36.1	20.8	1.11	0.13	0.87
	Average	44.1	10.3	44.7	12.7	-0.73	0.77	0.23

^a Under confidence level=0.95, significance probability (p-value) < 0.05 means the average of construction field worker is higher than that of firefighters (C > F).

^b Vice versa (C < F).

* p < .05

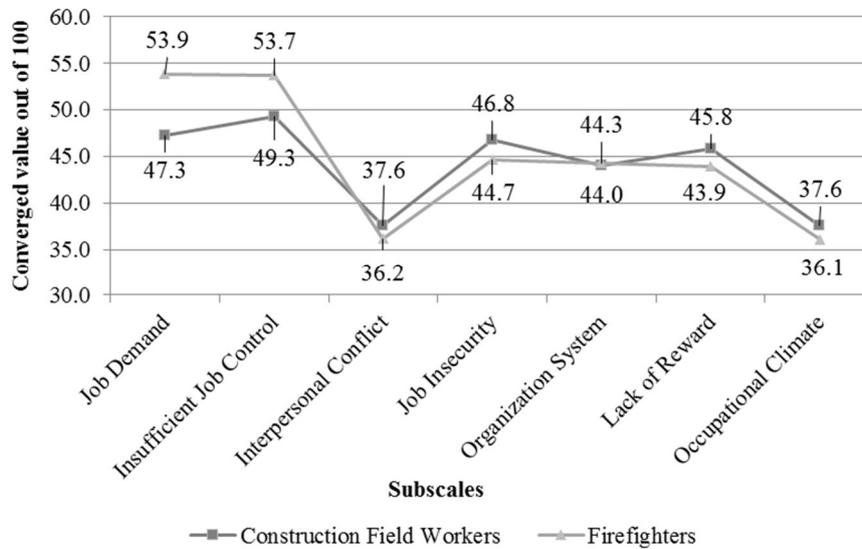


Figure 3.2 Comparisons of Subscales in Job Stress between Construction Field Workers and Firefighters

The research then compared the construction workers’ stress coping styles with general office workers from Kang (2012)’s data. Since the total score used by Kang differed from this study, it was converted into the total of 100 score scale. Construction workers were more likely to use a problem-focused coping style than the other strategies. The next preferred coping styles by ANOVA ($F=169.77$, $p=0.00$) were seeking social support, emotion-focused coping, and wishful thinking in the order named. General office workers, however, had a higher problem-focused coping style and wishful thinking than construction workers under a stressful situation. Seeking social support coping was on a similar level between the two target populations (Table 3.2).

Table 3.2 Comparisons of Stress Coping Style between Construction Field Workers and General Office Workers

Section	Subscales	Construction field workers				General office workers				z	p	
		Raw score		Converted score		Raw score		Converted score			C > G ^a	C < G ^b
		M	SD	M	SD	M	SD	M	SD			
Stress coping style	Problem-focused	45.3	5.5	61.1	11.5	21.2	4.9	63.3	20.4	-1.90	0.97	0.03*
	Seeking social support	13.8	2.0	58.8	13.4	20.4	4.5	59.8	18.5	-0.86	0.81	0.19
	Emotion-focused	9.6	1.7	46.5	14.4	15.9	3.7	41.3	15.4	4.91	0.00*	1.00
	Wishful thinking	16.3	2.6	44.3	12.4	20.3	3.8	59.6	16.0	-15.15	1.00	0.00*

^a Under confidence level=0.95, significance probability (p-value) < 0.05 means the average of construction field worker is higher than that of firefighters (C > F).

^b Vice versa (C < F).

* p < .05

3.2.2 Personal Temperament

This study made a comparison between construction worker's personal temperament data and that of normal adult males in Korea of the 980 samples (Min et al., 2007) since the target population of construction workers consisted mostly of males (98.2%) in this study.

In three areas of novelty seeking, harm avoidance, and reward dependence, the average score of a construction field worker was higher than that of a Korean adult male. Min et al. (2007) also suggested that the score range of under 45, 45 to 55, and over 55 indicated low, medium, and high temperament respectively. Based on this, construction workers' and general Korean men' temperaments, especially the novelty seeking, harm avoidance and reward dependence, were low, while persistence was medium (Table 3.3). Low scores of novelty seeking showed that a person is reflective, rigid, loyal, and slow tempered. Such person tends to follow regulations and act systematically. The novelty seeking score of the construction workers was higher than that of Korean adult males in general.

In addition, when harm avoidance scores are low, a person is confident, carefree, energetic, and daring. Such person has a tendency to act calm and optimistic in dangerous or changeable working situations. Over-optimism, however, can make a person insensitive to danger. The average harm avoidance score of the construction workers was higher than that of a Korean adult male.

Table 3.3 Comparisons of Personal Temperament between Construction Field Workers and Korean Adult Male

Section	Subscales	Construction field workers		Korean adult males		z	p	
		M	SD	M	SD		C > K ^a	C < K ^b
Temperament	Novelty seeking	32.3	9.6	29.6	9.2	4.84	0.00*	1.00
	Harm avoidance	37.4	9.3	33.7	10.0	6.48	0.00*	1.00
	Reward dependence	43.2	7.9	42.0	8.1	2.53	0.01*	0.99
	Persistence	46.1	8.5	46.1	9.7	0.02	0.49	0.51

^a Under confidence level=0.95, significance probability (p-value) < 0.05

means the average of construction field worker is higher than that of Korean adult males (C > G).

^b Vice versa (C < G).

* p < .05

Individuals in low reward dependence are normally susceptible to “rewards” in behaviorism (i.e., feedback from other people) and tough-minded, practical, detached, and independent. The low average scores can indicate that they can be insensitive to other people’s changing emotions, independent, and in a low level of emotional exchange with others.

On the other hand, a high level of persistence represents a person who tends to make steady and persistent efforts. This type of person is likely to be industrious, ambitious, an overachiever, and a perfectionist. Both construction workers and Korean males in general showed a medium achievement motivation.

3.2.3 Emotional Disturbance

Degree of depression can be categorized into the four levels: normal (0-15), mild (16-20), moderate (21-24), severe (25 or higher) (Chon and Rhee 1992; You et al., 2010). 62.4% of construction workers were free from depression; however, 37.6% of the total population suffered symptoms of depression. It is recommended that a person who has mild depression (15.4%) needs to seek medical help; as such, 22.2% of construction workers with moderate or severe depression should get a diagnosis and treatment from a specialist in psychology (Table 3.4).

Kim (1978) reported the critical points of trait anxiety as 54 (mild), 59 (moderate), and 64 (severe) by studying 816 samples of university students. Using the cutoff scale, the analysis showed that 169 construction workers (42.7%) underwent trait anxiety. Similar to depression results, 23.3% of workers who were judged as having a moderate or severe state of trait anxiety need special treatment.

3.2.4 Drinking Habit

The cutoff scales used in Choi (2011)'s research about general male office workers that explain the tendency towards alcohol abuse were applied. The survey results represented construction workers considerable suffered from problematic alcohol usage. 59.3% of respondents experienced alcohol use disorder and needed proper treatment. Respondents with a problem drinking state of 8 to 15 points have a need for medical consultation and

advice. 10.1% of field workers who had a score of 16 to 19 points were in the status of alcohol abuse that requires continuous monitoring with consultation. 10.9% of workers scored over 20 points, that is alcohol dependence, and they have a high probability of developing alcoholism.

Table 3.4 Comparisons with Cutoff Scores in Depression, Trait Anxiety, and Alcohol Use Disorder

Sections	Cutoff score		Frequency (%)		Total
Depression	0-15	Normal	247 (62.4%)		396 (100%)
	16-20	Mild	61 (15.4)	149	
	21-24	Moderate	33 (8.3)	(37.6%)	
	25-	Severe	55 (13.9)		
Trait anxiety	0-53	Normal	227 (57.3%)		396 (100%)
	54-58	Mild	77 (19.4)	169	
	59-63	Moderate	64 (16.2)	(42.7%)	
	64-	Severe	28 (7.1)		
Alcohol use disorder	0-7	Normal	161 (40.7%)		396 (100%)
	8-15	Problem drinking	152 (38.4)	235	
	16-19	Alcohol abuse	40 (10.1)	(59.3%)	
	20-	Alcohol dependence	43 (10.9)		

3.3 Comparisons of Psychological Conditions Based on Personal Backgrounds

To explain the psychological differences between personal backgrounds, the study collected personal information in five categories: (1) demographic information, (2) employment status, (3) work types, (4) work experiences, and

(5) wage conditions. The research performed the F-test in ANOVA homogeneity test, and post-hoc analyses. In each category, the research found both similarities and differences in psychological conditions. The p-values of the each comparison and the results of post-hoc analyses are shown in Table 3.5.

3.3.1 Demographic Information

Demographic information consisted of gender, age, educational background, and marital status, but gender was excluded because most of the respondents were male (98.2%). The younger construction workers were, the more stressed they could be by a demanding job and occupational climate. The average scores of novelty seeking and harm avoidance were also high in younger age. On the other hand, workers over fifties got more stressed from insufficient job control their alcohol use disorder was the highest than the other age bands. The respondents who graduated from university suffered more by job demand and occupational climate stress.

Other job stress types, all of the four stress coping styles, and other personal temperaments showed similar trends over the demographic groups.

