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A Study on Logistical Distribution Management and Safety in Thailand's Highway Work Zone: The case of Logistics Drivers

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Abstract

Purpose: The purpose of this study is to analyze the Safety and Logistical Distribution Management system in Thailand's Highway Work Zone based on data from Logistics drivers. Accidents in highway construction zones have caused enormous casualties in Thailand yearly. Statistical data shows evidence of correlation between numbers of accidents and drivers' recklessness. **Research design, data, and methodology:** In this study, we conducted an in- depth interview with 414 logistics drivers and highway construction workers in Khon Kaen province, Thailand. The data was collected based on 63 questionnaires aiming at capturing factors contributing to the risk of safety and cause of accidents in logistic infrastructures such as Highway work zone. **Results:** The result reveals two significant factors affecting safety in highway work zone, which includes construction environment and safety management system. Moreover, the result shows that feeling of afraid and confused while driving within the construction zones significantly affecting driver's risk of having an accident. **Conclusions:** The findings of this study offer that a strategic planning and evaluation of the logistics drivers' satisfaction and construction workers' participation to mitigate highway accidents at construction zones and that drivers' knowledge and perception toward construction safety management plays a significant role in preventing highway accidents at the construction areas.

Keywords : Logistical Distribution, Logistics Drivers, Construction Safety Management, Work Zone Accident

JEL Classification Code : R41, L74, N65

1. Introduction

Transportation system is one of the most important infrastructures in all countries. Transportation does not only allow people to move from one place to another but also is a significant logistic mean of goods distribution, both domestically and cross borders. From a standpoint of economics and policy, transportation is a tool for decentralization and income distribution across regions.

In Thailand, there are four types of transportation, namely road-, railway-, water-, and air-transportations. Road is the main transportation system in Thailand as presented in Table.1. In the construction of logistic infrastructure such as highway construction work zone, risk of accident is high. Accidents occurring at construction sites or zones can cause enormous damages and could involve with people on sites such as engineers, contractors, general workers, outside drivers, pedestrians, and people who live nearby.

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Table 1: Types of Transportation and cost of logistic

Modes of Transportation	Proportion	Cost of logistic
Road	87.50	2.12
Railway	1.40	0.95
Water	11.08	0.65
Air	0.02	10.00
Total	**100**	**2.02**

The road traffic accidents have become the 8th leading cause of death of the world population of all ages. Approximately 1.35 million people are killed on roads yearly. While Thailand has been reported among the countries that have the highest numbers of road traffic accidents and deaths tolls annually, the road accidents relating to highway construction zones have contributed significantly to this number. The highway accidents in Thailand have been an unsolvable issue for decades and numbers of accidents have increased year over year.

The worldwide statistics shows an increase in the number of highway accidents occurring in construction zones annually. In 2019, the United States showed 762 cases of accidents found in highway construction zones that caused 842 deaths (Sakhare, Desai, Mahlberg, Mathew, Kim, Li, & Bullock, 2021). In Thailand, according to the 2019 data from the Department of Highways, there were 17,244 general accidents on highways and of which 310 were reportedly related to the highway construction zones.

During the constructions, not only the relative parties working in the construction areas, but people outside of the work zones such as logistics drivers and pedestrians who make their journeys through the areas also are exposed to risk of getting involved in accidents. Thus, the construction materials, equipment, machines and even the workers affected the convenience of those people outside the construction areas (Haslam, Hide, Gibb, Gyi, Pavitt, Atkinson, & Duff, 2005).

While standard construction safety management can help reduce the risks and improve safety for workers and related staff on sites, accidents occurring on highways relating to the construction zones are different and involve external factors such as logistics driver recklessness and their roles in taking the safety precautions at the highest level. Thus, to better understand the causes and influential factors of logistic highway accidents, it is important to account for the driver's role in the safety management model.

The previous studies have found that there are three important elements of road accidents, namely human element (accounted for 53%), road and environment condition (accounted for 34%), and vehicle element which accounted for 13% (Mohammed, Ambak, Mosa, & Syamsunur, 2019). While previous researchers put their focus analyzing factors of accidents from the road and surrounding conditions, this study focuses on understanding factors that affect drivers' risks and perception while traveling through infrastructure construction areas by using the analysis of the Structural Equation Modeling (SEM).

