

Construction Logistics Safety Measures

Zuhra Junaida binti Ir Mohamad Husny^{#1}, Nurul Fatimah binti Ratin^{*2}

^{**}*Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia, Johor Bahru 81310, Malaysia*

¹*z.junaida@utm.my*

²*nurulfatimahratin@gmail.com*

Abstract— Construction logistics is really important as one of the enablers to support rapid development and economy in Malaysia. Heavy trucks used in construction logistics provide the ability to move more and bigger materials for development and manufacturing. However, it caused many problems, particularly in safety aspects, to the community. Hence, it is crucial to investigate more on the safety measures practised in construction logistics activities to adopt the right safety guideline. Three objectives were established. Firstly, to investigate current state of construction logistics in Malaysia. The second objective is to determine the safety measures practised for construction logistics activities by using five indicators from construction safety and health programs: rules and regulations, communications, accident investigation, training and evaluation. Lastly, the objective is to recommend suggestion to improve current situation of construction logistics activities that possessed danger to communities. With extensive data collection, this study has succeeded in stipulating evidence to show: (1) lack of stricter enforcement to combat wrongdoings in construction logistics activities, (2) lack of communication and information sharing among stakeholders, from the authorities, industry players to the communities and (3) insufficient training for employees, particularly drivers. This research has also contributed to future high safety performances in logistics company by providing a guideline and indicators that can be used by the company to measure its safety program practiced.

Keywords— Construction Logistics, Safety Program, Safety Performance, Safety Guideline

1. Introduction

The aim of this research is to study the safety measures practised in construction logistics activities from the scope of construction safety and health. Based on the Department of Statistics Malaysia Press Release Gross Domestic Product Fourth Quarter 2017 [1] Construction industry grew

to 5.8% in 2017, hence demand on construction logistics has also increased. Construction logistics can be defined as a transportation process which are complex, costly and has a high degree of social responsibility, as it involved network of organisations and bounded with a product (project) life cycle and the final assembly of materials and components, usually takes place at the point of consumption, i. e. on the construction site [2]. Construction logistics usually requires the use of heavy truck to carry all the construction materials such as rock, sand and cement. The effect of the increasing volume of heavy trucks on road safety are quite alarming [3][4]. There are various safety problems caused by the construction logistics heavy vehicles to the community, in term of health [4][7] such as noise [5][9] and dirt [9], residential structure risk from vibrations [6], risk from irresponsible parking [6] and risk from increased traffic [8][9]. Building a safe social environment is very necessary to facilitate smooth construction logistics management and operation [10]. There are guidelines in safety and health program to practise safe construction logistics activities in Malaysia such gazetted by DOSH and city councils. However, issues in regards with safety in construction logistics activities are still recurring and complaints from local community still coming to city council. Hence, it is crucial to investigate more on the current guidelines that has been implemented to identify what is lacking in the safety and health program measurements taken in construction logistics activities so that fatalities and problem cost caused by the accidents, and also risks faced by the communities can at least be lessen, because there will be guideline proposed based on the indicators [11] that can improved safety performance of logistics industry.

1.1 Rules and Regulation

Employees must be aware that safety rules are for their own benefit, because they have the most at stake in term of suffers. Rules were made to protect, especially the weaker parties, or in this case

employees and communities. Besides that, when rules are obliged and used in the right direction, it can provide more stable environment. Rules and regulations came from every level. Government is the most powerful law maker, and the laws must be followed by everyone in the country, and then rules also set by the organization that will protect everyone in that organization, and also to protect the business.

1.2 *Communication*

Numerous safety problem occurred because everybody assumed that everyone knows the proper and safe ways to do the job. Unfortunately, that is not the real case scenario. A large percentage of injuries occur when people are not aware and informed of policies, methods or basic skills needed to safely perform a job. The examples of safety practise that will enhance overall communication process are like roadway signs on speed and specific driving issues should be sent to inform drivers about road conditions, and vehicles should be checked for safety before starting the transition. In the event of malfunction during the transit, the operator shall have repaired the vehicle promptly. Checklists preparation will do good for this purpose. Therefore, some methods of communicating can be done to ensure safety not only to employees and drivers but also the community, such as safety meetings, job training, safety bulletin boards and accident investigations [11].

