



CONSTRUCTION SAFETY ISSUES RELATED TO TELECOMMUNICATION INDUSTRY

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Abstract:

Construction is one of the booming industries in the present context. With the rapid development in past couple of decades, it has become one of the driving industries of most the economies in the world. Telecommunication industry, being one of the major branches in construction, too has erupted within this period due to the excessive use of mobile phones. It has been estimated that more than 80% of Sri Lankans use them; when it comes to countries like China and USA, this percentage has become more than 90%. However, mostly due to the time constraints, safety is an aspect which is paid the least attention, particularly in telecommunication industry. Hence, there are a number of fatalities and severe injuries recorded in this arena. Even though that there are several legislations imposed to minimize these, it is observed that there's hardly any proper monitoring scheme to implement them. In this study, the safety issues related to telecommunication industry are identified by means of a questionnaire survey. The survey is carried out covering all the stakeholders; telecommunication companies, tower contractors, neighbouring communities and experts in the field, and the key issues and mitigation techniques are recognized with respective to each perspective. Finally, a set of recommendations are made to mitigate the safety issues related to telecommunication industry.

Keywords: *Tower safety, Relative importance index, Neighbouring communities, Field experts
Telecommunication suppliers, Tower contractors*

1. introduction

Construction industry has become one of the booming industries within past couple of decades, and with the competition and due to the alarming demand, it has become one of the most hazardous among all industries [1]. This unfavourable situation is aggravated due to the nature of the construction industry's rapidly changing conditions, associated work hazards, and the characteristics of construction organizations [2]. Elaborating how hazardous it is, in recent years the construction industry has had a high number of fatalities and high injury rate which is ranking as third worst nationally among industry groups [3]. The reported cost in construction is billions in dollars in economic loss, the cost exceeds beyond its evidence. Indirect cost of accidents might be as much as six times the direct cost or more [4]. This is not only restricted to those working on sites but also children and other members of the public are also killed or injured since construction activities have not been adequately controlled [5].

Hence, Safety has to be considered a major dimension in construction [6] and the causes of accidents should be paid a thorough attention in order to mitigate them. Those major causes are related to the unique nature of the industry, human behaviour, difficult work-site conditions, and poor safety management, which results in unsafe work methods, equipment's and procedures [7]. Majority of them are manageable and within the control of workers and the organization, but in current practise, they are paid considerably less attention than what it deserves.

Various bad effects can be raised due to various causes of poor health and safety aspects and the major effects of poor health and safety aspects are falling down, struck by falling objects, caught in or between objects, contact with electric currents and contact with gasses and fire explosions [8]. People are struck by material falling from loads being lifted and material that rolls or is kicked off work platforms; others are struck or buried by falling materials when excavations, buildings or tower structures collapse [5][9]. A more comprehensive understanding of casual factors leading to fall incidents is essential to prevent falls in the construction industry [10]. On the other hand,

people undergo electric shock and burns when they employ unsafe equipment and overhead power lines and buried cables [5]. Each of these aspects is well within the control of the workers, but their care towards this is of concern.

As per the observation, there are two major reasons why safety is paid the least attention, the urge from the client to deliver the item within a very short period of time, and the reluctance of the organization to invest on proper safety policy. In spite of that a large number of unskilled and unqualified workers engaged in the industry and as a result workplace accidents still occur at an unacceptably high rate [3]. The organization is the key party who should have the commitment about the health and safety aspect as a significant influence on cultivating a positive health and safety culture [11]. There are three competencies that health and safety coordinators deem necessary to strengthen their job performance. These are communication, negotiation, and commitment to the project [12]. Those will improve the safety drastically.

The telecommunications industry, being a branch of construction industry, is experiencing a robust growth on a global scale. Since the introduction of mobile phones in the mid-1980s, there has been a significant increase in the number of mobile phone users and installations of base stations. Mobile phones have become very popular because they allow people to maintain constant and continuous communication without hampering their freedom of movement. This in turn has created a competition between the service providers to provide a better & faster network to the consumer.

As a result of this competition, more & more towers were built to have a greater advantage by providing a seamless connection to the wider consumer population. This will lower the safety standards of both tower & workers as found out in the survey. Clients must be concerned not only with the risk to their employees, but also have to consider about the safety of the public in the tower locations. They have to consider the drawbacks of public lawsuits that may arise.

It is also important to avoid or minimize potential damage to properties, from the perspective of public safety. Therefore, institutions like Telecommunications Regulatory

commission (TRC) are committed to protect public health, safety and general welfare by implementing regulations and guidelines to reduce the impact on environment also.

2. Objectives

The main objectives of this study are:

- Identifying the key issues related to safety in design phase, construction phase and operational phase
- Finding out the relative importance of each of the identified aspects in the perspectives of neighbouring communities, telecommunication suppliers, tower contractors and field experts of construction field and telecommunication field.
- Bringing forward a set of recommendations to mitigate the safety issues related to telecommunication industry.

