

Construction Practices in Karachi Featuring Town Wise Study: Non-Compliance of Safety Measures and Consequences

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Abstract— Based on the statistical evaluation of accidents, the construction industry on an overall basis is full of dangers and risk oriented. The activities involved become hazardous when compliance with the safety rules and regulations are not properly followed, as a result high rates of accidents occur on the construction sites. In the metropolitan city of Karachi, Pakistan, a poor safety record has been observed in the construction industry. The primary reason existing for this situation is a non preventive construction safety practice during execution of the projects. The secondary causes are dependent on the lack of resources, skills and interest of the concerned public sector agencies in enforcing the safety protocol regulations for the construction sites. In-addition, this situation also arises due to the lack of training in construction practices, child labor and a minimum awareness about the safety rules and regulations concerned with working on the construction sites.

This necessitated a need to embark on a program of collecting data in connection with the accidents occurring on construction sites in Karachi; a six months program involving Construction Site Accidents (CSA) was accomplished. This involved different districts of Karachi region to be included in this study. In particular, CSA contributory factors relating to skilled, semi-skilled, and non-skilled laborers were evaluated and marginalized. Through this study, it will be shown how by properly implementing the safety and operational measures, based on statistical conclusions, the rate of accidents can be significantly reduced.

Index Terms— Construction, Construction Site Accidents (CSA), Safety, Labor, Construction Industry.

I. INTRODUCTION

Construction sites all over the world have been regarded as very risky areas where construction workers are subject to all sorts of major injuries and health related problems. Risk assessment analyses at the construction workplaces in relation to the activities from working underground, working in confined places, close proximity to falling objects, handling loads manually, handling hazardous substances, noises, dusts, using site equipment, fire and exposure to live cables etc., provide a viable foundation for a safe construction environment. In absence of reliable risk assessment of the construction site activities, the safety aspects in relation to the productivity of construction projects in general and labor accident related issues in particular are more probable to occur. In order to mitigate the risk factors, an integrated risk

assessment and safety check plan has to be exercised. This scenario in construction practices in Pakistan, in general, and Karachi metropolitan in particular, has attained the monumental dimension where appraisal of risk assessment and safety compliance actions is most often performed only minimally or even neglected in certain situations. To gain insight into the construction practices in Karachi, in general, and labor related safety issues, in particular, it necessitated a need to embark on a program of collecting data in connection with the accidents occurring on construction sites in Karachi. In the later sections, the impact of Karachi as the financial hub of construction practices, scope of work detailing data collection about labor accidents, research methodologies adopted for accident identifications, statistical presentation and recommendations and conclusions about this study are presented.

II. ASSESSMENT OF THE GROUND REALITIES OF CONSTRUCTION PRACTICES IN KARACHI

Construction is one of the biggest industry amongst all focusing revenues and expenditures of the country specifically for densely populated city Karachi, Pakistan. Karachi is the financial Hub of Pakistan which in turn produces a signified rate of return featuring industrial and construction parameters. The construction industry has contributed in the major developments of the city of Karachi for the past few years identifying number of sectors including commercial, industrial and residential. These areas are developed in the standard lines of technological advancements. When different types of constructions are considered in the industry with respect to the nature of work, site requirements, manpower, machinery and available resources, then it is more important to create a uniform balance in between the construction parameters and safety aspects which is unfortunately not fulfilled at all especially in the construction industry of Karachi, Pakistan [1].

Safety is not only concerned with the labor or site safety, it has a very vast perspective. In each stage and phase of a construction project safety is mandatory which will ultimately benefit the overall project in several terms at the completion or in return after availing some useful time for the entire project.

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Now -a- days, the construction safety parameter taken to be considered as an expensive feature so it must be taken as an unavoidable action, although if it is taken in a serious manner, the situation shall be in control from design phase till the handover of the project [2]. A chronological list of labor related accidents from the most frequent to the lowest are described below.

The most of the major causes of labor related accidents in the top tier are related to:

- A lack of work safety awareness among labor.
- Improper operations.
- Attitudes toward safety issues.

There is a big gap between safety awareness programs and steps taken by the workers on safety issues. The agenda of construction safety is not taken into account for education perspective although it is not being implemented by all stakeholders. When the project is not subjected to safety parameters, improper operations were taken leading to site injuries and accidents.

