

# Understanding the Relationship between Construction Workers' Psychological Conditions and Safety Factors

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**Abstract:** *The South Korean construction industry has shown a high proportion of industrial accidents (approximately 28% of whole injuries) and the continuously increasing accident rate. 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 studied the relationships between psychological conditions—which cover stress, personal temperament, emotional disturbance, and drinking habit—and specific safety-related factors including safety motivation and knowledge, and safety performance of individual workers at a construction site. This study conducted a survey of 430 respondents and analyzed the data with the multiple linear regressions. The results imply persistence, trait anxiety, and problem-focused coping style are the critical factors that should be controlled for enhancing jobsite safety. Finally, the research outcomes could be applied to build a strategic safety management plan for a construction manager.*

**Keywords:** *Construction Worker, Psychological Factor, Safety Performance, Construction Accident, Multiple Linear Regression*

## I. INTRODUCTION

According to the accident report from Korea Occupational Safety and Health Agency (KOSHA, 2014a), 27.70% of the industrial injuries were due to the construction industry and the accident rate in construction has consistently increased in contrast to the whole industry's decreasing accident rate since 2008. KOSHA categorized main causes of industrial fatalities into technological, educational, and managerial issues. The managerial issues accounted for 65.57% of the total fatalities and unsafe behaviour such as leaving hazardous materials onsite (25.21%), carelessness during work (27.29%), and misuse of personal protective equipment (22.08%) took the majority of such managerial issues (KOSHA, 2014b).

Many safety studies have emphasized that 3E (Enforcement, Education, and Engineering) approaches have true potential to reduce workplace injuries and improve safety (Kim and Park, 2002; Ann et al, 2011; Porter, 2011, Park, 2013a). They explained 3E changes safety climate to enhance motivation and safety knowledge of workers and thus perform better performance. In addition to such extrinsic 3E approaches, psychological aspects of construction workers are reported as a potential driver for occupational injuries since construction activities are human-oriented and mental conditions affected by stress, depression, anxiety, or alcoholism can cause abnormal working condition (Haslam et al. 2005; Glasscock et al., 2006; Son, 2011). Thus, investigation of psychological, that is "Emotional", factors will explain more inherent accident causes from the human being's point of view and benefit to safety enhancement by

enriching the concept of 3E (Lim and Chi, 2014). The primary purpose of this study is to understand the relationship between the mental conditions of construction workers and the safety-related factors including safety motivation, knowledge and performance. More specifically, the research will first understand the typical trend of psychological conditions of construction workers and their safety awareness and then investigate how the personal conditions will affect the safety performance on the jobsite.

## II. RESEARCH METHODS

### A. Survey Design

The research team developed a questionnaire to investigate construction field workers' mental health conditions with professional clinical psychologists. The questionnaire also included items to check workers' safety awareness and behavior. Based on previous studies, some psychological conditions could influence on workers' safety awareness and behavior, which include (1) personal temperaments, (2) level of stress, (3) emotional disturbance (e.g. depression, anxiety), and (4) drinking habit (Haslam et al. 2005; Glasscock et al., 2006; Leung et al., 2010; Son, 2008; Son, 2011; Lee, 2011). The authors used the Temperament and Character Inventory Revised Short version (TCI-RS) to look into innate personal temperaments. For understanding the level of stress, the study adopted the Korean Occupational Stress Scale Short Form (KOSS-SF) made by the Occupational Safety and Health Research for job stress measurement and the Ways of Coping Checklist (WCC) developed by Lazarus and Folkman (1985) for stress coping style analyses. For the

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disturbance that influences safety factors, depression was measured by the Center for Epidemiologic Studies Depression Scale (CES-D) and the State Trait Anxiety Index (STAI-T) by Spielberger et al. (1970) was used to investigate anxiety. Finally, the Korean version of the Alcohol Use Disorder Identification Test (AUDIT) from the World Health Organization (WHO) analyzed worker's alcohol drinking habit. Table 1 summarizes the developed questionnaire and the subscales of some measurements.