1.3 *Training*

A well planned, ongoing training program is base for a good safety program. It must consist of classroom-type experiences and on the job training to enhance understanding of the employees. Employees or drivers must be taught about technical and job descriptions, safety rules and practises, accidents reporting, first-aid treatment and federal and state laws. A collaboration training programs with government agencies, industrial associations, insurance companies etc will keep the safety training interesting. The drivers will learn more, and they will be afraid to break the rules and harm others. In Malaysia, future drivers must attend several courses in order to obtain driving license. Besides that, companies will set several training sessions for new drivers or employees as mentioned above. For example, in Malaysia, Environmental Department Malaysia has an institute called Environment

Institute of Malaysia that offer various industrial training to industry players. Construction logistics also involved in this kind of training because of their gas emissions and construction materials that can harm the environment.

1.4 *Accident Investigation*

Proper accident investigation is important to prevent reoccurrence of the accident. It must use the right approach which is the fact-finding rather than fault-finding [11] because nowadays too many investigations are based on finding people to blame rather than what exactly happened. Real accident investigation also helps in good training sessions, safety talks and safety meetings. In Malaysia, accidents involving vehicles are usually reported to traffic police and if its involved accidents while working, they must report it to DOSH. Proper investigation will be done, and the case will be used in government study or research to find better solution to prevent or to at least lessen the accident. Besides that, companies usually have their own investigation panels too. Looking at all these efforts by various parties shows that safety is very much important, and proper investigation can help in improving safety and to prevent accidents, because prevention is always better than a cure.

1.5 *Evaluation*

Evaluation is important as it gives review on the effectiveness of company's safety and health programs and help to identify areas for improvement. Checklist for safety and health program can be used by construction logistics service provider to ensure that their safety programs are parallel with its safety goals.

2. **Literature Review**

Logistics is widely used in every industry existed in this world, small and big. Without logistics, movement of people and goods won't be as efficient as it is now, even though there is still error here and there, but it is still manageable. One of the most important elements in logistics is supply chain management (SCM). The supply chain encompasses all the activities associated with processing from raw material to the completion of the end products [12]. Logistics and supply chain are so called repeated activities to support business activity. Goods are repeatedly manufactured and purchased in an ongoing business process, that involved relationships and communication between partners.

However, in construction logistics, in order to minimize the partners exposure to risk, each party in the supply chain attempts to extract maximum reward for minimum risk that is normally achieved by means of passing risk down to the next level in the supply chain [12]. This leads to tension and conflict between partners which result in increasing cost and reducing efficiency, hence safety is not the main concern anymore. Figure 1.0 illustrates this scenario [12].

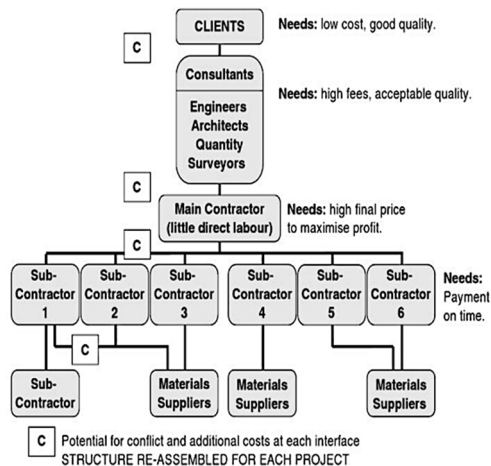


Figure 1.0: Construction Logistics Industry Structure

2.1 Stakeholders in Construction Logistics

Stakeholders in construction logistics plays an important role in ensuring sustainability of construction logistics activities. No public or private decision maker have sufficient knowledge and information to regulate, operate and finance an effective governance action [13]. As construction logistics is a multi-stakeholder activity, the only way to find most successful solution to the issue of safety in construction logistics towards the community, is through the involvement of all stakeholders. Their cooperation will develop into smart governance concept approach [14] which will integrate all the successful tools in construction logistics into a plan that can be set as an example to all construction logistics service provider in Malaysia. Three stakeholders involved in construction logistics activity that will be discussed in this study are (1) Authority (2) Contractors or Developers and (3) Community. Authority is important in controlling various aspects in a government.

Authorities were established to develop policies, and in the context of road safety in Malaysia, its main function is to promote road safety on the ground among the public together with Members of Parliament and State Legislative Members [15].