Occurrence of labor accidents on an intermediate tier is mostly due to the result of:

- Use of ill-conditioned equipment.
- Mishandling of the relevant equipment by non-professionals.
- Lack of work competence.
- Extreme weather condition.

The above are some indirect factors also responsible for on-site accidents including inadequate equipment in association with workers competency and related to use of equipment with respect to different weather conditions. Relevant professionals are not present for equipment dealing and management.

The labor accidents at the lowest tier are due to:

- Operational and organizational pitfalls.
- Poor lighting, health and fatigue.
- Lack of supervision.

Construction safety perspective is also dependent on some of the managerial issues which include site conditions, operational issues and improper supervision by concerned staff.

Occupational health and safety guidelines and construction safety code of practice may provide better understanding of safe utilization of resources, perhaps regulations must be transformed in relation to the exact nature of work [3]. It is needed for a country to develop their own standards of construction safety based on the legal framework of available standards. The identified codes and standards may provide better help for the formulation of said work based on the own construction activities, nature of work, available resources, human capacity and monetary benefits.

III. SCOPE OF WORK

The overall research study is carried out to meaningfully ascertain the number of construction accidents that took place for safety reasons. In this connection, a detailed survey of various towns of Karachi has been carried out. The survey is based on the identification of minor and serious injuries of

construction related to the unfavorable environmental conditions faced by labor. It is expected that in the wake of recommendations of this particular study through an effective use of site resources, an adaptation of codes and regulations, safety training and consistent managerial skills of the concerned stakeholders, the rate of accidents will be reduced. Concerning this a detailed classification of contributory causes for various categories of labor is developed through proper questionnaire survey technique; the data of such study are then analyzed on a macro level for the formulation of safety outlooks, recommendations, and conclusions. The scope of work is presented in a way to focus attention on the construction site accidents of labor, and come out with a proposed model incorporating the critical human issues, environmental aspects, and managerial engagements. The recommendations are then drawn based on the surveys performed, detailed analysis, and the available literature related to construction safety. The described study is well designed to impart a little effort in the area of construction safety. At the initial run, the paper is presented for different towns of Karachi but afterwards the study may be carried out for black spots of the city in support to subjected towns and that must be the next outcome of this research work.

IV. LITERATURE REVIEW

Occupational safety is a main concern in the construction safety. This is due to the expectation and demands of clients for improved benefits and excellent performance by contractor's side resulting into the economic benefits and increased productivity [4], [5]. According to literature [6], the fatal rate in construction industry leads to the total in excess of 1,000 annually, which is thrice the fatal rate of manufacturing industry. Safe working zone for workers should be provided on priority basis when dealing with construction industry, this is explained in detail in [7]. The workers employed on construction sites are fully aware with the rules and regulations of working stream but the situation is adverse in developing countries, especially Pakistan. While comparing the education and knowledge of skilled labors, there is a ratio of only 5% labors who are experienced with the safety knowledge of construction sites and even they are in a position to rectify or overcome their own rights and problems in judicial manner; but unfortunately this percentage is too small when compared with other countries.

It is quite evident that the working environment for construction works are more hazardous and technical than other labor industry due to working with heavy equipment, tools and machinery and risks involved in handling with hazardous materials; that is why there is an immense need to incorporate safety at all associated levels of construction [8]. It is a common practice that owners of large projects are actively involved in construction issues and can push for implementation of safety parameters. This may include design contract selection, safe development and recognition programs [9]. One of the important interventions in this study is the entitlement of safety committee for improvement and safety culture promotion. An organogram consisting of the concerned stakeholders and professionals is designed in such a way that a sense of collective responsibility is realized at

different safety activities in the construction [10], [11]. It should be in practice to compulsorily impose the matters of on-site construction safety to the labor; construction safety education must be given by training programs and related activities. The activities of workers should be monitored at various stages of construction during the training program and they should be given incentives and promotions on their better results. This will provide them the room for improvement and appreciation for future works.