3.3.2 Employment Status

Type of employment, position of company, work position composed employment status. Stress levels were different from those three subcategories. Daily workers suffered from higher stress by insufficient job control. Contract workers showed a high level of active stress coping styles including problem-

focused and seeking social support coping. Full-time workers showed higher reward dependence. Additionally, general contractors felt more stressed in insufficient job control than subcontractors and resulted in higher alcohol dependence. About work position, the assistants got stressed high by insufficient job control and organization system and they had more patients who underwent trait anxiety but not in a serious level. The average of stress originated from job demand was highest in foremen; their stress by lack of reward was low. Foremen showed active stress coping styles and relatively high levels of reward dependence and persistence. A ratio of workers who suffered from trait anxiety was higher in the following order: assistants, craftspeople, and foreman.

Other job stress, passive stress coping styles, novelty seeking and harm avoidance in personal temperaments, and depression represented similar trends within the employment status.

3.3.3 Work Types

Work types covered construction trades and type of construction. Survey results indicated that earth workers, iron workers, carpenters, and electricians (i.e., construction trades) showed severe psychological stress by insufficient job control, interpersonal conflict, and occupational climate (earth workers resulted in the highest stress). Iron workers underwent more stress caused by insufficient job control and interpersonal conflict. Carpenters experienced stress by insufficient job control, and electricians felt more stress by interpersonal conflict. Earth workers and iron workers had a high level of

wishful thinking, one of the passive stress coping styles, than carpenters and electricians.

Type of construction such as road, subway, apartments, bridge and tunnel also represented the level of negative psychological conditions. The highest was workers in the road projects. The condition level was estimated by the number and severity of stress originated from job demand, job insecurity, organization system, and occupational climate. Construction workers who worked on road sites scored high in those four areas Subway site workers got more stressed due to the demanding job, job insecurity, and negative occupational climate. The respondents who worked on apartment sites suffered from the stress by job demand, job insecurity, and occupational climate at medium level, but they felt higher stress in organization system than other sites' workers. Workers who build bridges on sites experienced a relatively low level of stress. Additionally, novelty seeking tendency was high for the road site workers but low for the tunnel site workers. The road site workers also suffered from high depression.

Construction workers within work type categories showed similar trends in stress due to lack of reward, all types of stress coping styles, harm avoidance, reward dependence, and persistence in personal temperaments, trait anxiety, and alcohol use disorder.

3.3.4 Working Experiences

Working experience was divided into two subcategories: experience in years and experience on a present work site. Working experience in years had

five ranges: under 2 years, 2 to 5, 5 to 10, 10 to 20, and over 20 years. Workers who had experienced less than 2 years showed higher stress by insufficient job control and organization system. Respondents with a career for 2 to 5 and 5 to 10 years got higher stress caused by job demand and occupational climate. Over 20-year career workers were relatively less sensitive to get stressed: lower levels in job demand, insufficient job control, organization system, and occupational climate. About depression, workers having over 20-year experience resulted in the highest score. Working experience on a present work site did not show critical differences in psychological conditions.

Working experiences showed a similar stress trends in interpersonal conflict, job insecurity, and lack of reward, seeking social support coping, emotion-focused coping, and wishful thinking coping, all four temperaments, and alcohol use disorder.

3.3.5 Wage Conditions

Daily-paid worker got stressed higher than monthly-paid worker from job insecurity, and a high number of the daily-paid workers suffered from depression with the high severity level of patients. Workers who earned over 2.5 million Korean won (US\$ 2,500) per month got relatively low stressed from insufficient job control, interpersonal conflict, organization system, and lack of reward. The research set two groups by monthly income: the lower group (less than 1.5 million won and 1.5 to 2 million won) and the higher group (2 to 2.5 million won and over 2.5 million won). The lower group

suffered from depression or alcohol use disorder more and the higher group showed relatively high active stress coping style and reward dependence.

Wage groups, however, showed similar trends in job stress from occupational climate, passive stress coping style including emotion-focused and wishful coping style, novelty seeking, harm avoidance, and persistence of temperaments.

Table 3.5 Comparisons of Psychological Conditions Based on Construction Workers' Personal Background

Categories		Demographic information			Employment status			Construction work characteristics		Working experiences		Wage conditions	
Characteristics		Age	Educational background	Marital status	Type of employment	Position of company	Work position	Construction trades	Type of construction	Working experiences in years	Working experiences on present work site	Type of pay	Amount of income
Stress	p-value	0.00*	0.00*	0.61	0.07	0.86	0.01*	0.06	0.00*	0.03*	0.22	0.87	0.04*
	Job demand	Under 40 > 40s, Over 50	Under middle school > High school University > The others				Foreman > Craftspeople, Assistants		Road, Subway, Apartment > Tunnel Road, Subway > Bridge	2-5, 5-10 > 10-20, Over 20 years			Violation of Same Variance Assumption
	p-value	0.03*	0.33	0.13	0.00*	0.01*	0.00*	0.03*	0.13	0.00*	0.01*	0.11	0.00*
	Insufficient job control	Over 50 > 40s			Daily worker > Full-time worker, Contract worker	Prime contract > Subcontract	Assistants > Craftspeople > Foreman	Iron worker, Carpenter, Earthworker > Electrician		Under 2 yrs > The others	3-6 mths > Under 1 mth, 6 mths-1 yr, Over 1 yr		Under 1.5 M, 1.5-2 > Over 2.5 M
	p-value	0.27	0.28	0.92	0.29	0.37	0.32	0.04*	0.19	0.11	0.10	0.39	0.05
	Interpersonal conflict	Similar			Similar			Iron worker > Carpenter, Equipment installer, welder		Similar			2-2.5 > Over 2.5 M
	p-value	0.62	0.73	0.03*	0.09	0.10	0.20	0.24	0.01*	0.73	0.06	0.01*	0.12
	Job insecurity			Married > Unmarried	Similar				Road, Subway, Apartment > Tunnel	Similar		Daily > Monthly	
	p-value	0.45	0.06	0.22	0.26	0.54	0.03*	0.59	0.00*	0.03*	0.02*	0.14	0.00*
	Organization system	Similar					Assistants > Craftspeople		Road, Apartment > Tunnel, Bridge, Subway	Under 2 yrs > 10-20, Over 20 years 5-10 > Over 20 years	3-6 mths, 6 mths-1 yr > Under 1 mth, Over 1 yr		1.5-2, 2-2.5 > Over 2.5 M
	p-value	0.36	0.28	0.60	0.23	0.36	0.01*	0.10	0.35	0.05	0.21	0.71	0.01*
	Lack of reward	Similar					Craftspeople, Assistants > Foreman	Similar		Similar			1.5-2, 2-2.5 > Over 2.5 M
p-value	0.00*	0.00*	0.62	0.44	0.05	0.73	0.03*	0.00*	0.01*	0.00*	0.13	0.35	
Occupational climate	Under 40 > 40s, Over 50	University > Under middle school Junior college > High school		Similar			Earthworker, Construction machine driver > Carpenter, Electrician	Road > Apartment > Tunnel Road, Subway > Tunnel, Bridge	2-5 > 10-20, Over 20 years 5-10 > Over 20 years	Significant but not any trends	Similar		

Table 3.5 (Continued)

Categories		Demographic information			Employment status			Construction work characteristics		Working experiences		Wage conditions	
Stress coping style	p-value	0.34	0.28	0.29	0.00*	0.21	0.01*	0.56	0.08	0.08	0.00*	0.32	0.00*
	Problem-focused coping	Smilar			Contract worker > Daily worker		Foreman > Craftspeople, Assistants	Smilar			Under 1 mth, Over 1 yr > 3-6 mths Over 1 yr > 3-6 mths, 6 mtns-1 yr		2-2.5, Over 2.5 M > Under 1.5 M, 1.5-2
	p-value	0.84	0.28	0.28	0.01*	0.65	0.04*	0.55	0.71	0.96	0.29	0.43	0.01*
	Seeking social support coping	Smilar			Contract worker > Daily worker		Foreman > Craftspeople, Assistants	Smilar		Smilar			2-2.5, Over 2.5 M > 1.5-2
	p-value	0.15	0.58	0.15	0.22	0.39	0.69	0.26	0.35	0.09	0.64	0.55	0.58
	Emotion-focused coping	Smilar								Smilar			
p-value	0.21	0.53	0.80	0.31	0.38	0.16	0.04*	0.78	0.11	0.22	0.53	0.20	
Wishful thinking coping	Smilar			Smilar			Iron worker, Construction machine driver > Carpenter, Electrician Earthworker > Electrician		Smilar		Smilar		
Personal temperament	p-value	0.00*	0.33	0.22	0.76	0.54	0.20	0.20	0.00*	0.06	0.25	0.99	0.50
	Novelty seeking	Under 40 > 40s, Over 50			Smilar				Road > Apartment > Tunnel Road > Bridge	Smilar		Smilar	
	p-value	0.04*	0.82	0.01*	0.97	0.15	0.24	0.26	0.47	0.81	0.22	0.47	0.14
	Harm avoidance	40s > Over 50		Unmarried > Married, Divorced	Smilar			Smilar		Smilar		Smilar	
	p-value	0.70	0.82	0.42	0.04*	0.44	0.01*	0.91	0.69	0.69	0.55	0.13	0.03*
	Reward dependence	Smilar			Full-time worker > Daily worker		Foreman > Craftspeople, Assistants	Smilar		Smilar			
p-value	0.17	0.86	0.40	0.84	0.67	0.00*	0.46	0.63	0.21	0.64	0.83	0.25	
Persistence	Smilar					Foreman > Craftspeople > Assistants	Smilar		Smilar		Smilar		

Table 3.5 (Continued)