2. Literature Review

2.1. Risks of Safety

The causation of accidents and injuries are attributed to many factors. Numerous research groups (Hamid, Abd Majid, & Singh, 2008; Agarwal, Kumar, & Singh, 2020; Helander, 1991; Sawacha, Naoum, & Fong, 1999; Wingea, Albrechtsen, & Mostue, 2019), and have shown that human errors, lack of knowledge, insufficient & improper training, negligence, carelessness, and recklessness, and poor safety management are the leading causes of accidents. Over the years, safety management experts have developed theories and models to allow for a better understanding about the causations and ways to manage the chances of allowing the accidents to occur. In 1931, Herbert William Heinrich, a prominent safety engineer, coiled the Domino Theory that describes the causation of accidents. The theory explains that accidents occur from unsafe acts and unsafe conditions. When these two causes occur concurrently, it is more likely to have an accident.

Similarly, the Swiss Cheese Model introduced by the prior author (Reason, 1990) explains a factor which can affect an accident with failure, mistake, or accident. In this model, each of the four levels of cheese is described as a representative of 1) influence of organization, 2) unsafe supervisions, 3) unsafe conditions, and 4) unsafe acts. Additionally, Reason (1990) explains that the holes on those cheeses presented the potential mistakes that could happen and would affect an accident during work. If placing the 4 cheeses together and the hole on each cheese aligns with one another, such a situation will allow the accident to occur.

2.2. Factors Affecting Risks of Safety

Safety concerns on the construction sites are often caused by hazardous human behaviour and unsafe working conditions which described as the representations of individual factor and system factor.

Heinrich, Petersen, and Roos (1980) described safety management as an integral form of accident prevention which comprises of a series of coordinated activities. Hamid, Abd Majid, and Singh (2008) cited from the study of Heinrich et al. (1980) that these activities are "directed to control of unsafe individual behaviour and the unsafe mechanical conditions and must be based on proper knowledge, attitudes, and abilities." The idea of safety management using five factors of safety including 1) environment factor, 2) equipment factor, 3) human factor, 4) management factor, and 5) technical factor. Additionally, the authors provide evidence that human factors affect safety management the most.

Hamid, Abd Majid, and Singh (2008) studied the causation of accidents at construction sites in Malaysia found that human element coupled with factor such as workers' negligence while performing their works leads to high risks of accident. Furthermore, their findings suggests that an unsatisfactory body condition of the workers (i.e., tiredness, illness, alcohol, and drug consumption) decreases efficiency of works and lead to accidents.

Wingea et al. (2019) applied Construction Accident Causation (ConAC) and analyzed 176 severe accidents from the construction areas. The authors examined accidents using the Norwegian Labor Inspection (LIA) introduced in 2015. The results found that there were 7 factors identified as the most affecting factors of safety management including 1) worker's behavior, 2) risk management, 3) timely supervision, 4) the use of materials or equipment, 5) danger in the area, 6) worker skills, and 7) project management.

Agarwal et al. (2020) conducted a study of causes and factors for road accidents in Uttar Pradesh, India. The result revealed 4 determining causes of road accidents leading to death. The authors described that 1) human factor contributes to 78.0% of accidents (57.0% by drivers, 18.0% by pedestrians walking by the roads, and 3.0% by passengers), 2) vehicles account for 8.0% of accidents causes, 3) 7.8% occurred from weather conditions, 4) road conditions accounts for 4.0%, and 5) 2.2% identified as occurred from other causes.

The causes of accidents which occurred on national highways that the Department of Highways oversees were identified as the direct driver causes and accounts for 89%, while indirect drivers and vehicles account for 6% and 4% respectively. In addition, the causes of accidents by direct drivers are described as reckless driving behaviour and violation of traffic signs, while the indirect drivers' causes are related to drunk driving. Regarding the vehicle causes, the report describes overloading and outdated equipment as the leading factors of accidents.

2.3. Safety in Construction Project

Safety management is a vital component of a construction project management. By nature, construction work is considered as one of the most hazardous industries in the world. Construction projects often experience high level of risks, uncertainties, and complexities. Accidents tend to occur more frequently in the construction areas in comparison to other types of work (Sousa, Almeida, & Dias, 2014).