Authorities' performances are important in giving positive public perception to overall government structure [16], hence improving the quality of government is very crucial to ensure that positive public perception and support towards government's programs especially road safety program are continuous. Figure 1.1 shows the authorities involved in construction logistics activity.

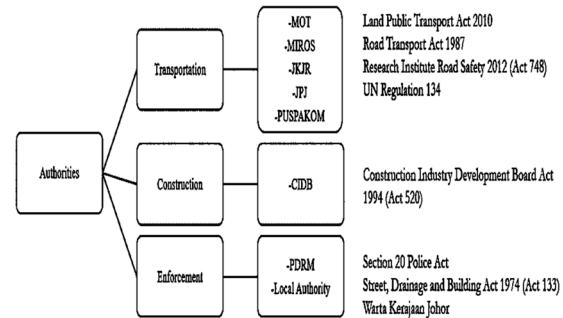


Figure 1.1: Authorities Involved

Contractors are considered as the main player in a project, because they are the one who actually run the project including detailed design, technology selection, plant layout, commissioning, start-up, and further expansion, modification, maintenance activities [17] and communicate with everyone in all levels. Contractors play a crucial role in managing risk throughout project execution, in every aspect, including the logistics activities, and it is proven that contractors need to engage in building safety awareness in the process and personnel [17]. Developers and contractors have the responsibility to ensure win-win situation for their business and community, called 'duty of care'. Duty of care may be reflected as formalization of social contract, the absolute responsibilities held by individuals or organization towards others within community. It is not a must that duty of care be defined by law, though it will often develop through common law [18]. The thing is, if all developers and contractors comply with the laws, there won't be any issues arising.

Community has been portrayed as an original phenomenon, the local union of a group of human beings who live together, share and accept their social, economic and cultural values, and agree to hold certain obligations and standards in common [19], or in simple words, community can be defined as people who live in close geographical proximity, and they usually has the same needs and wants, and they just compromise with each other to achieve one solution for any problem. Community can be seen as a strong force who influenced construction logistics activities. Road safety are no longer perceived as an individual issue or problem [20]. When an accident happened in one area, it is not going to worry only

the people who were involved, but also people who lived in the area, which is the community. There are various reports from reliable sources from local news like Berita Harian, Utusan Malaysia, Sinar Harian and Metro, mentioned that some actions from the community, such as demonstration, road closing and installing bar steel barrier will prevent the trucks from entering residential areas, which directly will disrupt the logistics activities, causing time and financial loss.

2.2 *Impact of Unsafe Construction Logistics Activities to Community*

Unsafe construction logistics will result in bad and negative impact towards community, especially in their social life and daily routine. There are various negative impacts, but major problems that have been discussed in various literature are road accidents (safety), noise, vibration and dust. These have major effects towards community social life in term of health, psychological and environmental issue.

2.3 *Construction Logistics Safety and Health*

Government effort to improve road safety comes in various approach by different stakeholders. All of these efforts have one and one objective only, which is to reduce fatality in road traffic accidents. From the analysis of the data available, in term of accident prevention for heavy trucks, it can be summarized Figure 1.2.

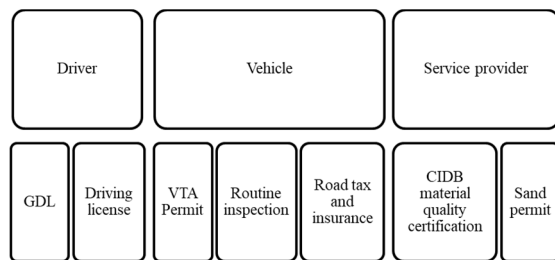


Figure 1.2: Government Regulation to ensure Road Safety

Drivers must have GDL license and Driving license for them to be qualified to drive vehicles carrying goods. For the vehicles used to carry goods, it must have VTA permit, road tax and insurance, besides the need to undergo routine inspection every six months in PUSPAKOM. In term of the construction logistics' service provider, they must have CIDB material quality certification and sand permit to ensure safe movement of construction materials.

3. **Research Methodology**

This study adopted qualitative analysis using the interview. There are five indicators in this study, which formed the semi structured interview with open ended questions. The research design, as shown in Figure 1.3, was developed for this study and divided into three phases where these phases were designed to achieve the three objectives of this research.