Poor construction and safety performance may also be watched closely and evaluated through a proper hazard management system. The system contributes to construction environments and produces linkages with the associated incidents [12]. All of the suggested programs are based in order to properly enhance the skills of related workers that shall help them out to produce the best for a much better productivity. The workers usually are too pleased or satisfied about something they have achieved, in these circumstances the challenge is for any organization, is to break the cycle of smugness substituting for knowledge, i.e., using knowledge to reduce the risks that complacency brings with it [13]. The labor group of any construction should be treated with the direct coordination amongst the stakeholders because this is a common practice that they might not approach to higher authorities for specific rights, compromising on the basic necessities and provisions. It is the mind set of labor group that to work with safety equipment is a difficult task and the management is simply forcing it to do so. In fact based on facts and figures, it is revealed that to work with safety equipment during construction ultimately benefits the labor by all means. In developing countries, a big responsibility lies on the shoulders of labor in regards to support of their dependents; it is therefore extremely important for the executing authorities to safeguard the safety and welfare of the labor at every stage of construction. The following is the probable list of activities that may be considered for any hazard recognition program for construction project [14]:

- Pre-job safety meeting; for hazards identification and awareness. Responsibilities shall be assigned in such type of meetings.
- Engagement of senior staff in activities; as they are not aware of all issues and problems.
- Development of the virtual environment for hazard identification; software applications and trainings shall be promoted for monitoring and evaluation. This will ensure the use of latest technology rather than manual working.
- Situational awareness training programs; this training is somehow different than the ordinary training as noticeable issue and problems are to be practiced and dealt on-site as experienced and faced. Video tapping techniques may be used for capturing certain problems and discussing afterwards in between.
- Audit procedures; safety audits may be done for unidentified hazards and future lessons.
- On-site information for hazards; on-site informatory signs shall be used for workers safety. Furthermore, specific work zone safety signs must be used for visitors and residential area if required.

- Precursory visual aids; tapes, signals and LEDs are utilized in this case for providing on-site safety information.
- Deputation of foreman employee; designated responsibility should be given to a person monitoring the labors working with safety, provision of protective equipment, safe material handling and similar tasks.
- Video/ photo monitoring and impact; CCTV cameras should be installed for monitoring focusing safe working environment and producing impact studies on productivity.
- Hazard analysis; before the start of work, a detailed mathematical analysis should be carried out for clear picture.
- Task demand assessment; preliminary approach should be proposed for each task and activity during construction initially considering the complexity of work.
- What-if analysis; brainstorming should be done by all members at the safety meetings. A representative from labor side should get involved in such meetings for better outputs.
- Impact studies; before and after studies should be carried out for learning.
- Record keeping and accident analysis; with the help of specific mathematical tools and techniques detailed accident analysis should be done following the contributory factors while data base of all incidents and activities should be maintained by a representative.
- Safety checklists; a checklist should be produced and developed for site safety program. This may be developed based on site requirements and available literature.
- Method statement; work permit for all tasks and activities should be given.
- Walk-through safety audit; unplanned safety audits may be carried out by project managers in order to check certain activities.
- Worker to worker observation program; observations and intensions should be provided on an individual basis by stakeholders. At some stages, the overall project is affected due to the non-competence of a single labor.
- Proactive safety alerts; sirens and alarms will be considered for proactive system and hazard detection.
- Efficient analysis and planning; above all, planning and analytical works must be carried out in association with reality and documented effectively.

V. RESEARCH OBJECTIVES

Following are some of the concerned objectives of this comprehensive research study:

- Development of proposed statistical model based on the construction site accidents of labor in particular reference to certain contributory factors.

- Development of analytical strategy with a coding type approach for similar accidents in various towns, and hotspot sites of Karachi.
- Identification of unsafe practices and management actions happening on construction sites connected with different categories of labors i.e., un-skilled, semi-skilled and skilled.
- Identification concerning lack of awareness, and training related construction site accidents through analytical evidence.
- Conclusions and suggestions of ways and means that might be helpful for the practicing construction industry of Karachi.

VI. ENFORCEMENT OF LABOR LAWS CONCERNED WITH THE CONSTRUCTION ACCIDENTS

It goes without saying that how the pivotal and important role of the labor is concerned with the success of the construction industry; non-the-less in metropolitan cities in developing countries in general and specifically in relation to Karachi, this role is greatly influenced by lack of enforcement of the safety standards. The labor safety standards and guidelines [15], [16] are rarely practiced in letter and spirit; neither is sufficient safety equipment available on the site nor is there any sustained program of training to use this equipment safely. Training programs educating the labor about personal safety, proper use of equipment, precaution in handling of hazardous and toxic materials and substances, and similar issues are very often ignored by the construction management. The labors are not well aware of the safety equipment, like safety helmets, gloves, shoes, glasses, ear plugs, visible jackets etc. The understanding of these accessories should be the part of safety trainings.