Therefore, safety management needs to focus on high-consequence and high-risk activities as the priority such as verification and validation whether or not the personal protective equipment (PPE) is appropriate and in good condition for the required activity, pre-site preparation (hazard analysis, permits, site familiarization, and ongoing hazard tagging, etc.), ongoing training, traffic management, verification of safeguards, periodic checking of tools and equipment, standard operating procedures (SOPs), risk recognition and assessment, OSHA compliance, and on-site safety compliance personnel.

While quality, cost, and time are the determining factors of a successful construction project, safety cannot be overlooked but must be accounted as the most significant factor. There are many causes of accidents relating to safety concerns. Lack of safety eliminating procedure, avoiding quality design, unskilled labors, lack of knowledge and experience, lack of personal protective equipment, lack of knowledge and training on equipment etc. could expose the construction projects to a great chance of accidents (Ahmed & Hoque, 2018). Therefore, the main purpose of this study is to investigate, identify, and analyze the relation between factors affecting the cause of accidents in highway construction areas.

2.4. Research Hypothesis

This research investigated the relationships between the four dimensions in the context of safety management in logistic infrastructure work zone and driver's feeling through the testing of the following.

Hypothesis:

H_0: Construction environmental factors have no effect on driver's feeling.
H_1: Construction environmental factors have effects on driver's feeling.

H_0: Machine and equipment factors have no effects driver's feeling.
H_2: Machine and equipment factors have effects on driver's feeling.

H_0: Worker's behavior factors have no effects on driver's feeling.
H_3: Worker's behavior factors have effects on driver's feeling.

H_0: Safety management factors have no effects on driver's feeing.
H_4: Safety management factors have effect on driver's feeling.

The theoretical research model is presented in Figure 1.

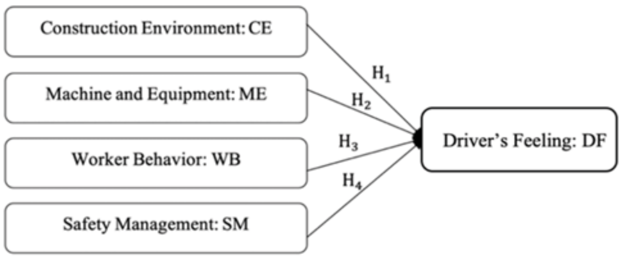


Figure 1: Research Hypothesis

3. Research Methodology

3.1. Questionnaire Development

Data of this study were collected using a questionnaire survey form. In addition, to make sure that the questionnaire was accurate and conformed to working- and social-conditions, four professionals with relevant experience in logistic highway constructions were invited to give advice, improvement guidance, and develop the questionnaire that is most suitable for this field of study. Moreover, all participating professionals are engineers, supervisors, and contractors who have more than 5 years on experience.

The questionnaire items are presented in Table 2. The items for measuring safety factors in logistic highway work zone and logistics driver's feeling were classified into five dimensions as used in the model. A 5-point Likert Scale format was used in questionnaire, ranging in importance level from "1 = Strongly Disagree to 5 =Strongly Agree".