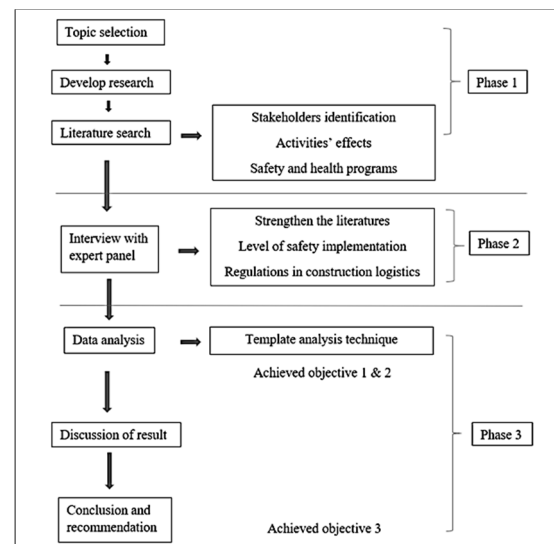


Figure 1.3: Research Design

Phase 1, extensive search and reading have been done through various sources including articles, journal, theses, official websites, reports and statements from government high official, and the review is provided in literature review. The review really helps the researcher in term of: (1) Really understand the subject matter, hence having better plan to execute the study, (2) Familiar with stakeholders in the case study, (3) Impacts of construction logistics to community and (4) Construction logistics safety and health.

Phase 2, In this study, one to one semi-structured interview with the selected panels with the most relevant relationship and experience with this study was used because in depth opinion and information need to be discuss with these related parties. Interview is a specific data collection technique used in qualitative research [21]. Interviews were conducted by setting an appointment for a personal meeting and discussion with the selected respondents in their offices. This method was chosen so that the opinion of the interviewees could be discussed and clarified. The respondents of these

interviews were (1) Authority – MBIP, JKJR and CIDB, (2) Contractor – KOMEJ, (3) Developer – CRESCENDO and (4) Community – Lima Kedai and Ulu Choh.

Phase 3, In data analysis, process to analyse the data will be explained. The process of data analysis involves making sense out of collected textual data [22]. Figure below shows the steps of data analysis process to ensure validation of the information accuracy.

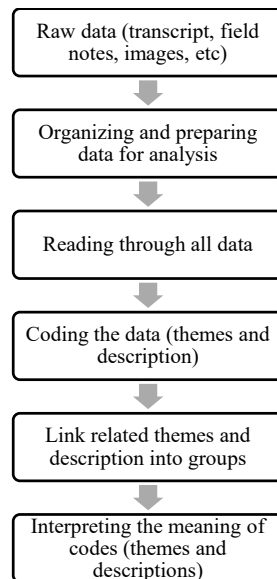


Figure 1.4: Data Analysis Procedure

1. Raw data: Data were gathered in the form of recording, notes or images.
2. Organized and prepared data for analysis: Data gathered from all respondents were transcript word by word, to avoid misinterpreted of information. Data were sorted according to its source.
3. Read through all data: After transcribe process were done, general idea of the information and reflection of overall meaning of the conversations were obtained. Understanding what the respondents were saying and their expression were very important.
4. Begin detail analysis with coding process: All transcription slips were organized into segment of text before meaning can be brought to the information needed. Sentences or paragraphs in transcription were segment and categorized into five themes: (1) Rules and regulations in construction logistics, (2) Communications among stakeholders

in construction logistics, (3) Training of construction logistics' major player (drivers), (4) Accident investigation of construction logistics' heavy trucks and (5) Evaluation of construction logistics' employees and activities.

5. Coding process is used to generate a description of the setting or people as well as categories or themes for analysis: All relevant information was extracted from each respondent. Detail interpretation of the interviews from each respondent and organization was done.

6. Link related themes and description into groups: Themes and description are presented in a table form. Evidence from each theme was compiled according to its group in a category. Descriptive evidences were displayed in coding form to support the themes of the study.

4. Result

All objectives of this study were successfully achieved as shown in Figure 1.5.