TABLE I  
 DEVELOPED QUESTIONNAIRE

Psychological categories	Selected Psychological Measurements	Subscales
Personal temperament	Temperament (TCI-RS)	1. Novelty seeking 2. Harm avoidance 3. Reward dependence 4. Persistence
Level of stress	Job stress (KOSS-SF)	1. Job demand 2. Insufficient job control 3. Interpersonal conflict 4. Job insecurity 5. Organization system 6. Lack of reward 7. Occupational climate
	Stress coping style (WCC)	1. Problem-focused 2. Seeking social support 3. Emotion-focused 4. Wishful thinking
Emotional disturbance	Depression (CES-D)	-
	Trait anxiety (STAI-T)	-
Drinking habit	Alcohol use disorder (AUDIT)	-
Safety awareness and behavior	Safety motivation	-
	Safety knowledge	-
	Safety performance	1. Safety compliance 2. Safety participation

Additionally, for the questionnaire development for the self-diagnosis of safety awareness and behavior, the questionnaire validated by Griffin & Neal (2000) and Kim and Park (2002) for the Korean context was adopted to ask worker's safety motivation, safety knowledge, and safety performance such as safety compliance and safety participation. This questionnaire was also ethically approved by the Institutional Review Board (IRB, Approval No.E1403/001-005) and the minimum but reliable number of respondents to justify the regression-based statistical analyses under the .05 significance level was estimated as 304 by G\*Power 3.1 from Heinrich-Heine-Universität Düsseldorf (Park, 2013b). The target group was set based on the type of construction including road, tunnel, bridge, subway, and apartments.

### B. Analysis Methods

The measurements for temperament, job stress, and stress coping style (i.e., TCI-RS, KOSS-SF, WCC) do not

have absolute threshold values that explain whether the respondent has psychological problem or not: it explains A is higher or lower than B relatively. Thus, the research team compared the survey results by construction workers to the other groups including normal adult males, firefighters (an extremely stressful working group), and general office workers in Korea. On the other hand, depression (CES-D), trait anxiety (STAI-T), and alcohol use disorder (AUDIT-K) provide cut-off values for diagnosis that determines respondent's mental conditions. For the relationship analysis, a multiple linear regression (MLR) model was used on SPSS 21.0.

### III. RESULT ANALYSES

The research collected the total of 430 responses: 59 from road, 62 from tunnel, 44 from bridge, 62 from subway, and 169 from apartment construction sites. To understand the respondents' temperaments, the survey results were compared with the normal adult males' score investigated by Min et al. (2007) since the majority of the respondents were male. The results showed that construction workers tended to show higher novelty seeking, harm avoidance, and reward dependence than the normal adult males. Comparing with the firefighter's group (Jo, 2010), the construction workers suffered from the job stress originated from interpersonal conflict, job insecurity, organization system (e.g., unfair organizational policy and support), lack of reward, and occupational climate (e.g., authoritarian culture) that were a similar stress level as firefighters. About the stress coping style, construction workers' responses were compared to the one by general office workers (Kang, 2012) and the result showed that the construction workers had higher emotion-focused coping style and lower problem-focused coping tendency and wishful thinking coping style than general office workers. Seeking social support coping level was similar in both group. But construction workers' converted scores (total: 100) of problem-focused coping style and seeking social support coping style were higher than emotion-focused coping and wishful thinking coping style.

Meanwhile, the collected data indicated that construction workers considerably suffered from depression, trait anxiety, and alcohol use disorder. The research used the cutoff scales adopted from You et al. (2010), Kim and Shin (1978), and Choi (2011), respectively. 37.6% of the respondents had a depression in the level that needed medical aids such as professional diagnosis and treatments. 42.7% of the workers were experiencing trait anxiety and 59.3% of workers experienced alcohol use disorder that required medical treatment as well as continuous monitoring.

Based on survey results, the research selected significant subscales that represented construction workers' mental conditions. The selected subscales for the

regression model development included: (1) personal temperaments, (2) stress coping style even though persistence level and seeking social support were in the standard level because the regression model can compensate such innate characteristics, (3) stresses that stem from job demand, (4) depression, (5) trait anxiety, and (6) alcohol use disorder. Using the six significant influence elements as independent variables, a multiple linear regression model with a stepwise method was developed. The safety awareness and behavior related factors including safety motivation, knowledge and performance were acted as dependent variables. Table 2 summarized statistical analysis results.