Table 2: Questionnaire items

Code	Item
Safety factor in highway work zone	
SF1	The third party entered the construction area.
SF2	Working without warning signs.
SF3	No installation of lighting at night.
SF4	No warning signs while working at night.
SF5	Failure to control the behavior of workers.
SF6	Insufficient number of signs or equipment.
SF7	Invisible position of traffic signs.
SF8	Incomplete traffic signs.
SF9	Inappropriate position of traffic signs.
SF10	Driving or using heavy machinery in a hurry.
SF11	Inappropriate materials of temporary signs.
SF12	Workers do not wear reflective vests.
SF13	Working without a protective device.
SF14	Narrowing or reducing traffic lanes.
SF15	Traffic deviation
SF16	In sufficient reflective vests for workers.
SF17	Workers neglect while working.
SF18	Heavy rain.
SF19	Electric cables on the road
SF20	Driving with high speed
SF21	Workers tend to drink alcohol.
SF22	Disordered material placing positions
SF23	Unclear construction zone.
SF24	Inappropriate construction zoning equipment.
SF25	Lack of site control over construction areas.
SF26	Inappropriate traffic management.
SF27	No entry-exit management
SF28	Inappropriate use of materials for traffic sign.
SF29	Inappropriate electric system
SF30	Reflection of traffic signs.
SF31	Confusion in construction area.
SF32	Rough road surface.
SF33	No information's board in advance.
SF34	No signs to advise the drivers.
SF35	Inappropriate construction material placing.
SF36	No traffic plans.
SF37	No traffic signs.
SF38	Workers multi-task at the same time.
SF39	Parking in an accident-prone position.
SF40	No signs for material and machine placing.
SF41	Inappropriate position of traffic cones
SF42	A warning sign located too far in advance.
SF43	Working machine close to the traffic.
SF44	Workers not ready to work.
SF45	Workers lift heavy material alone.
SF46	Workers do risky work.
SF47	Not enough traffic lights at night.
SF48	Equipment interferes with traffic lanes.
SF49	Inappropriate temporary traffic lanes
SF50	Construction joins.
SF51	Waterlogging or Flood
SF52	Workers do not pay attention to their work.
SF53	People walk or run across the traffic lane.
SF54	Storing materials in unsafe places.
SF55	Inappropriate dressing in construction area
SF56	Construction area close to the traffic area.
SF57	Several blind spots or high risky points.
Driver's feeling	
DF1	Afraid
DF2	Uncomfortable
DF3	Stressful
DF4	Irritability
DF5	Excited
DF6	Confused

3.2. Sample selection

The sample size of this study was calculated using Taro Yamane's formula (Reliability at 95%). Random samples of 400 people were selected from a pool of 1,802,872 people residing in Khon Kaen province. However, to increase the evenly distribution of data around the province, all of 26 sub-districts of Khon Kaen province were being distributed for the number of the sample groups.

Distributing the number of the sample groups was done by calculating proportions and rounding up fraction numbers. These methods were conducted by dividing the samples into two groups by areas: the urban area and the rural area. The number of samples from two groups were equal and each was 414 people in total. Further, the samples were interviewed and asked to complete the questionnaire. Additionally, calculation method is shown in Table 3.

Table 3: Number of Sample

No.	District in Khon Kaen	Population	Percentage	No. of Sample
1	Mueang	416,285	23.1	92
2	Ban Fang	55,135	3.1	12
3	Phra Yuen	34,806	1.9	8
4	Nong Ruea	93,574	5.2	22
5	Chum Phae	119,697	6.6	28
6	Si Chomphu	78,148	4.3	18
7	Nam Phong	114,017	6.3	26
8	Ubolratana	49,185	2.7	12
9	Kranuan	78,863	4.4	18
10	Ban Phai	100,443	5.6	22
11	Pueai Noi	20,144	1.1	4
12	Phon	86,572	4.8	20
13	Waeng Yai	29,562	1.6	8
14	Waeng Noi	41,921	2.3	10
15	Nong Song Hong	78,307	4.3	18
16	Phu Wiang	72,701	4.0	16
17	Mancha Khiri	71,258	4.0	16
18	Chonnabot	48,205	2.7	12
19	Khao Suan Kwang	38,335	2.1	10
20	Phu Pha Man	23,195	1.3	6
21	Sam Sung	23,651	1.3	6
22	Khok Pho Chai	25,430	1.4	6
23	Nong Na Kham	23,844	1.3	6
24	Ban Haet	32,937	1.8	8
25	Non Sila	26,707	1.5	6
26	Wiang Kao	19,950	1.1	4
Total		**1,802,872**	**100**	**414**

4. Result

A questionnaire was used in collecting the data by interviewing the samples one by one until reaching all 414 samples. The data collected between both groups of samples: the group of samples who drive vehicles in the urban area, and the other group who drive in the rural area. The results of general data collection have shown in Table 4.

Table 4: General Information

Characteristics	No.	Percentage
Gender		
Male	197	47.58
Female	217	52.42
Age		
15-24 years	209	50.48
25-34 years	123	29.71
35-44 years	51	12.32
45-54 years	23	5.56
55-64 years	7	1.69
More than 65 years	1	0.24
Accident Information		
Never	13	3.14
Sometime	306	73.91
Always	95	22.95
Accident Encountered		
Never	94	22.70
Sometime	275	66.43
Always	45	10.87
Accident Experience		
Never	298	71.98
Sometime	95	22.95
Always	21	5.07
Traveling Area		
Urban Area	207	50.0
Rural Area	207	50.0
Total	**414**	**100.0**

4.1. Reliability Analysis

Validity of this study is evaluated based on the developing process of questionnaire. Additionally, the validity of the questionnaire has been examined at the beginning of research design. Various factors have been added or reduced to make it proper to the logistic infrastructure construction context in Thailand.