Categories	Demographic information			Employment status			Construction work characteristics		Working experiences		Wage conditions		
	p-value	0.08	0.40	0.74	0.65	0.77	0.83	0.00*	0.01*	0.00*	0.83	0.01*	0.01*
Depression		Smilar			Smilar				High abnormal ratio in Road site High normal ratio in Tunnel and Bridge sites	High abnormal ratio in 5-10 High normal ration in Over 20 years		High abnormal ratio in Daily workers	High abnormal ration in Under 1.5 M
	p-value	0.33	0.10	0.58	0.34	0.09	0.05*	0.40	0.07	0.15	0.01*	0.17	0.01*
Trait anxiety		Smilar					High abnormal ratio in the order: Assistants > Craftspeople > Foreman	Smilar			High abnormal ratio in 3-6 mths High normal ration in Under 1 mth and Over 1 yr		High normal ratio in Over 2.5 M
	p-value	0.02*	0.56	0.87	0.10	0.01*	0.02*	0.48	0.07	0.27	0.56	0.11	0.02*
Alcohol use disorder		High normal ratio in Over 50				High abnormal ratio in Prime contract	Significant but not any trends	Smilar		Smilar			High normal ratio in Over 2.5 M

Chapter 4. Relationships between Psychological Conditions and Safety-related Factors

4.1 Psychological Factors Influencing Construction Workers' Safety

The results of Pearson's correlation analysis showed interrelationships between psychological conditions and the safety-related factors including safety perception (motivation and knowledge) and safety behavior (compliance and participation). The majority of psychological factors were correlated with the safety-related factors (Table 4.1); however, emotion-focused coping style and some temperaments including impulsiveness (NS2), fear of uncertainty (HA2), shyness with stranger (HA3), and dependence (RD4) did not show critical relationships with the safety-related factors.

To be specific, all of the subscales of job stress were negatively correlated with the safety-related factors except job demand, job insecurity, and occupational climate. They had no relationship with safety motivation. Active coping strategies were positively correlated with all of the safety-related factors, while wishful thinking strategy was negatively related to safety motivation, knowledge, and participation (Table 4.1).

Some psychological factors even in the same subcategory showed

positive or sometimes negative correlation to safety factors. For example, exploratory excitability (NS1), which belongs to novelty seeking in temperament, indicated positive relationships with safety motivation and safety behavior, but disorderliness (NS4) in the same category were negatively correlated with all safety factors. As one aspect of harm avoidance, fatigability (HA4) had negative relationships with all of the safety factors, and subscales of reward dependence except dependence (RD4) and all subscales in persistence had positive connections with the safety-related factors. Emotional disturbances such as depression and trait anxiety showed negative relationships with the safety factors, and drinking habit had negative linkage with the safety behavior. Furthermore, there were positive interrelationships between the safety-related factors (Table 4.1).

Table 4.1 Correlations between Psychological Factors and Safety-related Factors

Categories	Subcategories	Subscales	31.Safety motivation	32.Safety knowledge	33.Safety compliance	34.Safety participation
Stress	Job stress	1. Job demand	-0.024	-0.110 *	-0.167 **	-0.186 **
		2. Insufficient job control	-0.106 *	-0.191 **	-0.140 **	-0.174 **
		3. Interpersonal conflict	-0.101 *	-0.140 **	-0.129 *	-0.169 **
		4. Job insecurity	0.005	-0.105 *	-0.167 **	-0.160 **
		5. Organization system	-0.105 *	-0.196 **	-0.256 **	-0.282 **
		6. Lack of reward	-0.143 **	-0.182 **	-0.218 **	-0.282 **
		7. Occupational climate	-0.052	-0.138 **	-0.212 **	-0.144 **
	Stress coping style	8. Problem-focused	0.189 **	0.304 **	0.350 **	0.406 **
		9. Seeking social support	0.208 **	0.168 **	0.234 **	0.270 **
		10. Emotion-focused	0.046	0.067	0.036	0.021
		11. Wishful thinking	-0.005	-0.085	-0.130 **	-0.082
Personal temperament	Novelty seeking	12. NS1. Exploratory Excitability	0.131 **	0.092	0.148 **	0.138 **
		13. NS2. Impulsiveness	-0.018	0.015	0.009	0.029
		14. NS3. Extravagance	-0.093	-0.106 *	-0.098	-0.091
		15. NS4. Disorderliness	-0.111 *	-0.183 **	-0.160 **	-0.205 **
	Harm avoidance	16. HA1. Anticipatory Worry & Pessimism	-0.127 *	-0.070	-0.098	-0.092
		17. HA2. Fear of Uncertainty	-0.064	-0.022	-0.009	-0.011
		18. HA3. Shyness with Stranger	-0.082	-0.040	-0.085	-0.070
	Reward dependence	19. HA4. Fatigability	-0.151 **	-0.287 **	-0.240 **	-0.322 **
		20. RD1. Sentimentality	0.200 **	0.150 **	0.134 **	0.216 **
		21. RD2. Openness to warm communication	0.138 **	0.123 *	0.129 *	0.187 **
		22. RD3. Attachment	0.142 **	0.124 *	0.173 **	0.170 **
	Persistence	23. RD4. Dependence	-0.002	-0.011	-0.041	-0.053
		24. P1. Eagerness of effort	0.209 **	0.160 **	0.127 *	0.133 **
		25. P2. Work hardend	0.176 **	0.287 **	0.291 **	0.339 **
26. P3. Ambition		0.230 **	0.254 **	0.249 **	0.299 **	
Emotional disturbance	-	27. P4. Perfectionism	0.130 **	0.119 *	0.109 *	0.148 **
		28. Depression	-0.292 **	-0.264 **	-0.314 **	-0.262 **
Drinking habit	-	29. Trait anxiety	-0.241 **	-0.382 **	-0.411 **	-0.397 **
		30. Alcohol use disorder	-0.044	-0.073	-0.148 **	-0.137 **
Safety-related factors	Safety perception	31. Safety motivation	-	0.580 **	0.502 **	0.453 **
		32. Safety knowledge	0.580 **	-	0.662 **	0.662 **
	Safety behavior	33. Safety compliance	0.502 **	0.662 **	-	0.787 **
		34. Safety participation	0.453 **	0.662 **	0.787 **	-

** Correlation is significant at $p < .01$ (two-tailed).

* Correlation is significant at $p < .05$ (two-tailed).

Using the significant results of the correlation analysis, the input variables were selected for multiple linear regression analysis. First, VIF figures were checked to avoid a multi-collinearity problem. The maximum figure was 1.53 which was quite smaller than the criteria, 10, so there was a very low probability of the problem.

Model 1 in the Table 4.2 represented psychological factors that influenced safety motivation. The less symptoms of depression led to high motivation for safety, and ambition (P3), eagerness of effort (P1), seeking social support coping style, and sentimentality (RD1) negatively affected on safety motivation. Model 2 showed that trait anxiety and job stress from insufficient job control had a negative impact on safety knowledge while problem-focused coping style and ambition (P3) showed positive effects on safety knowledge. Safety compliance was the dependent variable in Model 3 and was negatively influenced by trait anxiety and job stress due to occupational climate. Problem-focused coping style and work hardened (P2), and job stress from interpersonal conflict, however, had positive relationships with safety compliance. At last, Model 4 investigated the input variables which highly affected safety participation. The variables that positively influenced on the participation behavior were problem focused coping style, ambition (P3), work hardened (P2). Negative variables were trait anxiety, job stress from job demand, and disorderliness (NS4). Trait anxiety, problem-focused stress coping style, and ambition (P3) were frequent input variables (Table 4.2).

Table 4.2 Regression Models of Psychological Conditions and Safety-related Factors

No.	Dependent variables	Independent variables	B	β	t	R	R ²	Adjusted R ²	F (ANOVA)
1	Safety motivation	Depression	-0.068	-0.212	-4.327 **	0.408	0.166	0.16	15.562 **
		P3_Ambition	0.113	0.131	2.586 *				
		P1_Eagerness of effort	0.102	0.132	2.715 **				
		Seeking social support coping style	0.164	0.124	2.590 **				
		RD1_Sentimentality	0.107	0.105	2.078 *				
2	Safety knowledge	Trait anxiety	-0.083	-0.299	-6.224 **	0.464	0.215	0.21	26.815 **
		Problem-focused coping style	0.083	0.156	3.043 **				
		P3_Ambition	0.124	0.130	2.742 **				
		Job stress from Insufficient job control	-0.020	-0.108	-2.198 *				
3	Safety compliance	Trait anxiety	-0.093	-0.292	-5.875 **	0.508	0.258	0.25	27.082 **
		Problem-focused coping style	0.162	0.267	5.135 **				
		P2_Work hardened	0.125	0.115	2.370 *				
		Job stress from Occupational climate	-0.023	-0.111	-2.328 *				
		Job stress from Interpersonal conflict	0.022	0.098	1.970 *				
4	Safety participation	Problem-focused coping style	0.178	0.256	5.454 **	0.550	0.303	0.29	28.135 **
		Trait anxiety	-0.070	-0.191	-3.758 **				
		P3_Ambition	0.201	0.160	3.071 **				
		Job stress from Job demand	-0.023	-0.104	-2.284 *				
		NS4_Disorderliness	-0.105	-0.100	-2.174 *				
		P2_Work hardened	0.129	0.103	1.974 *				

** Significant at $p < .01$ (two-tailed).

* Significant at $p < .05$ (two-tailed).