VII. CONSTRUCTION SITES OF DENSELY POPULATED CITY KARACHI, PAKISTAN (VISUAL PRESENTATION)

In order to setup, a format of recommendations encompassing a densely populated Karachi, and as well identify the spots of the unsafe construction practices, a vast array of sites needed to be included. Therefore, an efficient identification of target areas with a view to generating the required information that will be pertinent to the construction safety issues specific to the Karachi construction sites was conducted; with a particular reference to site supervision, building works, handling of equipment and inefficient site management. In the following, more details about the selected sites are mentioned.



(a) Labors without safety provision

(b) Unattended construction material

Fig. 1: View of a Construction Site in Karachi

As shown in Fig. 1(a), the unsafe construction procedures are displayed during the work in progress at one of the selected sites. The labors are elevated for execution while they are not provided with safety helmets and belts for safety. According to a study related to accidents due to fall of workers showed that accidents took place at elevations of less than 9.15m [17]. Now, if workers are forced to work with these accessories, safety will be enhanced not only in terms of manpower but an associated safe intention shall be transformed on execution for better outputs [18]. In Fig. 1(b), reinforcement bars are placed unattended with no safety signs and markings. This may produce injuries for on board manpower and visitors. These are some of the onsite examples giving the clear idea, in-fact there are also unsafe and dangerous features by labor that are to be noticed everyday on site. Certain labor by laws and evidences like contract labor regulations, building workers act etc., should be followed and imposed for effective working environment [19], [20]. It is also important to have a safe environment for non-workers as well. There are number of sites in Karachi that are more exposed to main arterials and certainly harmful for road users. Safety zones with major restrictions should be identified for pedestrians, passengers and other road users.

VIII. RESEARCH METHODOLOGY

The whole research study is carried out with coverage of the construction accidents that occurred on the selected spots and towns of Karachi. For a strategic balance of this study, a total of 18 towns of Karachi are taken into account for this consideration. While the proposed strategic planning is applied in order to highlight the relevant problems and suggest probable solutions akin to the specific construction sites or spots. Data collection and complete analysis with recommendations is being done in this research study for a period of six months (July to December, 2017).

Fig. 2 is featured keeping in view the severity rate of construction accidents in different towns of Karachi [21], which will be discussed in later part of the paper. Town wise numbering is mentioned in the map while the order or numbers shown in square shapes are basically the sequence of severity rated accidents in respective towns.

The data is collected on the basis of a detailed questionnaire and suitable survey techniques. The interview survey was directed to the deputed labors pertaining to construction safety and this interview was taken from number of stakeholders in order to perceive the relevant and targeted information. The coding based questionnaire was developed in a way to highlight two major parameters, type of injury and contributory factor, and this illustrates type of injuries like minor, moderate or severe associated with the corresponding contributory factors. The contributory factors were in themselves were categorized into personal responsibility, equipment malfunctioning or handling, managerial actions, organizational and environmental related factors. The identified factors were the main heads of questionnaire; detailed factors with proper coding strategy were also mentioned and collected for macro level analysis. The Table I, is giving the brief idea of designed and implemented questionnaire.