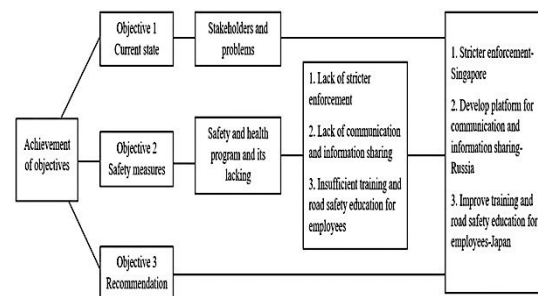


Figure 1.5: Summary of Result

Researcher has identified the stakeholders and the problems related to construction logistics. Findings were gathered from the preliminary interviews had confirmed that problems of construction logistics identified has also occurred in Johor Bahru. Such problems are road accidents, noise, vibration and dust due to impact on unsafe construction logistics activities. According to all respondents, dust and road accidents are the common problems. Even though noise contributed as a problem, but it is not as common as the first two mentioned. Nevertheless, vibration was found as the least issue mentioned by the respondents.

Findings gathered from the interviews also showed that there were few shortcomings in the implementation of safety measures practised for construction logistics activities. First, lack of sterner

enforcement to combat wrongdoings in construction logistics activities. Although, the law and regulations in Malaysia are sufficient in terms of protecting the public, the enforcement is still insubstantial. Second, inefficient communication and information sharing among the stakeholders; the authorities, industry players and community. Lastly, deficient training received by the employees, particularly the drivers. Road safety education is still inadequate in Malaysia. Then again, training might also not be very effective for driver with experience. They tend to be reluctant to change from their usual way of doing things, Hence, human behaviour and attitude should be addressed first in order to resolve any problem. Therefore, it applies the same in construction logistics. So as to be safe and efficient, drivers should understand on the importance to apply good working practice in their working routine.

This study has proposed a Safety Measures Guidelines for Construction Logistics as an improvement recommendation for Malaysian construction logistics as shown in table 1.1.

Table 1.1: Safety Measures Guidelines for Construction Logistics

	Measure	Explanation
1	Rules and Regulations	<ul style="list-style-type: none"> – Follow all safety code and Acts set by Government – Sterner law enforcement – Authority should provide an alternative solution to resolve problem
2	Communication	<ul style="list-style-type: none"> – Establish a shared communication platform – Establish written safety procedures – Provide an efficient training – Investigate violation case – Allocate fund and resources to control activities
3	Training	<ul style="list-style-type: none"> – Develop training modules for road safety specifically for construction work related vehicle drivers
4	Accident Investigation	<ul style="list-style-type: none"> – A more tedious investigation on accidents – Allocate fund and resources to conduct the investigation – Company to establish corrective and preventive action – Effective solution to eliminate problem
5	Evaluation	<ul style="list-style-type: none"> – Establish evaluation / audit tools – Review effectiveness of safety system – Conduct programs to identify areas of improvement

5. Contribution and Conclusion

This study has set a guideline for safety measures in construction logistics as a proposed improvement on current safety practises in construction logistics in

Malaysia. There are five the suggestions proposed in this study. First, increase the number of enforcers, or to deploy current enforcers to work effectively, train enforcers to work with integrity and discipline. Second, develop a platform for stakeholders to share information, such as a website, integration of information between agencies is allotted. logistics The exchange information of certain operations, traffic conditions and delays at drop-off stations, assessment on logistics impacts towards traffic situations (e.g., driver speeding up to deliver cargo in time with no penalty can cause near-miss traffic situations), can contribute to the improvement of road safety, as proved by one case study in Russia [23]. Third, develop a comprehensive training module of road safety specifically for construction logistics. In Malaysia, road safety awareness is still unsatisfactory. However, there is already a plan to start road safety education by the authority. The implementation will start around 2019 or 2020, whereby every primary school and secondary school will have road safety subject, 2 hours per week for primary school and 1 hour per week for secondary school. For kindergarten, it is still in plan to have road safety syllabus in their learning activities. Japan is the real-life example of successful case of effective education resulting in the one of the safest countries, not only in term of crime but also traffic accidents [24]. Apart from regular license application, countries such as Japan has introduced point system. To obtain a driving license in Japan is very difficult and take up necessary knowledge and skills. Japan also have special law dedicated for safe driving education and management system for private companies or public organizations, named The Operational Rules for Road Traffic Law. The best thing about effective road safety education is that, in Japan the system is believed to be remarkably effective in reducing the accidents among freight drivers [24]. Hence, road safety education is indeed the most important element to be improve in Malaysia, so that current situation of construction logistics can be enhanced, and road accidents can be reduced, consequently ensuring behaviour change among the drivers.

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