4.2 Mediating Effects among Psychological Conditions, Safety Perception, and Safety Behavior

As discussed in Chapter 2, the first hypothesis for the mediating effect analysis was that safety perception mediates between subscales of job stress and safety behaviors. As one aspects of safety perception, safety motivation showed mediating effects between job stress by insufficient job control, organization system, or lack of reward and safety compliance (Model 5-7 in Table 4.3). Job stress due to insufficient job control significantly influenced safety motivation ($\beta=-0.11$, $p < 0.05$) in Step 1, and the stress also affected safety compliance ($\beta=-0.14$, $p < 0.01$) in Step 2. Step 3 demonstrated the significance of mediation because the standardized coefficient, β (i.e., c'), was -0.09 , whose absolute value decreased smaller than the absolute value of β (i.e., c) in Step 2. Also, the result of Sobel test was significant under the confidence level of 0.95. Based on these verifications, it can be suggested that a high level of job stress from insufficient job control, organization system, or lack of reward influenced a low level of safety compliance, and the relationships can be controlled by safety motivation. However, this finding is just partially supported because the c' of each model was not zero. Job stress from job demand, job insecurity, and occupational climate was disregarded because of no correlation with safety motivation. In the case of job stress by interpersonal conflict, the model was not considered since the standardized coefficients (i.e., b , c') in Step 3 were not significant.

Another safety perception, safety knowledge, partially mediated between

subscales of job stress and safety compliance (Model 8-11 in Table 4.3). It meant that job stress by job demand, organization system, lack of reward, or occupation climate had an impact on a low level of safety compliance, and safety knowledge can control the level of impact. A model with job stress from insufficient job control or interpersonal conflict was not significant in Step 3. Moreover, the Sobel test result ignored job stress originated from job insecurity. Therefore, both model were insufficient to show mediating effects.

The other hypothesis was partially demonstrated: safety motivation mediates between subscales of job stress and safety participation (Model 12-15 in Table 4.3). When a level of job stress by insufficient job control, interpersonal conflict, organization system, or lack of reward was high, safety participation were low and the relationship can be adjusted by safety motivation.

The results of this research supported the hypothesis that safety knowledge mediates between subscales of job stress and safety participation (Model 16-19 in Table 4.3). A high level of job stress due to job demand, interpersonal conflict, organization system, or lack of reward showed relationships to low safety participation with safety knowledge as a controller. Job stress by insufficient job control, occupational climate was omitted as Step 3 was not significant. Since p-value of the Sobel test was not significant, job stress by job insecurity was not also considered.

Table 4.3 Mediation Models of Stress and Safety Behavior Mediated by Safety Perception

Safety motivation (M) / Safety compliance (Y)											
No.	X	Link between variables		B	SE	β	t	R ²	Adjusted R ²	F	Z (Sobel test)
5	Insufficient job control	a	Insufficient job control → Safety motivation	-0.02	0.01	-0.11	-2.12 *	0.26	0.26	4.50 *	-1.96 *
		c	Insufficient job control → Safety compliance	-0.03	0.01	-0.14	-2.81 **			7.88 **	
		c'	Insufficient job control → Safety compliance	-0.02	0.01	-0.09	-2.01 *			68.86 **	
		b	Safety motivation → Safety compliance	0.62	0.06	0.49	11.28 **				
6	Organization system	a	Organization system → Safety motivation	-0.02	0.01	-0.11	-2.10 *	0.29	0.29	4.42 *	-1.97 *
		c	Organization system → Safety compliance	-0.06	0.01	-0.26	-5.26 **			27.66 **	
		c'	Organization system → Safety compliance	-0.05	0.01	-0.21	-4.82 **			81.70 **	
		b	Safety motivation → Safety compliance	0.61	0.05	0.48	11.27 **				
7	Lack of reward	a	Lack of reward → Safety motivation	-0.02	0.01	-0.14	-2.87 **	0.27	0.27	8.23 **	-1.96 *
		c	Lack of reward → Safety compliance	-0.05	0.01	-0.22	-4.44 **			19.72 **	
		c'	Lack of reward → Safety compliance	-0.03	0.01	-0.15	-3.44 **			74.09 **	
		b	Safety motivation → Safety compliance	0.61	0.06	0.48	11.06 **				

** Significant at $p < .01$ (two-tailed).

* Significant at $p < .05$ (two-tailed).

Table 4.3 (Continued)

Safety knowledge (M) / Safety compliance (Y)											
No.	X	Link between variables		B	SE	β	t	R ²	Adjusted R ²	F	Z (Sobel test)
8	Job demand	a	Insufficient job control → Safety knowledge	-0.02	0.01	-0.11	-2.20 *	0.01	0.01	4.86 *	-1.99 *
		c	Insufficient job control → Safety compliance	-0.03	0.01	-0.17	-3.36 **	0.03	0.03	11.30 **	
		c'	Insufficient job control → Safety compliance	-0.02	0.01	-0.10	-2.52 *	0.45	0.44	159.05 **	
		b	Safety knowledge → Safety compliance	0.75	0.04	0.65	17.27 **				
9	Organization system	a	Organization system → Safety knowledge	-0.04	0.01	-0.20	-3.97 **	0.04	0.04	15.79 **	-3.91 **
		c	Organization system → Safety compliance	-0.06	0.01	-0.26	-5.26 **	0.07	0.06	27.66 **	
		c'	Organization system → Safety compliance	-0.03	0.01	-0.13	-3.45 **				
		b	Safety knowledge → Safety compliance	0.73	0.04	0.64	16.76 **				
10	Lack of reward	a	Lack of reward → Safety knowledge	-0.03	0.01	-0.18	-3.68 **	0.03	0.03	13.57 **	-2.96 **
		c	Lack of reward → Safety compliance	-0.05	0.01	-0.22	-4.44 **	0.05	0.05	19.72 **	
		c'	Lack of reward → Safety compliance	-0.02	0.01	-0.10	-2.65 **				
		b	Safety knowledge → Safety compliance	0.74	0.04	0.64	16.89 **				
11	Occupational climate	a	Occupational climate → Safety knowledge	-0.02	0.01	-0.14	-2.76 **	0.02	0.02	7.64 **	-1.99 *
		c	Occupational climate → Safety compliance	-0.04	0.01	-0.21	-4.31 **	0.05	0.04	18.58 **	
		c'	Occupational climate → Safety compliance	-0.03	0.01	-0.12	-3.27 **				
		b	Safety knowledge → Safety compliance	0.74	0.04	0.65	17.13 **				

** Significant at $p < .01$ (two-tailed).

* Significant at $p < .05$ (two-tailed).

Table 4.3 (Continued)

Safety motivation (M) / Safety participation (Y)											
No.	X	Link between variables		B	SE	β	t	R ²	Adjusted R ²	F	Z (Sobel test)
12	Insufficient job control	a	Insufficient job control → Safety motivation	-0.02	0.01	-0.11	-2.12 *	0.01	0.01	4.50 *	-1.97 *
		c	Insufficient job control → Safety compliance	-0.04	0.01	-0.17	-3.51 **	0.03	0.03	12.31 **	
		c'	Insufficient job control → Safety compliance	-0.03	0.01	-0.13	-2.84 **	0.22	0.22	55.88 **	
		b	Safety motivation → Safety participation	0.64	0.06	0.44	9.82 **				
13	Interpersonal conflict	a	Interpersonal conflict → Safety motivation	-0.02	0.01	-0.10	-2.02 *	0.01	0.01	4.09 *	-1.97 *
		c	Interpersonal conflict → Safety compliance	-0.04	0.01	-0.17	-3.40 **	0.03	0.03	11.56 **	
		c'	Interpersonal conflict → Safety compliance	-0.03	0.01	-0.12	-2.77 **	0.22	0.22	55.63 **	
		b	Safety motivation → Safety participation	0.64	0.06	0.44	9.84 **				
14	Organization system	a	Organization system → Safety motivation	-0.02	0.01	-0.11	-2.10 **	0.01	0.01	4.42 *	-1.96 *
		c	Organization system → Safety compliance	-0.07	0.01	-0.28	-5.83 **	0.08	0.08	33.97 **	
		c'	Organization system → Safety compliance	-0.06	0.01	-0.24	-5.43 **	0.26	0.26	69.31 **	
		b	Safety motivation → Safety participation	0.62	0.06	0.43	9.82 **				
15	Lack of reward	a	Lack of reward → Safety motivation	-0.02	0.01	-0.14	-2.87 **	0.02	0.02	8.23 **	-1.96 *
		c	Lack of reward → Safety compliance	-0.07	0.01	-0.28	-5.83 **	0.08	0.08	33.99 **	
		c'	Lack of reward → Safety compliance	-0.05	0.01	-0.22	-5.03 **	0.25	0.25	66.71 **	
		b	Safety motivation → Safety participation	0.61	0.06	0.42	9.57 **				

** Significant at $p < .01$ (two-tailed).

* Significant at $p < .05$ (two-tailed).