3. Methodology of the study

The significance of poor safety practices in construction industry were examined and identified through a relevant international literature review and by conducting a pilot study that sought advice from experts in both telecommunication industry and construction industry. The basic purpose of the pilot study was to verify the completeness of the questionnaire in capturing the factors relevant to the local context.

The questionnaire was developed to assess the perceptions of neighbouring communities, telecommunication suppliers, tower contractors and experts in both telecommunication section and construction sector on the *Relative Importance Index* of factors of causes and effects influencing the safety of telecommunication industry, particularly related to tower construction, in Sri Lanka.

The questionnaire focused on obtaining different perspectives of the targeted communities towards key issues identified in all three phases (design, construction and operation) of a tower.

Then the relative importance index values are compared and a set of recommendations are made.

3.1 Justification of Sample Size and Reliability of Data

As per the *Central Limit Theorem*, when the *Sample Size* approaches 30, the *Distribution of Sample Mean* is approximately *Normal* in spite of the *Distribution of Population*. Therefore, a random sample of 80 neighbours, 42 representatives from tower suppliers, 39 representatives from tower consultants and 31 experts, including 12 telecommunication engineers and 19 construction consultants, has been selected for the questionnaire.

3.2 Relative Importance Index (RII)

Relative Importance Index (RII) method is used to determine the relative importance of various causes of delays of in construction projects [10]. The same method can be used to find the relative importance index of effects and causes of poor safety practices in building construction industry in Sri Lanka. The five point scale ranged from 1 (minimum effect) to 5 (extreme effect) was adopted and transferred to relative importance index (RII).

$$RII = \frac{\sum W}{A*N} \dots\dots\dots (1)$$

- “W” is the weighting given to each factor by the respondents.
- “A” is the highest weight
- “N” is the total number of respondents.

The RII value has a range from 0 to 1. Higher the value of RII, more critical is the issue according to the respective respondent.

4. Analysis of Data

Data analysis has been carried out to identify the different perspectives of the four selected groups of stakeholders, neighbouring communities, telecommunication suppliers, tower contracts

and experts related to the field (telecommunication engineers and consulting civil engineers)

It had been found out that neighbouring communities have an extremely negative attitudes towards the towers around. By this analysis, it is expected to identify exactly which issues that concerns them for that. The analysis is shown in **Error! Reference source not found.**. At a glance it can be seen that they are not really worried about the design phase of towers, but construction and maintenance phases.

The safety issues in telecommunication suppliers' perspective is presented in Table 2. According to them, design and construction phases play significant roles in issues related to tower construction industry.

Table 3 depicts criticality of the issues in the vision of tower contractors. They too claim that design and construction phases have to be carefully addressed in order to mitigate the issues related to the field.

The way that telecommunication engineers and civil engineering consultants see the safety of the industry is shown in Table 4. According to them, design is the phase where most of the current issues are caused, and it is the phase that the stakeholders have to address in order to mitigate the alarming safety condition of the field.

5. Discussion

Neighbouring communities think that construction and maintenance are the phases that are critical as far as safety is concerned. The key issue according to them is the lack of sufficient regulations to ensure safety during construction phase. According to them, there isn't sufficient provision for safety after construction. Not having a proper safety plan and not taking sufficient precautions to ensure them too have been identified as critical issues. The interviewed sample of telecommunication suppliers think that improper design of connections is the most critical issue with regards to the safety of the telecommunication

tower field. However, their ideas contradict with the ideas of neighbouring communities regarding the sufficiency of regulations. This sample claims that the existing regulations are sufficient, if they are implemented properly. It has been stated that it is a matter of execution of the existing regulations. Furthermore, they claim that the defects liability period, which is normally one year, is insufficient in the context of the industry.

According to the tower construction contractors, currently, the design of grounding is at a critical state, which is only checked only at the time of Provisional Acceptance Test is done, without paying any other governing parameters like the ground water table. Most importantly, they accept that they don't take proper security measures during construction, particularly because of the lack of allocation of expenditure from bills of quantities. In addition, they claim that not having a proper master plan for site selection and choosing of sites which are difficult to access too are significant issues as far as they are concerned.

In the context of this study, the expert ideas can be taken as the most important set of data as it can be taken that they represent the actual conditions in the field. As it has been mentioned above, both the sectors of telecommunication engineers and civil consultants are selected as experts. Key issues according to them are,

- Improper design of connections
- Unavailability of qualified supervisors during construction
- Not having a proper monitoring scheme for the towers after construction
- Not having a proper master plan in selecting locations for towers

Observing the expert views and other stakeholder views, it is evident that other stakeholders do not have the correct attitude towards the industry. The only coincidence of the expert opinion and the other stakeholders is that both the parties feel that the improper design of connections is the most severe issue that this field faces. Other than that there's hardly any match in opinions.