Furthermore, to ensure the reliability, 63 questions have been tested with 30 samples and calculated for the reliability by statistical analysis program, the result has found that the Cronbach's Alpha Coefficient are presented in Table 5.

Which was more than 0.8 (Hair, Black, Babin, Anderson, & Tatham, 2018; Woo & Kang, 2021) and confirmed that the questionnaire is reliable to use.

Table 5: Cronbach's Alpha Coefficient

Group of factors	Cronbach's Alpha Coefficient
Construction Environmental	0.939
Machine and Equipment	0.976
Worker Behavior	0.981
Safety Management	0.990
Driver's Feeling	0.922

4.2. Factor Analysis

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Factor Loading are presented in Table 6. Which was more than 0.5 (Hair et al., 2018), confirmed that groups of factors can be used

Table 6: Kaiser-Meyer-Olkin measurement

Group of factors	Kaiser-Meyer-Olkin (KMO)
Construction Environmental	0.977
Machine and Equipment	0.972
Worker Behavior	0.956
Safety Management	0.968
Driver's Feeling	0.883

Exploratory factor analysis (EFA) with oblique rotation was applied to determine the underlying factor structures of the sustainability factors construct are presented in Table 7.

Table 7: Factor Loading (EFA)

Factor					Code
SM	WB	CE	ME	DF	
0.772					SF4
0.768					SF40
0.765					SF3
0.763					SF25
0.754					SF36
0.747					SF42
0.745					SF28
0.742					SF26
0.740					**SF27**
0.737					SF54
0.722					SF41
0.720					SF5
0.718					SF39
0.709					SF55
0.695					SF34
0.682					SF16
0.679					SF35
0.664					**SF33**
0.586					SF29
	0.831				SF1
	0.819				SF17
	0.816				SF21
	0.807				**SF38**
	0.799				SF53
	0.794				SF31
	0.783				SF44
	0.774				SF52
	0.771				SF12
	0.764				SF10
	0.757				SF46
	0.753				**SF2**
	0.745				SF45
		0.730			SF18
		0.713			SF50
		0.712			SF56
		0.709			**SF32**
		0.708			**SF51**
		0.696			SF49
		0.689			SF31
		0.687			SF14
		0.683			SF57
		0.661			SF15
		0.642			SF37
			0.796		**SF23**
			0.772		SF11
			0.764		SF47
			0.756		SF22
			0.737		SF48
			0.723		SF24
			0.719		SF43
			0.718		**SF9**
			0.707		SF30
			0.700		SF19
			0.567		SF20
			0.796		SF6
			0.772		SF8
			0.764		SF7
				0.830	DF5
				0.809	DF6
				0.796	**DF1**
				0.788	**DF2**
				0.762	DF3
				0.685	DF4