Table 4.3 (Continued)

Safety knowledge (M) / Safety participation (Y)											
No.	X	Link between variables		B	SE	β	t	R ²	Adjusted R ²	F	Z (Sobel test)
16	Job demand	a	Job demand → Safety knowledge	-0.02	0.01	-0.11	-2.20 *	0.01	0.01	4.86 *	-1.99 *
		c	Job demand → Safety participation	-0.04	0.01	-0.19	-3.75 **	0.03	0.03	14.08 **	
		c'	Job demand → Safety participation	-0.03	0.01	-0.11	-3.03 **	0.45	0.45	161.36 **	
		b	Safety knowledge → Safety participation	0.85	0.05	0.65	17.26 **				
17	Interpersonal conflict	a	Interpersonal conflict → Safety knowledge	-0.03	0.01	-0.14	-2.80 **	0.02	0.02	7.86 **	-2.95 **
		c	Interpersonal conflict → Safety participation	-0.04	0.01	-0.17	-3.40 **	0.03	0.03	11.56 **	
		c'	Interpersonal conflict → Safety participation	-0.02	0.01	-0.08	-2.05 *	0.44	0.44	156.90 **	
		b	Safety knowledge → Safety participation	0.85	0.05	0.65	17.14 **				
18	Organization system	a	Organization system → Safety knowledge	-0.04	0.01	-0.20	-3.97 **	0.04	0.04	15.79 **	-3.89 **
		c	Organization system → Safety participation	-0.07	0.01	-0.28	-5.83 **	0.08	0.08	33.97 **	
		c'	Organization system → Safety participation	-0.04	0.01	-0.16	-4.18 **	0.46	0.46	168.74 **	
		b	Safety knowledge → Safety participation	0.83	0.05	0.63	16.72 **				
19	Lack of reward	a	Lack of reward → Safety knowledge	-0.03	0.01	-0.18	-3.68 **	0.03	0.03	13.57 **	-2.95 **
		c	Lack of reward → Safety participation	-0.07	0.01	-0.28	-5.83 **	0.08	0.08	33.99 **	
		c'	Lack of reward → Safety participation	-0.04	0.01	-0.17	-4.44 **	0.46	0.46	170.70 **	
		b	Safety knowledge → Safety participation	0.83	0.05	0.63	16.82 **				

** Significant at $p < .01$ (two-tailed).

* Significant at $p < .05$ (two-tailed).

The second hypothesis was about mediating effects of emotional disturbances: safety perception mediates in the relationship between depression or trait anxiety and safety behavior. To be specific, safety motivation or safety knowledge mediated between emotional disturbances (e.g., depression and trait anxiety) and safety compliance or participation. Among the four possible combinations of safety perception (motivation and knowledge) and safety behavior (compliance and participation) the partial mediating effects were found (Model 20-27 in Table 4.4). Thus, the result supported the second hypothesis but the level of mediation was partial.

For the last hypothesis of the safety perception mediated between alcohol use disorder and safety behavior, alcohol use disorder had no significant correlation with safety motivation or safety knowledge. Therefore, the mediating effects were not able to be verified.

Table 4.4 Mediation Models of Emotional Disturbances and Safety Behavior Mediated by Safety Perception

Safety motivation (M) / Safety compliance (Y)											
No.	X	Link between variables		B	SE	β	t	R ²	Adjusted R ²	F	Z (Sobel test)
20	Depression	a	Depression → Safety motivation	-0.09	0.02	-0.29	-6.07 **	0.09	0.08	36.79 **	-4.07 **
		c	Depression → Safety compliance	-0.13	0.02	-0.31	-6.56 **	0.10	0.10	43.03 **	
		c'	Depression → Safety compliance	-0.07	0.02	-0.18	-4.09 **	0.28	0.28	77.34 **	
		b	Safety motivation → Safety compliance	0.57	0.06	0.45	10.04 **				
21	Trait anxiety	a	Trait anxiety → Safety motivation	-0.06	0.01	-0.24	-4.94 **	0.06	0.06	24.37 **	-5.24 **
		c	Trait anxiety → Safety compliance	-0.13	0.01	-0.41	-8.94 **	0.17	0.17	79.98 **	
		c'	Trait anxiety → Safety compliance	-0.10	0.01	-0.31	-7.29 **	0.34	0.34	101.67 **	
		b	Safety motivation → Safety compliance	0.54	0.05	0.43	10.13 **				
Safety knowledge (M) / Safety compliance (Y)											
No.	X	Link between variables		B	SE	β	t	R ²	Adjusted R ²	F	Z (Sobel test)
22	Depression	a	Depression → Safety knowledge	-0.09	0.02	-0.26	-5.43 **	0.07	0.07	29.53 **	-4.36 **
		c	Depression → Safety compliance	-0.13	0.02	-0.31	-6.56 **	0.46	0.46	166.83 **	
		c'	Depression → Safety compliance	-0.06	0.02	-0.15	-3.88 **				
		b	Safety knowledge → Safety compliance	0.71	0.04	0.62	16.19 **				
23	Trait anxiety	a	Trait anxiety → Safety knowledge	-0.11	0.01	-0.38	-8.20 **	0.15	0.14	67.22 **	-8.55 **
		c	Trait anxiety → Safety compliance	-0.13	0.01	-0.41	-8.94 **	0.47	0.46	172.61 **	
		c'	Trait anxiety → Safety compliance	-0.06	0.01	-0.18	-4.64 **				
		b	Safety knowledge → Safety compliance	0.68	0.05	0.59	14.85 **				

** Significant at $p < .01$ (two-tailed).

* Significant at $p < .05$ (two-tailed).

Table 4.4 (Continued)

Safety motivation (M) / Safety participation (Y)											
No.	X	Link between variables		B	SE	β	t	R²	Adjusted R²	F	Z (Sobel test)
24	Depression	a	Depression → Safety motivation	-0.09	0.02	-0.29	-6.07 **	0.09	0.08	36.79 **	-3.98 **
		c	Depression → Safety participation	-0.12	0.02	-0.26	-5.38 **	0.07	0.07	28.93 **	
		c'	Depression → Safety participation	-0.07	0.02	-0.14	-3.04 **	0.22	0.22	56.59 **	
		b	Safety motivation → Safety participation	0.60	0.07	0.41	8.86 **				
25	Trait anxiety	a	Trait anxiety → Safety motivation	-0.06	0.01	-0.24	-4.94 **	0.06	0.06	24.37 **	-5.02 **
		c	Trait anxiety → Safety participation	-0.15	0.02	-0.40	-8.58 **	0.16	0.16	73.67 **	
		c'	Trait anxiety → Safety participation	-0.11	0.02	-0.31	-6.99 **				
		b	Safety motivation → Safety participation	0.55	0.06	0.38	8.68 **	0.29	0.29	81.50 **	
Safety knowledge (M) / Safety participation (Y)											
No.	X	Link between variables		B	SE	β	t	R²	Adjusted R²	F	Z (Sobel test)
26	Depression	a	Depression → Safety knowledge	-0.09	0.02	-0.26	-5.43 **	0.07	0.07	29.53 **	-4.35 **
		c	Depression → Safety participation	-0.12	0.02	-0.26	-5.38 **				
		c'	Depression → Safety participation	-0.04	0.02	-0.09	-2.40 *	0.45	0.44	158.28 **	
		b	Safety knowledge → Safety participation	0.84	0.05	0.64	16.37 **				
27	Trait anxiety	a	Trait anxiety → Safety knowledge	-0.11	0.01	-0.38	-8.20 **	0.15	0.14	67.22 **	-8.99 **
		c	Trait anxiety → Safety participation	-0.15	0.02	-0.40	-8.58 **	0.16	0.16	73.67 **	
		c'	Trait anxiety → Safety participation	-0.06	0.01	-0.17	-4.22 **				
		b	Safety knowledge → Safety participation	0.78	0.05	0.60	14.93 **	0.46	0.46	169.00 **	

** Significant at $p < .01$ (two-tailed).

* Significant at $p < .05$ (two-tailed).

Chapter 5. Discussions

This section provides in-depth analyses of the survey findings explained in Chapter 4. The chapter provides reasons for the provided psychological results and suggests implications to mental health and safety relationships and their mediating effects.

5.1 Average Psychological Conditions of Construction Workers

5.1.1 Stress

The similar trends of the stress levels between construction workers and firefighters indicated that construction workers' stress was problematic as that of firefighters. Firefighters work under 24-hour shifts and are deployed in emergency situations. For that reason firefighters usually feel tension, anxiety, and fear but have difficulty in expressing their emotions. In addition, the high probability of being injured or losing one's life during work can result in increased fatigue (Choi et al., 2012). Similarly, construction work usually starts at daybreak, and their tasks are physically demanding. They are often pushed to reduce construction schedule and work with a sense of urgency

along with many risky conditions. Furthermore, the large number of construction accidents can let construction workers experience increased tension. Such similar working environments might cause a similar stress level of construction workers compared to firefighters' stress.

Construction workers' stress caused by job demands and insufficient job control, however, was lower than that of firefighters because of the nature of their tasks. Firefighters' tasks and work-related accidents are more dangerous and less controllable than those of construction workers (Jo, 2010).

Within only the construction workers' internal results, stress by insufficient job control was higher than others but stress by interpersonal conflict and occupational climate was relatively low. Construction works are normally repetitive. Workers must follow scheduled work routine that is assigned by supervisors. Their autonomy is limited. These conditions may cause high stress in insufficient job control.

The reason why stress from both interpersonal conflict and occupational climate was low can be found from the culture of Korean society. The Korean society is more hierarchical. That is why stress levels of interpersonal conflict and occupational climate were also low in firefighters. In construction, big barriers exist between general and subcontractors externally and managers and workers internally. However, they do their responsibility well without causing interpersonal problems because of high social learning behaviors discussed in the previous sections. Construction workers in Korea feel less sensitive about conflict with seniors and colleagues and tend to adapt themselves well into the occupational climate...

Generally, different people have different coping styles to overcome

stressful situations (Park, 2003). When a person seeks an active coping strategy, which consists of problem-focused coping and seeking social support coping, they are more likely to maintain psychological stability and be able to mentally adjust to stressful situations (Lee, 2013). Construction workers use a more problem-focused coping attitude and seek a social support style, rather than a passive style. They believe that their situations can be changed (“seeking social support coping”) when they know more as they experience more works—they are more risk takers instead of risk avoidance during their work responsibility— (“problem-focused coping”), and this type of worker responds by being more active (Folkman, 1984; Vitaliano, 1985). The construction industry is labor-intensive, so experience is a key knowledge for a worker. Based on this background, the respondents were likely to have more knowledge to solve problematic situations.