Table 1: The issues related to telecommunication industry according to neighbouring communities		RII	Overall rank
Design phase			
1	Not taking proper actions to protect neighbouring communities	0.788	4
2	Not having a provision for construction safety	0.741	11
3	Improper estimation of costs	0.718	13
4	Not having a proper master plan in selecting locations for towers	0.706	14
5	Construction of towers in environmentally sensitive areas	0.682	15
Construction phase			
6	Not having sufficient regulations to ensure safety	0.825	1
7	Not using a safety plan	0.800	3
8	Bad co-ordination of the parties involved	0.788	5
9	Lack of provision of budget for site safety	0.776	6
10	Clearance issues (high voltage lines, etc.)	0.753	9
Operational phase			
11	Not having a provision for construction safety	0.812	2
12	Not obeying the available regulations during construction	0.765	7
13	improper security measures during construction	0.765	8
14	Unavailability of qualified site supervisors	0.750	10
15	constructing towers in locations in underground service lines or overhead power lines	0.729	12

Table 2: The issues related to telecommunication industry according to telecommunication suppliers		RII	Overall rank
Design phase			
1	Bad design of connections	0.840	1
2	under designing of towers	0.800	5
3	Bad grounding design	0.780	8
4	Not having a provision for construction safety	0.780	9
5	Not taking proper actions to protect neighbouring communities	0.760	12
Construction phase			
6	Clearance issues (high voltage lines, etc.)	0.830	2
7	Not obeying the available regulations during construction	0.820	3
8	Not using a safety plan	0.800	6
9	Lack of provision of budget for site safety	0.780	10
10	Not having sufficient regulations to ensure safety	0.780	11
Operational phase			
11	Limited defects liability period	0.810	4
12	Lack of staff for carrying out inspection	0.790	7
13	Not measuring the radiation levels after construction	0.760	13
14	Lack of provision for cost for inspection	0.760	14
15	Not checking the condition of towers after construction	0.700	15

Table 3: The issues related to telecommunication industry according to tower contractors		RII	Overall rank
Design phase			
1	Bad grounding design	0.867	1
2	Not having a proper master plan in selecting locations for towers	0.830	5
3	Bad design of connections	0.810	7
4	Not taking proper actions to protect neighbouring communities	0.808	8
5	under designing of towers	0.764	13
Construction phase			
6	Clearance issues (high voltage lines, etc.)	0.850	2
7	improper security measures during construction	0.840	3
8	Lack of provision of budget for site safety	0.824	6
9	constructing towers in locations in underground service lines or overhead power lines	0.802	9
10	Not obeying the available regulations during construction	0.798	10
Operational phase			
11	Corrosion of the towers	0.838	4
12	Not carrying out inspections by relevant authorities	0.790	11
13	Lack of provision for cost for inspection	0.786	12
14	Not checking the condition of towers after construction	0.760	14
15	Resistance from neighbouring communities	0.733	15

Table 4: The issues related to telecommunication industry according to the experts		RII	Overall rank
Design phase			
1	Bad design of connections	0.850	1
2	Not having a proper master plan in selecting locations for towers	0.820	4
3	Construction of towers in sites that are difficult to access	0.810	5
4	Not taking proper actions to protect neighbouring communities	0.780	7
5	Not having a provision for construction safety	0.776	8
Construction phase			
6	Unavailability of qualified site supervisors	0.846	2
7	Not having sufficient regulations to ensure safety	0.800	6
8	improper security measures during construction	0.770	9
9	Not using a safety plan	0.767	10
10	Clearance issues (high voltage lines, etc.)	0.750	12
Operational phase			
11	Not checking the condition of towers after construction	0.833	3
12	Not carrying out inspections by relevant authorities	0.760	11
13	Not measuring the radiation levels after construction	0.740	13
14	Corrosion of the towers	0.733	14
15	Limited defects liability period	0.730	15

6. Conclusions

In this study, four different points of views have been studied, neighbouring communities, telecommunication suppliers, tower contractors and experts (telecommunication engineers and civil engineers). Following conclusions can be made:

- Neighbouring communities claim that construction and operational phases are more critical in terms of safety.
- The key issues identified by them are,
 - Insufficiency of regulations to ensure safety
 - Lack of provisions to ensure safety during construction
 - Unavailability of a proper safety plan during construction
 - Insufficiency of attention to protect neighbouring communities to towers.
- According to telecommunication suppliers the critical phases are, design and construction
- Major issues as far as they are concerned are,
 - Improper design of connections
 - Clearance issues
 - Not obeying the existing regulations
 - Insufficient defects liability period
- Tower contractors also think that design and construction phases are more severe in risk in comparison with the operational phase.
- The issues to be paid priority according to them are,
 - Improper grounding design
 - Clearance issues
 - Improper security measures during construction
 - Corrosion of towers
- Experts see many critical issues in design phase. According to them, the key issues are,
 - Improper design of connections

- Unavailability of qualified site officers during construction
- Unavailability of a proper monitoring scheme of towers after construction
- Not having a master plan in selecting location of towers

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