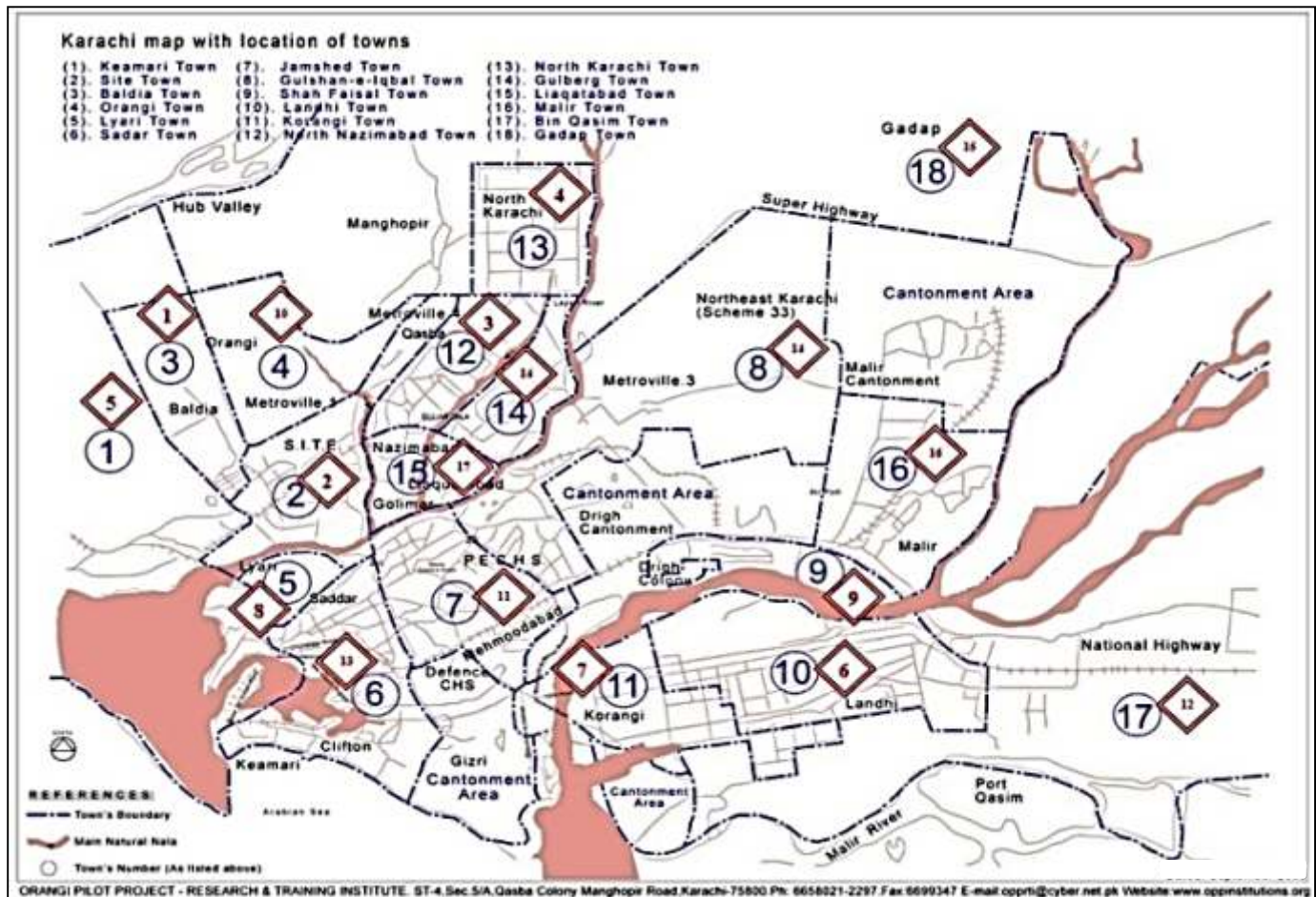


Fig. 2: Scheme or Town Plan of Karachi, Pakistan with Severity rate observed [21]

Table I: Detailed designed Questionnaire for Research study

Questionnaire Construction Accidents Survey Data (July 2017 to December 2017) Karachi										
Address of Construction Site:										Date:
										Labour Age:
<i>Please Tick</i>										
Labour Type:			Skilled	Semi-Skilled	Un-Skilled	Work Experience in Months:				
Mason	Formworker	Steel Fixer	Plumber	Welder	Electrician	Carpenter	Glazer	Painter	Machine Operator	Other (Specify)
Type of Injury			Minor	Moderate	Severe	Type of Treatment After Injury		First Aid at Spot	Medical Treatment	Remarks:
Code A	Human Factors	Code B	Equipment Factors	Code C	Management Factors	Code D	Organizational Factors	Code E	Environmental Factors	
A.1	Lack of work safety awareness	B.1	Improper operations	C.1	Inappropriate construction planning	D.1	Lack of organizational safety norm	E.1	Extreme weather	
A.2	Lack of work competence	B.2	Unreliable work equipment's	C.2	Inappropriate operative action	D.2	Lack of team work	E.2	Lack of lighting	
A.3	Worker capabilities (including knowledge/skills) communication	B.3	Condition of equipment	C.3	Lack of supervision	D.3	Supervisor negligence	E.3	Injuries by wastage and raw materials	
A.4	Attitudes towards safety	<i>Describe in Detail (if Required):</i>								
A.5	Health and fatigue									
<i>For Office Use Only</i>										
Name:						Designation:				

The assigned coding is also based on technical norms while labor types like mason, plumber, carpenter, etc. are also focused on construction safety provisions in a personalized fashion.