With regard to passive strategies, an emotion-focused coping style of construction workers was lower than active strategies, but higher than one of general office workers. Under uncontrollable and less predictable working environments that can lead to the high accident rate, construction workers expect the risky situation and their poor emotional feeling to be changed. Construction workers pursue to more active strategies than the passive strategy, which makes them face a problematic situation and try to solve it.

5.1.2 Personal Temperament

In regards to personal temperament, the low status of novelty seeking suggested construction workers have an inclination to observe safety rules and

follow work manuals. A person with low novelty seeking could also easily focus on a task, making them more productive. The fact that construction workers' novelty seeking scored higher than those of Korean adult male means that construction workers can be more active when they feel the need for condition changes; change orders are very common during the construction project. Also, there are many unexpected events during the project lifecycle that requires high flexibility for problem solving.

Again, construction workers easily encounter frequent or emergent changes; that is one typical part of project control. That might be why construction workers had low harm avoidance to emotionally respond well under a high risk situation: more cautious and apprehensive in a dangerous environment.

After the economic crisis in 1997 in Korea the number of part-time workers increased in the construction industry. In particular, since 2004, part-time workers in construction have grown to comprise around 60% of the total construction workers (Ministry of Employment and Labor, 2014). This value is much larger than the US, 20% in 2013 (United States Department of Labor, 2014). Such part-time worker ratio has led to individuals being more independent with a lack of sense of belonging. This could explain the tendency towards low reward dependence.

5.1.3 Emotional Disturbance and Drinking Habit

The proportion of construction workers who suffered from trait anxiety was 42.7%, and 23.3% of them needed professional treatment. Additionally,

more than half (59.3%) of construction workers experienced alcohol use disorder, and 20% of them needed treatment. Workers who suffer these kinds of mental illnesses incur negative effects on their individual productivity and safety. Depression decreases enthusiasm and therefore people who experience depression have difficulties in adapting to reality or their work environment (Lopez and Murray, 1998). People who have high trait anxiety realize danger and threats more frequently than normal people (Lee, 1995). Construction workers who experience depression and high anxiety find it hard to concentrate on tasks, their motivation decreases, and they also have difficulties in strategic decision making (Haslam et al., 2005). Additionally, problematic alcohol use absolutely leads to absenteeism from work, and workers in this psychological condition are exposed to the accident rate four times greater than normal people (Um et al., 2004).

5.2 Comparisons of Psychological Conditions Based on Personal Backgrounds

The following discussions are based on whether personal backgrounds influence on psychological conditions of construction workers. Stress coping style and temperaments are personal inheritance (Folkman, 1984; Kim et al., 2003; Lee and Hwang, 2009), and therefore, they are not easily changed by external intervention. On the other hand, job stress and emotional disturbances, and drinking habit can be influenced by social environments. According to

Svrakic et al. (2002), the lower novelty seeking and harm avoidance tendencies are, the more adjustable to the given environments the workers could be. In case of reward dependence and persistence, the higher tendencies can allow workers to change construction situations more.

5.2.1 Demographic Information

The research found that both different age range and marital status can change dispositions of workers. The results showed that the construction workers who were over fifties had higher tendencies towards novelty seeking and harm avoidance than the younger workers, and married or divorced people represented high harm avoidance. Thus, it is possible to say that older and married workers could be less stressed and adapted into the given situation well. Respondents who graduated from a university felt more stressed by job demand and occupational climate since workers in the management level are charged in project control and have stressful responsibilities for the on-time project delivery. .

5.2.2 Employment Status

Construction workers showed similar stress coping, reward dependence and persistence styles due to the dynamic and changeable nature of construction practices. However, daily workers and assistants felt more stressed by insufficient job control and organizational systems since their work are normally repetitive and less intellectual. A ratio of high trait anxiety patients was high in assistants, which indicates they tend to recognize their

circumstances as a threat with tiredness, worry and discomfort. Foremen got more stressed from job demand because they might feel time pressure to finish their works on time and need to do multiple functioning as subcontractors under general contractors but supervisors for their working groups.

5.2.3 Work Types

Earth workers, iron workers, carpenters, and electricians were suffered from the psychological stress harder, respectively. It is implied that they feel more hardships when working environment and scope are less straightforward. This also can explain earth workers and iron workers had high wishful thinking as one of passive stress coping strategies.

Job demand, job insecurity, organization system, and occupational climate were connected with type of construction. The order in severity was road, subway, apartments, bridge, and tunnel, and also novelty seeking was high in the same order. A person who has high novelty seeking is hard to accept a stressful situation, and this tendency might influence high stress by job demand, which means they feel job overloaded. Road projects require relatively less specialists than other project types and heavily equipment oriented, road workers felt highest stress in job security.

5.2.4 Working Experiences

Under 2-year-experience construction workers were more stressed from insufficient job control and organization system. For 2 to 5 and 5 to 10 years,

job demand and occupational climate were main stress causes. However, over 20-year-experience workers showed relatively lower stresses. It fits with the previous discussion of the age effects.

5.2.5 Wage Conditions

It is natural that daily-paid workers felt more stressed due to job insecurity than monthly-paid workers. Moreover, daily-paid worker had a high ratio of depressed people and also a high ratio of severe patients. Depression was related to the stress by job insecurity. For instance, road site workers more suffered from stress due to job insecurity and had a high depression level with a high proportion of severity. Also, workers from the bridge and tunnel sites showed lower stress from job insecurity and low depression tendency.

Workers who earned money over 2.5 million won per month got lower stress by insufficient job control, interpersonal conflict, organization system, and lack of reward than the other income groups. It might be said that monetary rewards mitigate job stress. Moreover, they showed high active stress coping strategies and reward dependence as well as low trait anxiety and alcohol use disorder.

5.3 Psychological Factors Influencing Construction Workers' Safety

The analysis results by multiple linear regression indicated that stress, stress coping styles, temperament, and emotional disturbance influenced the safety-related factors. 13 psychological factors of the total 30 different variables were identified as critical influencers. Job stress originated from job demand, insufficient job control, interpersonal conflict, and occupational climate acted as high-correlated independent variables to safety performance. Problem-focused coping and seeking social support coping, which were classified as the active coping strategy, were considered as predictors (X). Problem-focused coping style was a significant variable since one who has this tendency tries to actively try to change their stressful situation and thus positively influenced learning-oriented safety knowledge. Disorderliness (NS4), sentimentality (RD1), eagerness of effort (P1), work hardened (P2), ambition (P3) in temperament also showed high correlation to the safety factors. Specifically, persistence was a key factor that positively affected all of the safety-related factors. Some of temperaments (e.g., disorderliness) had a negative impact on the dependent variables and the others did positively since low novelty seeking or harm avoidance and high reward dependence or persistence are good indicators to adjust changing situations. A person who has high disorderliness prefers activities that do not heavily require rules or regulations, so the disorderliness showed a negative correlation with safety participation. Moreover, the reason why sentimentality positively influenced safety motivation may be that high sensitivity to accident severity can stimulate his or her inner compulsion to act safety. On the other hand, depression and anxiety identified negative causes on construction safety.

5.4 Mediating Effects among Psychological Conditions, Safety Perception, and Safety Behavior

Job stress resulted from organization system or lack of reward partially mediated between safety perception (safety motivation and knowledge) and safety behavior (safety compliance and participation). In other words, the effects of such stress on safety behavior can be controlled by mediators, safety perception. Likewise, depression and trait anxiety also mediated in the relationship between safety perception and safety behavior, which means depression and trait anxiety are able to be managed by safety motivation and knowledge. As a result, it was investigated that psychological conditions influenced safety behaviors and safety policies such as enhancement of safety motivation by rewards or safety training which enhances safety knowledge can provide a high opportunity to control the relationships. Therefore, we identified the causality between the second domino, inherent fault of person, and the third, unsafe act and mechanical or physical hazards in domino theory, so the results implied the effectiveness of prevention plans to eliminate two consecutive dominos.

Chapter 6. Conclusions

6.1 Summary and Conclusions

This research analyzed psychological conditions of construction field workers in Korea and investigated the differences in the level of psychological conditions by personal background based on the survey of 430 respondents. Korean construction workers had similar levels of stress to firefighters, and they mainly adopted problem-focused and seeking social support coping styles. The construction workers exhibited low levels of novelty seeking, harm avoidance and reward dependence personality traits, and had a medium degree of persistence. Even with the low levels, these three temperaments were higher than the levels in the average Korean adult male. For the major reasons, the research discussed that arduous, large-scale work and dynamically changing environments in construction can cause workers to experience stress resulted from insufficient job control. The hierarchical structure as well as the collective culture can result in low stress from interpersonal conflict and occupational climate. As an experience-based industry, the construction industry makes workers fit into the problem-focused coping strategies and low novelty seeking and harm avoidance enable workers to adjust themselves into dynamic situations well. In addition, two out of five

construction field workers are suffering from depression, and a similar proportion of people undergo trait anxiety. More seriously, three out of five workers have alcohol use disorder which needs professional diagnosis and treatment from a clinical counselor or psychiatrist. The study also analyzed different psychological conditions from different personal backgrounds. Temperaments in low levels of novelty seeking and harm avoidance in the over 50 years old group and high levels of reward dependence and persistence in full-time workers and foreman have an advantage to adapt changeable construction project environments.

The research then investigated the statistical relationships among construction workers' psychological conditions, safety perception, and safety behavior, and discovered that psychological factors can surely affect safety-related factors. Job stress caused by job demand, insufficient job control, interpersonal conflict, and occupational climate, active stress coping style, persistence, depression, and trait anxiety were key contributors. Last, the study also identified the mediation effects of safety perception by linking workers' mental conditions with safety behaviors.