TABLE II  
 RESULT OF MULTIPLE LINEAR REGRESSION

Variables		B	SE	$\beta^a$	Adjusted $R^2$ <sup>b</sup>
Safety motivation	Depression	-0.07**	0.02	-0.23	0.14**
	Persistence	0.06**	0.02	0.18	
	Seeking social support coping style	0.18**	0.06	0.14	
Safety knowledge	Trait anxiety	-0.08**	0.01	-0.28	0.20**
	Problem-focused coping style	0.10**	0.03	0.19	
	Persistence	0.05**	0.02	0.13	
Safety performance	Trait anxiety	-0.11**	0.01	-0.34	0.23**
	Problem-focused coping style	0.16**	0.03	0.26	
Safety participation	Problem-focused coping style	0.18**	0.03	0.25	0.27**
	Trait anxiety	-0.09**	0.02	-0.25	
	Persistence	0.07**	0.02	0.15	
	Job stress from organization system	-0.03*	0.01	-0.10	

<sup>a</sup> Standardized coefficient  $\beta$ .

<sup>b</sup> Adjusted  $R^2$  for the entire model.

\*  $p < .05$ .

\*\*  $p < .01$ .

The first model explained the relationship between psychological factors and the safety motivation for workers. Depression influenced safety motivation negatively while persistence and seeking social support coping style had a positive effect on motivation. Among three independent variables, depression was the most effective variable because the standardize coefficient beta was the largest. Second, safety knowledge had a significant relationship with trait anxiety, problem-focused coping style, and persistence. Trait anxiety had a negative effect on the level of safety knowledge. However, problem-focused coping style and persistence positively influenced the level of safety knowledge. Last, safety performance that covered safety compliance and safety participation was negatively impacted by trait anxiety but positively

influenced by problem-focused coping style. A construction worker who had more persistence might show a tendency to pursue safety more actively but one in a stressful situation due to the organizational systems tended to act passively.

#### IV. DISCUSSION

The results of temperaments—construction workers showed a low level of novelty seeking and harm avoidance—presented a tendency towards unwavering moods and overconfidence; it is known that these kinds of workers are not easily affected by emotional disturbance (Min et al., 2007). On the contrast, the results also explained such workers tended to suffer from depression and trait anxiety. It means that construction workers seem to be in a unique working environment where problems with emotional symptoms sometimes occur regardless of innate personalities. Second, persistence impacted on safety motivation, safety knowledge, and safety participation. High persistence usually represents that a person is industrious, persistent, ambitious, overachiever, and perfectionist, and thus, these kinds of personality may increase safety motivation and willingness to safety knowledge awareness. However, safety compliance is one of the passive performances, so the persistence less influence on safety compliance.

In addition, construction workers' stress level is as high as the level of the firefighters who are working under very harsh conditions such as 24-hour shifts and always deployed in emergency situations (Choi et al., 2012). Especially, stress originated in the organizational system—which includes unfair organizational policies or supports, interpersonal or decision conflict, and limitation of communication—have a negative impact on safety participation. When people who get stressed by their organizational system, they could act less actively for safety issues.

Problem-focused coping and seeking social support are categorized as active coping styles, and the other two are explained as passive coping styles. A person with the active coping styles might try to get over the stressful situation actively, while a person who has the passive styles acts timidly (Lee, 2013). Construction workers show an inclination for using the active coping styles, which reports that they always eager to overcome stressful working conditions. Moreover, the problem-focused coping style affects safety knowledge, safety compliance, and safety participation, while the seeking social support style more supports safety motivation. It implies that the active coping style is more important properties than the passive style.

As discussed before, quite large proportion of construction workers suffer from depression, trait anxiety, and alcohol use disorder, and those symptoms are likely to

harm workplace safety (Haslam et al., 2005; Son, 2011). Additionally, depression influences on safety motivation, and trait anxiety makes a bad effect on safety knowledge and performances. Therefore, such symptoms should be managed carefully by offering proper professional personal treatment.

## V. CONCLUSION

We investigated construction workers' psychological conditions. The respondents' temperaments were a low level of novelty seeking, harm avoidance, and reward dependence and a medium level of persistence. Construction workers suffered from a considerably high level of stress; however, they have active stress coping style. A serious number of construction workers undergo depression, trait anxiety, and alcohol use disorder.

The results of multiple linear regression represented that persistence, trait anxiety, and problem-focused coping style are critical factors to be controlled to improve site safety.

The overall construction workers' mental conditions and the relationship between the conditions and safety-related factors could be utilized to build a strategic safety plan on construction sites. For example, the contractors can provide psychological diagnosis and treatment to mitigate emotional disturbance of their employees.

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