During the data collection, public sector mega projects in particular were under consideration and the selected safety parameters were also checked and analyzed; the consensus of contractors and consultants was also sought for this. As per the interview survey, it was noticed that many site accidents were documented in accordance to the diversity of accidents, e.g., improper working in excavation, backfilling, steel work, working at elevation, operating machinery, and handling toxic materials like asbestos, bitumen and termite control agents, see Table I.

IX. ANALYTICAL FACTS & FIGURES

The analysis presented herein encompasses a broader perspective of safety format that addresses sufferings of skilled, semi-skilled and unskilled labor due to the negligence of safety norms coupled with unemployment potential in developing metropolitans like Karachi. The classification of accident types is based on three categories, namely, minor, moderate and severe injuries. As per the standard definition, a nominal and negligible injury produced, not pertaining to major health problems comes under the head of minor injury.

The complications that directly result in hospitalization, based on the on-site reporting, fulfill the criteria of moderate injuries. Furthermore, these include lifting operations, reinforcement handling and damaging of body parts using heavy or technical machinery like excavators, shovels or dumpers etc. Severe injuries are basically a step forward from the moderate injuries and in some cases these results in even the fatalities. The town wise construction accidents data involving the contribution factors discussed earlier is represented in the Table II. As per the statistics, the common factors amongst the total towns in respect of injury types are improper operations, attitude towards safety, ill condition of equipment and the literate capacities of the deputed labor. Nearly 30% to 50% of the construction accident data points onto the poorly maintained equipment assigned to the persons with operational handicaps. The collected data justifies that vigilant actions should be taken for the improvement of equipment with continued efficient training to the site staff.

The Table III, shows the severity rate for construction site accidents in different towns of Karachi. Here it is quite clear by author that a certain buffer zone application strategy is imposed on the collection of data. Coverage of out of city data and areas outside the town plan or scheme may not be the direct scope of this study.

Table II: Percentage of Construction accidents in different towns of Karachi

S. No.	Location	Location Code	Number of Accidents	Percentage
1	Lyari Town	LyT	23	5.96%
2	Saddar Town	SaT	20	5.18%
3	Jamshed Town	JaT	21	5.44%
4	Gulshan Town	GuT	16	4.15%
5	Korangi Town	KoT	24	6.22%
6	Landhi Town	LaT	25	6.48%
7	Shah Faisal Town	SfT	22	5.70%
8	Liaquatabad Town	LiT	9	2.33%
9	North Nazimabad Town	NnT	27	6.99%
10	Gulberg Town	GgT	16	4.15%
11	New Karachi Town	NkT	27	6.99%
12	Kemari Town	KeT	26	6.74%
13	SITE Town	SiT	30	7.77%
14	Baldia Town	BaT	31	8.03%
15	Orangi Town	OrT	22	5.70%
16	Malir Town	MaT	12	3.11%
17	Bin Qasim Town	BiT	21	5.44%
18	Gadap Town	GaT	14	3.63%
Total Number of Accidents			386	100.00%

As per the data, the severely rated towns of Karachi are Baldia Town, Site Town and North Nazimabad Town. So it may be concluded that more safety precautions are required on the construction practices procedures of the nominated towns. North area of Karachi city is in the phase of under construction covering comparatively more number of hotspots for the construction sites with accident data evidence in the range of about 15%. The site requirements and safety parameters for the periphery of North Nazimabad Town

should be checked and rectified with the proportional help of all the related stakeholders.

Alternatively, a graphical representation with a consistent statistical model and simultaneously showing a trend line approach, displays a better interpretation and understanding of this research study, as shown in Fig. 3.

The presented work shows that each town of Karachi has its own typical features depending upon variety of characteristic construction site environments.