6.2 Contributions

The results of this study are expected to be used to develop safety improvement plans by removing or mitigating stress sources, or by providing proper medical services that can address emotional disturbance and alcohol

abuse. The results of this study showed that making an effort to close the gap within different demographic information, employment status, work types, working experiences, and wage conditions would lead to the improved psychological conditions of construction field workers. Significant psychological factors and their causal relationships with safety behavior also implied that mitigating stressful causes or providing proper treatment, such as giving consistent job order to workers to decrease job stress from occupational climate, may cause improvement of safety compliance. Likewise, the significant factors can be considered as primary factors leading to promote construction field workers' psychological health and encourage safety behavior of individual workers. This study identified that the emotional factor has true potential to improve construction safety and enhance workers' wellbeing.

6.3 Limitations and Future Study

The research attempted to analyze construction workers' psychological conditions and their causality of safety-related factors based on the statistical analysis; however, there are still subjective descriptions and discussions since psychological explanations vary by researchers. There are still improvement opportunities. Future research can develop a short version of psychological intervention to check construction workers' mental conditions regularly and easily only using significant psychological factors. Moreover, a personalized

psychological treatment tool that can consider construction workers' overall psychological conditions and personal backgrounds is valuable to be developed to improve construction site safety. Additionally, when identifying mediating effects, the study focused on socially changeable variables such as job stress, depression, trait anxiety, and alcohol use disorder, but stress coping style and temperament can be also changed by other variables instead of safety perception. It can also be considered in the future study.

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Appendix. Developed Questionnaire

2. 다음은 **업무 상황에서 경험하는 스트레스**에 대한 설명입니다.
 각 문항을 잘 읽고 자신의 생각과 가장 일치하는 곳에 **○표시** 해주십시오.
 정답이 없으므로 모든 문항에 빠짐없이 솔직하게 응답해 주시기 바랍니다.

번호	내용	전혀 그렇지 않다	그렇지 않다	그렇다	매우 그렇다
1	나는 일이 많아 항상 시간에 쫓기며 일한다.	1	2	3	4
2	업무량이 현저하게 증가하였다.	1	2	3	4
3	업무 수행 중에 충분한 휴식(잠)이 주어진다.	1	2	3	4
4	여러 가지 일을 동시에 해야 한다.	1	2	3	4
5	내 업무는 창의력을 필요로 한다.	1	2	3	4
6	내 업무를 수행하기 위해서는 높은 수준의 기술이나 지식이 필요하다.	1	2	3	4
7	작업시간, 업무수행과정에서 나에게 결정할 권한이 주어지며 영향력을 행사할 수 있다.	1	2	3	4
8	나의 업무량과 작업스케줄을 스스로 조절할 수 있다.	1	2	3	4
9	나의 상사는 업무를 완료하는데 도움을 준다.	1	2	3	4
10	나의 동료는 업무를 완료하는데 도움을 준다.	1	2	3	4
11	직장에서 내가 힘들 때 내가 힘들다는 것을 알아주고 이해해 주는 사람이 있다.	1	2	3	4
12	직장사정이 불안하여 미래가 불확실하다.	1	2	3	4
13	나의 근무조건이나 상황에 바람직하지 못한 변화(예, 구조조정)가 있었거나 있을 것으로 예상된다.	1	2	3	4
14	우리 직장은 근무평가, 인사제도(승진, 부서배치 등)가 공정하고 합리적이다.	1	2	3	4
15	업무수행에 필요한 인원, 공간, 시설, 장비, 훈련 등의 지원이 잘 이루어지고 있다.	1	2	3	4
16	우리 부서와 타 부서 간에는 마찰이 없고 업무협조가 잘 이루어진다.	1	2	3	4
17	일에 대한 나의 생각을 반영할 수 있는 기회와 통로가 있다.	1	2	3	4
18	나의 모든 노력과 업적을 고려할 때, 나는 직장에서 제대로 존중과 신임을 받고 있다.	1	2	3	4
19	내 사정이 앞으로 더 좋아질 것을 생각하면 힘든 줄 모르고 일하게 된다.	1	2	3	4
20	나의 능력을 개발하고 발휘할 수 있는 기회가 주어진다.	1	2	3	4
21	회식자리가 불편하다.	1	2	3	4
22	기준이나 일관성이 없는 상태로 업무 지시를 받는다.	1	2	3	4
23	직장의 분위기가 권위적이고 수직적이다.	1	2	3	4
24	남성, 여성이라는 성적인 차이 때문에 불이익을 받는다.	1	2	3	4

3. 다음은 스트레스 상황에서 자신이 어떻게 대처 하는지에 대한 설명입니다.
 각 문항을 잘 읽고 자신의 생각과 가장 일치하는 곳에 O표시 해주십시오.
 정답이 없으므로 모든 문항에 빠짐없이 솔직하게 응답해 주시기 바랍니다.

번호	내용	전혀 그렇지 않다	그렇지 않다	그렇다	매우 그렇다
1	무엇을 해야 할지 알기 때문에 일이 잘 되도록 하기 위해 더 열심히 노력한다.	1	2	3	4
2	활동 계획을 세우고 그것을 따른다.	1	2	3	4
3	다음에는 어떻게 해야 할 것인지, 다음 단계의 준비에 전념한다.	1	2	3	4
4	일이 잘 해결되도록 무언가를 변화시킨다.	1	2	3	4
5	문제를 해결하기 위해 몇 가지 다른 대책을 세운다.	1	2	3	4
6	더 나은 사람으로 변하거나 성장하게 된다.	1	2	3	4
7	문제를 겪고 나서 좋은 경험을 얻는다.	1	2	3	4
8	새로운 신념을 얻는다.	1	2	3	4
9	인생에서 중요한 것이 무엇인가를 재발견한다.	1	2	3	4
10	나 자신의 어떤 점을 바꾼다.	1	2	3	4
11	그 일에서 무엇인가 창조적인 일을 하게 되었다.	1	2	3	4
12	그 상황에 대해 좀 더 알아보려고 누군가와 이야기 한다.	1	2	3	4
13	문제를 구체화 시킬 수 있는 사람과 이야기를 한다.	1	2	3	4
14	존경하는 친척이나 친구에게 충고해 달라고 한다.	1	2	3	4
15	내 자신의 느낌에 대해 누군가에게 말한다.	1	2	3	4
16	다른 사람들의 동정과 이해를 받아들인다.	1	2	3	4
17	전문적인 도움을 구한다.	1	2	3	4
18	자신을 반성하거나 교훈을 얻는다.	1	2	3	4
19	내 스스로 문제를 일으켰음을 깨닫는다.	1	2	3	4
20	다음 경우는 이번과 다를 것이라고 자신에게 다짐한다.	1	2	3	4
21	잘못을 만회하기 위해 사과를 하거나 무엇인가를 한다.	1	2	3	4
22	그 일이 사라지거나 끝나버리기를 바란다.	1	2	3	4
23	기적이 일어나기를 바란다.	1	2	3	4
24	일이 어떻게 마무리 되었으면 좋겠다는 상상이나 소망을 한다.	1	2	3	4
25	대체로 사람들과 어울리기를 피한다.	1	2	3	4
26	그런 일이 일어났다는 것을 믿지 않는다.	1	2	3	4
27	다른 사람에게 분풀이를 한다.	1	2	3	4
28	그것을 너무 심각하게 받아들이지 않고 가볍게 본다.	1	2	3	4
29	아무 일도 안 일어난 것처럼 한다.	1	2	3	4
30	그 일에 사로잡혀 너무 깊이 생각하지 않는다.	1	2	3	4
31	모든 것을 잊어버리려고 노력한다.	1	2	3	4
32	운으로 돌린다; 때로는 운이 나쁠 때도 있으니까.	1	2	3	4

4. 기질 및 성격검사-성인용

(Temperament and Character Inventory-Revised-Short Version: TCI-RS)

다음은 여러분의 기질과 성격을 알아보기 위한 질문입니다.

각 문항을 잘 읽고, 본인과 얼마나 일치하는지를 잘 판단하여 솔직하게 답해주세요.

This measurement tool has a copyright.

5. 아래에 적혀 있는 문항을 잘 읽으신 후, **지난 1주 동안** 당신이 **느끼시고 행동하신 것을** 가장 잘 나타낸다고 생각되는 숫자에 **○표시** 해주십시오.