4.3. Statistical Test (Regression)

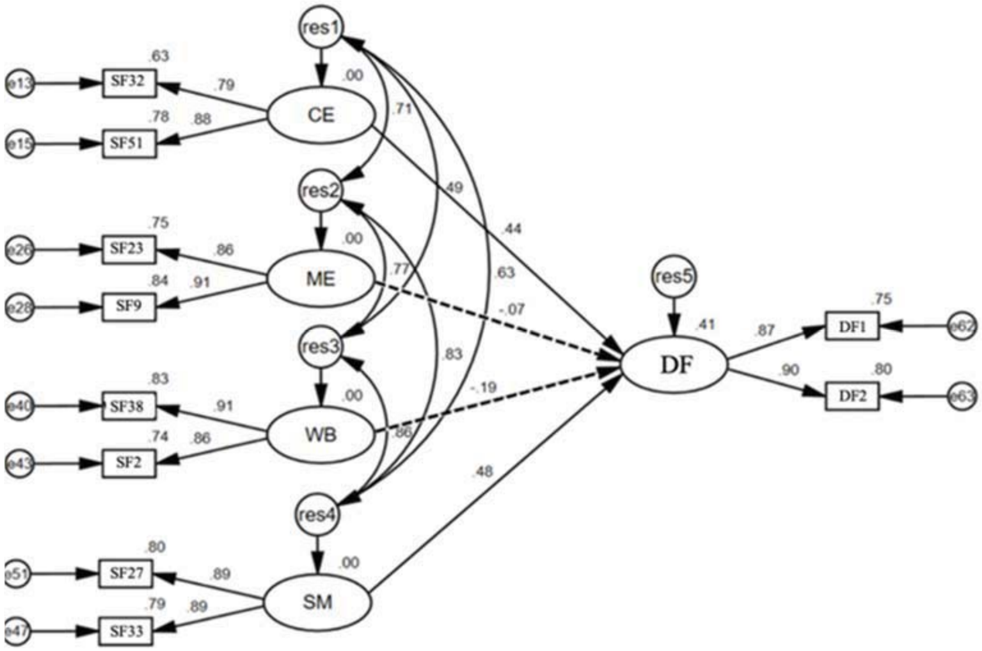
The statistical test from the analysis is presented in Table 8, the results show that some $\beta > 0$. Also, because the P-value is so small (less than 0.001), we can reject the null hypothesis and conclude that β does not equal 0 (Nantharath & Kang, 2019).

Table 8: Statistical test

Path Analysis	β	p-value	Null hypothesis
H_1	0.44	***	Accept
H_2	-0.07	0.554	Reject
H_3	-0.19	0.141	Reject
H_4	0.48	0.001*	Accept

4.4. Structural Equation Modeling

The Causal relationship model is presented in Figure 2 and is presented in Table 9.



Chi-square=33.895, Degrees of freedom (df)=25, Probability level=0.110,
Chi-square/df=1.356, GFI=0.984, RMSEA=0.029

Figure 2: Causal Relationship Model

To confirm that the result is good, fitted model, the measures of agreement is presented in Table 9.

Table 9: Measures of agreement

Index	Results	Reference	
p-value	0.110	> 0.05	Barrett, 2017
Chi-square/ df	1.356	< 2.00	Tabachnick and Fidel1, 2007
GFI	0.984	> 0.95	Hu and Bentler, 1999
RMSEA	0.029	< 0.06	Hu and Bentler, 1999

5. Conclusion

This research aimed to study logistics drivers' feeling toward safety management factors affecting accidents on highway work zone. Using the Exploratory Factor Analysis (EFA) method, the results from statistical analysis in regards to the factors affecting driver's feeling can be divided into 4 groups as follows: 1) Construction environment group, which means the proper environment in construction sites, controlling and preventing the construction workers and drivers from the uncontrollable external factors; 2) Machine and equipment group, which means machines, equipment, and construction materials; 3) Worker behavior group, which means the behavior of construction workers including working carefully according to the rules and procedures., with well management, those materials would be in a proper spot and used properly. That helps increase safety in construction areas; and 4) Safety management group, which means managing the construction area to prevent danger for logistics drivers, managing the risk of accidents which could affect the third party, and managing the flow of traffic lanes. And one group of driver's feeling while passing through highway work zone.

The results of this study were analyzed based on the safety management factor which includes 19 variables that are defined as behavior determinant of construction projects. These variables are considerably high risk for accidents from poor safety management (Tam, Zeng, & Deng, 2004). Worker Behavior, as a second factors, consists of 13 variables concerning safety from the construction environment. Construction Environment group, as the third factors, consists of 11 variables and concern with the safety from the construction environment (Nkurunziza, 2020). There are 14 variables in the Machine and Equipment factor regarding lack of machine equipment affecting accidents in highway construction projects. And 6 variables of driver's feeling while passing through highway work zone.

The confirmatory factor analysis (CFA) summarizes that the first two factors from each group with the highest to lowest factor ranking are presented in Table 10.