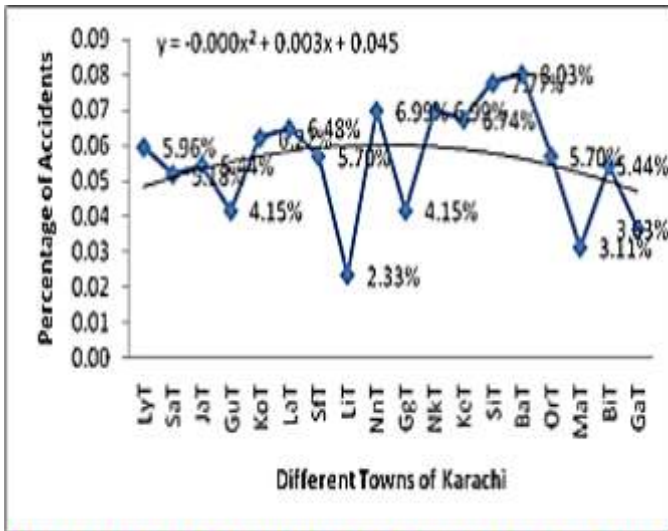


Fig. 3: Graphical Illustration of Town wise Construction Accidents

This is evident from the polynomial manifestation of the trend line amongst different towns.

The curve line shows that a signified variation is present in the percentages of on-site accidents mainly due to a number of related contributory factors on the selected sites. A noise pattern identified in the statistical data reveals that almost all accidents happening in different project are covered according to the analytical study.

The above developed trend line approach also reveals the close interaction between the dependent factors of the data in an appropriate manner. The slope equation formed on the basis of polynomial equation i.e., $y = mx + c$, provides better understanding of drawn comparison in collected data, however, this generated polynomial equation pertains about the critical towns of Karachi in the context of all types of accident factors along with modeled severity rate. They may include human, equipment, management, operational and environmental factors. Obtained small value of C factor is also showing that high considerations are required for safety aspects in almost all towns of Karachi city.

Table III: Strategically Collected data (Contributory factors & Number of accidents)

Construction Accidents Survey Data (July 2017 to December 2017) Karachi																													
S. No.	Location	Type of Accidents (Skilled Labors)									Type of Accidents (Semi-Skilled Labors)									Type of Accidents (Un-Skilled Labors)									Number of Accidents
		Minor			Moderate			Severe			Minor			Moderate			Severe			Minor			Moderate			Severe			
		Code A.1	Code B.1	Code D.2	Code A.4	Code B.2	Code C.1	Code A.5	Code C.3	Code E.2	Code A.2	Code B.3	Code C.1	Code A.1	Code D.3	Code E.3	Code A.4	Code C.2	Code D.1	Code A.1	Code B.2	Code E.1	Code A.3	Code B.1	Code E.3	Code A.1	Code C.1	Code D.3	
1	Lyari Town	0	0	1	1	2	2	1	0	0	3	0	0	0	2	1	0	1	2	0	1	0	1	3	0	0	0	2	23
2	Saddar Town	1	2	0	1	3	1	0	1	0	1	2	0	1	1	0	0	0	1	2	0	1	0	0	0	0	2	0	20
3	Jamshed Town	0	1	0	2	0	0	1	0	0	2	0	1	0	1	1	0	1	0	0	2	0	3	3	0	0	2	1	21
4	Gulshan Town	0	1	0	3	0	0	0	0	0	0	1	0	5	0	0	0	0	0	1	2	0	2	0	1	0	0	0	16
5	Korangi Town	0	3	0	0	0	0	0	0	1	5	2	0	1	0	3	0	0	0	0	2	1	3	0	0	1	0	2	24
6	Landhi Town	2	0	3	1	1	1	0	0	0	1	0	0	0	2	2	2	1	0	2	0	2	1	1	2	0	1	0	25
7	Shah Faisal Town	0	2	1	1	2	0	0	0	0	0	0	2	1	2	1	1	0	0	2	1	0	0	2	2	0	2	0	22
8	Liaquatabad Town	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	2	0	0	0	1	1	9
9	North Nazimabad	0	3	3	3	1	0	1	1	1	0	1	1	0	0	2	2	1	0	0	0	0	2	2	1	0	2	27	
10	Gulberg Town	0	0	2	0	0	0	0	1	0	1	0	0	1	2	0	1	0	0	0	3	2	0	0	0	0	1	2	16
11	New Karachi Town	2	5	1	5	0	0	0	0	0	0	5	0	0	0	1	0	0	1	0	1	2	0	0	2	2	0	0	27
12	Kemari Town	2	1	3	0	2	0	0	0	1	2	3	2	0	2	0	1	0	0	1	0	0	0	0	2	0	2	2	26
13	SITE Town	0	2	0	1	1	1	1	2	0	0	1	0	2	0	0	1	0	0	2	2	3	1	5	1	2	2	0	30
14	Baldia Town	1	0	3	3	0	2	0	0	3	0	0	1	2	0	2	0	0	2	1	0	0	2	2	2	1	2	2	31
15	Orangi Town	0	0	2	1	0	0	1	0	0	1	4	1	0	1	0	2	1	0	1	2	2	2	0	0	0	1	0	22
16	Malir Town	0	1	0	0	0	1	0	1	0	0	0	0	1	0	1	1	2	0	0	0	0	3	0	0	0	0	1	12
17	Bin Qasim Town	1	0	2	0	1	0	0	0	1	2	6	0	0	0	3	0	0	1	0	0	0	0	2	0	2	0	0	21
18	Gadap Town	1	2	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	2	1	1	0	2	1	0	0	0	14
Total Number of Accidents		10	23	21	22	13	9	6	6	7	19	25	8	15	15	17	12	8	7	14	17	15	20	22	15	9	16	15	386
Cumulative with respect to Type of Accidents		54			44			19			52			47			27			46			57			40			