0. 극히 드물게(1일 미만) 2. 자주(3일~4일)
 1. 가끔(1일~2일) 3. 거의 대부분(5일~7일)

번호	나는 지난 1주 동안	극히 드물게 (1일 미만)	가끔 (1~2일)	자주 (3~4일)	거의 대부분 (5~7일)
1	평소에는 아무렇지도 않던 일들이 귀찮게 느껴졌다.	0	1	2	3
2	먹고 싶지 않았다; 입맛이 없었다.	0	1	2	3
3	가족이나 친구가 도와주더라도 울적한 기분을 떨쳐버릴 수 없었다.	0	1	2	3
4	다른 사람들만큼 능력이 있다고 느꼈다.	0	1	2	3
5	무슨 일을 하든 정신을 집중하기가 힘들었다.	0	1	2	3
6	우울했다.	0	1	2	3
7	하는 일마다 힘들게 느껴졌다.	0	1	2	3
8	미래에 대하여 희망적으로 느꼈다.	0	1	2	3
9	내 인생은 실패작이라는 생각이 들었다.	0	1	2	3
10	두려움을 느꼈다.	0	1	2	3
11	잠을 설쳤다; 잠을 잘 이루지 못했다.	0	1	2	3
12	행복했다.	0	1	2	3
13	평소보다 말을 적게 했다; 말수가 줄었다.	0	1	2	3
14	세상에 홀로 있는 듯한 외로움을 느꼈다.	0	1	2	3
15	사람들이 나에게 차갑게 대하는 것 같았다.	0	1	2	3
16	생활이 즐거웠다.	0	1	2	3
17	갑자기 울음이 나왔다.	0	1	2	3
18	슬픔을 느꼈다.	0	1	2	3
19	사람들이 나를 싫어하는 것 같았다.	0	1	2	3
20	도무지 무엇을 시작할 기운이 나지 않았다.	0	1	2	3

6. 다음 질문지는 지금 이 순간이 아니라 여러분이 평소에 느끼는 일반적인 기분과 심정을 나타내는 정도를 표시하는 것입니다.
 각 문항을 잘 읽고 평소에 당신이 느끼시고 행동하신 것을 가장 잘 나타낸다고 생각되는 숫자에 ○표시 해주십시오.

번호	평소에 일반적으로	전혀 그렇지 않다	그렇지 않다	보통이다	조금 그렇다	매우 그렇다
1	기분이 좋다.	1	2	3	4	5
2	쉽게 피로해 진다.	1	2	3	4	5
3	울고 싶은 심정이다.	1	2	3	4	5
4	다른 사람들처럼 행복했으면 한다.	1	2	3	4	5
5	마음을 빨리 정하지 못해서 실패를 한다.	1	2	3	4	5
6	마음이 놓인다.	1	2	3	4	5
7	차분하고 침착하다.	1	2	3	4	5
8	너무 많은 문제가 밀어닥쳐서 극복할 수 없을 것 같다.	1	2	3	4	5
9	하찮은 일에 너무 걱정을 한다.	1	2	3	4	5
10	행복하다.	1	2	3	4	5
11	무슨 일이건 힘들게 생각한다.	1	2	3	4	5
12	자신감이 부족하다.	1	2	3	4	5
13	마음이 든든하다.	1	2	3	4	5
14	위기나 어려움을 피하려고 애쓴다.	1	2	3	4	5
15	울적하다.	1	2	3	4	5
16	만족스럽다.	1	2	3	4	5
17	사소한 생각이 괴롭힌다.	1	2	3	4	5
18	실망을 지나치게 예민하게 받아들이기 때문에 머릿속에서 지울 수 없다.	1	2	3	4	5
19	나는 착실한 사람이다.	1	2	3	4	5
20	걱정거리 생각만 하면 긴장되거나 어찌할 바를 모른다.	1	2	3	4	5

7. 다음은 술을 마시는 것과 관련된 경험들입니다. 자신의 **평상시 음주습관**과 일치하는 번호에 **○표시** 해주십시오.

1. 술은 얼마나 자주 마십니까?

- ① 전혀 마시지 않음 ② 한 달에 한 번 미만 ③ 일주일에 2~3번 ④ 일주일에 4회 이상

2. 보통 술을 마시는 날 한 번에 몇 잔정도 마십니까?

- ① 1~2잔 ② 3~4잔 ③ 5~6잔 ④ 7~9잔 ⑤ 10잔 이상

번호	내용	전혀 없다	한 달에 한번 미만	한 달에 한 번	1주일에 한 번	매일
3	한 번 술을 마실 때, 소주 1병 또는 맥주 4병 이상의 음주는 얼마나 자주 하십니까?	1	2	3	4	5
4	지난 1년간 술을 마시기 시작하면 멈출 수 없었던 적이 얼마나 자주 있었습니까?	1	2	3	4	5
5	지난 1년간 평소에 할 수 있었던 일을 술 때문에 하지 못했던 적이 얼마나 자주 있었습니까?	1	2	3	4	5
6	지난 1년간 술을 마신 다음날 아침에 일어나 다시 화장실이 필요했던 적이 얼마나 자주 있었습니까?	1	2	3	4	5
7	지난 1년간 술을 마신 후 죄책감이 들거나 후회를 한 적이 얼마나 자주 있었습니까?	1	2	3	4	5
8	지난 1년간 술 때문에 전날 밤에 있었던 일이 기억나지 않았던 적이 얼마나 자주 있었습니까?	1	2	3	4	5
9	음주로 인해 자신이나 다른 사람이 다친 적이 있었습니까?	1	2	3	4	5
10	친척이나 친구 또는 의사가 당신이 술 마시는 것을 걱정 하거나 술을 끊기를 권유한 적이 있습니까?	1	2	3	4	5

8. 다음은 귀하의 **안전동기와 안전지식**에 관한 문항들입니다.
 귀하가 생각하시는 것과 가장 가깝다고 느끼시는 곳에 **○표시** 해주십시오.

번호	문항	전혀 그렇지 않다	그렇지 않다	보통이다	그렇다	매우 그렇다
1	나는 작업장의 안전보건의 중요한 문제라고 믿는다.	1	2	3	4	5
2	나는 나 자신의 안전을 지키거나 개선하는 것이 가치 있는 일이라고 느낀다.	1	2	3	4	5
3	나는 항상 안전을 지키는 것이 중요하다고 느낀다.	1	2	3	4	5
4	나는 작업장의 사고위험을 줄이는 것이 중요하다고 믿는다.	1	2	3	4	5
5	나는 내 작업을 안전하게 하는 방법을 알고 있다.	1	2	3	4	5
6	나는 안전장치와 표준작업절차를 이용하는 방법을 알고 있다.	1	2	3	4	5
7	나는 작업장 안전보건을 유지 또는 개선하는 방법을 알고 있다.	1	2	3	4	5
8	나는 사고의 위험을 줄이는 방법을 알고 있다.	1	2	3	4	5

9. 다음은 귀하의 **안전 행동**에 관한 문항들입니다.
 귀하가 생각하시는 것과 가장 가깝다고 느끼시는 곳에 **○표시** 해주십시오.

번호	문항	전혀 그렇지 않다	그렇지 않다	보통이다	그렇다	매우 그렇다
1	나는 안전한 방법으로 작업을 수행한다.	1	2	3	4	5
2	나는 작업을 할 때 항상 필요한 모든 안전장치를 사용한다.	1	2	3	4	5
3	나는 정확한 안전 절차에 따라 작업한다.	1	2	3	4	5
4	나는 가장 안전한 상태에서 일할 수 있도록 한다.	1	2	3	4	5
5	작업 시간 중 작업장 내에서 안전모를 쓰고 있다.	1	2	3	4	5
6	나는 작업을 빨리 끝내야 한다는 압력을 느낄 때 안전과 관련된 절차를 생략하는 경우가 있다.	1	2	3	4	5
7	나는 안전과 관련된 절차들을 따르지 않더라도 안전하게 작업을 마칠 수 있다고 느낀다.	1	2	3	4	5
8	나는 시간을 절약하기 위해 안전 절차를 무시한 경우가 있다.	1	2	3	4	5
9	나는 조직 내 안전 프로그램에 적극적으로 참여한다.	1	2	3	4	5
10	나는 작업장 안전개선을 위해 개인적으로 더 노력하는 편이다.	1	2	3	4	5
11	나는 동료가 유해 또는 위험한 작업을 할 때 안전하게 작업하도록 도와준다.	1	2	3	4	5
12	나는 작업장 안전개선 작업에 자발적으로 참여한다.	1	2	3	4	5
13	나는 동료의 안전을 위해서 도와준다.	1	2	3	4	5
14	나는 안전에 대한 아이디어를 열심히 내놓는다.	1	2	3	4	5

초 록

한국 건설 산업의 재해 수준은 매우 높은 수치로, 매년 재해율이 증가하고 있는 상황이다. 많은 안전 관련 연구에서는 안전 사고에 영향을 미치는 요인들과 안전과 관련된 선행요인, 결정요인, 구성요인 간의 관계를 규명하고자 하였다. 다수 연구에서 건설 현장의 안전을 증진하는 방안으로 제도적, 공학적, 교육적인 접근을 제시하였으나, 많은 건설 작업들은 사람에 의해 이뤄지므로 기존의 접근과 더불어 심리적인 요인을 고려하는 것은 더욱 효과적인 접근 방식이다. 따라서, 건설근로자의 심리적 상태를 파악하는 것이 선결되어야 한다. 본 연구에서는 건설 근로자의 안전에 영향을 미치는 스트레스 (직무 스트레스 및 스트레스 대처방식), 정서적 장애 (우울, 특성불안), 음주 습관 (알코올 사용 장애)에 대해 알아보하고자 한다. 이를 위해 도로, 교량, 터널, 지하철, 아파트 현장의 근로자 396명을 대상으로 임상심리학에서 사용되는 심리검사도구와 Griffin과 Neal (2000)의 안전 성과 모델을 이용하여 구축한 설문조사를 실시하였다. 본 연구는 먼저 건설 근로자의 전반적인 심리 상태와 개인적 배경 (인구학적 정보, 고용 상태, 직무 유형, 직무 경험, 임금 조건)에 따른 심리 상태의 차이를 파악하였다. 또한 안전 인식과 안전 행동에 영향을 주는 심리적 요인을 파악하고, 이들간의 매개 효과를 분석하였다. 본 연구의 결과는 심리적 문제들에 대한 경각심을 일깨우고 현장 안전 증진 방안이 있어 심리적 접근의 가능성을 시사한다.

주요어 : 건설근로자, 심리 상태, 개인 특성, 심리적 요인, 안전 행동,
안전 성과

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