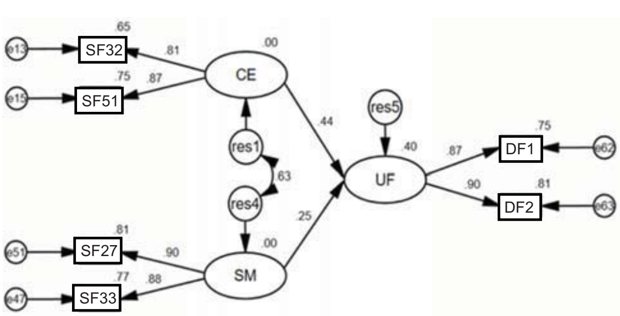
Table 10: Highest factor in each group

Group of factors	Item	
Construction Environment	1	Rough road surface.
	2	Waterlogging or Flood
Machine and Equipment	1	Unclear construction zone.
	2	Inappropriate materials of temporary signs.
Worker Behavior	1	Working without warning signs.
	2	Workers multi-task at the same time.
Safety Management	1	No information's board in advance.
	2	Inappropriate use of materials for traffic sign.

Considering the first two factors from each factor group with the highest factor ranking, the samples have opinions that for construction environment, the participants have stated that weather condition such as heavy rains and rough road surface. When examining the machinery and equipment factor, participants have explained that lack of clear control over construction areas, improper traffic sign (i.e., invisible, or improper located, and not enough lights at night) causing accidents. Regarding the worker behavior, the samples have addressed that the third parties or objects entering the construction areas contributes to the cause of accidents, while the reckless behavior of the construction workers (i.e., playing and making fun act each other while on duty). The concerning relates to safety management, the samples have opinions that no warning signs while working at night and no warning signs where construction equipment are placed causing the accidents. All factors are affected driver's feeling such as feeling afraid and feeling uncomfortable.

The results of regression weight and significant, can be concluded that the construction environment and safety management are affected the driver's feelings. At the statistically significant level of 0.05, while the worker behavior and safety management are not affected.

The results of the causal model analysis revealed that the driver's feelings while traveling through the highway work zone, are 2 feelings, 1) Feeling afraid and feeling uncomfortable. The causal model can be seen in Figure. 3



Chi-square=12.279, Degrees of freedom (df)=6, Probability level=0.056, Chi-square/df=2.047, GFI=0.990, RMSEA=0.050

Figure 3: The Causal Model Analysis

This aligns with the accident causation theory of prior studies (Heinrich et al, 1980; Petersen, 1982) that humans are the fundamental causation behind accidents while safety management is an integrated activities for the prevention of accidents. Moreover, this would standardize the works and increase the level of safety for the construction workers and related personnel as well.

6. Discussion

Accident causation theory (H.W Henrich) said that an accident is caused by the unsafe act and the unsafe condition. In this study, the unsafe act is a result of the performance of construction workers. In addition, if the construction process is being performed correctly step by step, with proper standard and quality, the chance of accident will be decreased and making logistic infrastructure safer for the logistics drivers who travel through the area. The unsafety condition in a logistic highway construction can also cause an accident. Since the process in construction areas consists of machines, construction machines, equipment, materials including some human error conditions, thus, if equipment conditions failure and human error conditions occur, the accident is prone to happen easily at any time.

The Domino Theory by H.W. Henrich has suggested that mistakes or unexpected situations are caused by various causes. One cause affects another cause on and on like dominos collapse. It is as well as a highway construction, only some failures or mistakes from the controller can affect working process. Further, the error working process can affect individual workers and drivers as well.

Additionally, Reason (1990) suggested that an accident caused by mistakes is like holes on cheeses, which are considered as flaws and layers respectively. There are some layers of cheeses preventing the hazard from causing any damages. However, if the holes on each cheese are happened to be aligned, the hazard could get through and cause losses. This metaphor used to compare with the highway constructions. For example, some mistakes happened by the construction workers, but logistic drivers are aware of safety, the chance that an accident will happen is still low. However, if both workers and drivers are careless and unaware of safety at the same time, the accident is prone to happen easier.

Furthermore, statistical data from various units have suggested that there are three main factors causing road accidents. Those three factors consist of 1) Human or driver, 2) Road Conditions and Environments and 3) Vehicle Conditions. In addition, human is number one factor that cause accident. However, considering the detail of data with the data of this study, it has found that the human factor, is the major causes of accidents and can be divided into two groups, namely construction workers and drivers.

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