X. CONCLUSION AND RECOMMENDATIONS

The construction safety is becoming one of the important areas that need to be considered and incorporated in all levels of the construction industry. Micro and Macro scale level working, both, are required in construction safety and this is only possible if the centralization of working methodologies in respective industry are realized. Based on agreement on the common interest principles, protecting interests of labor community and without stretching the resources of the industrial sector related to the safety issues, a realistic relation among stakeholders can be established.

A follow-up on analyzed data and related observations, a comprehensive set of recommendations, both general and specific, is described below:

A. Generalized Recommendations

- At the initial run, it is mandatory to have created a strong coordination between Public and Private sector agencies. The lack of coordination is increasing in this industry which is promoting an ownership based construction.
- At the preliminary stage, it is the responsibility of Government to take serious notice of violation of labor laws concerned with construction safety and take prompt necessary actions. This may include standardization and optimization of projects on the basis of certain given guidelines.
- Safety planning and improvement plans for resource safety should be developed town wise for the city of Karachi. This is basically a core responsibility of the Government and competent authorities.
- There is an immense need to develop an industrial advisory board based on experienced professionals of various construction industries in order to make and design standards and specifications for safe construction works.
- For construction safety, it is more important to focus on standards and policy formulation which should make an integral part in construction credentials and contract documents.
- An improved check and balance system should be promoted on construction sites of Karachi for the functionality of safety aspects.
- Rules, regulations, specifications, guidelines, by-laws, key responsibilities and major rights of each stakeholder of any construction should be clearly defined. In case of any accidents and unwanted issues, a coordinated set of evidence and documentation should be instituted.
- Safety guidelines for every typical construction like residential, commercial, industrial etc. should always be ready.
- Strong coordination should be produced between the academia and construction industry; since the academia professionals are more focused towards the research work, these professionals can bring significant improvements in the standard operating techniques and procedures.
- Construction safety trainings should be introduced for all labors and stakeholders and educate them about challenges, demands and safe working at the construction sites.
- A labor before being employed must be required to provide a proof of safety training certification.

B. Specific Recommendations

- The development and improvement plans should be based on the studies related to the statistics of each town. Improvements and interventions should be reflective of the parent statistical analysis.
- Data punching and manipulation for construction safety should be the part of the overall project and it must be maintained on a routine basis for smooth working.
- Based on available data and severity rates of all towns of Karachi, priority may be set out accordingly.
- Impact studies in order to check the improvements may be carried out by a specific group of people.
- The methodologies may be adopted on a single city like Karachi initially but in the long run other cities may also be included.
- All employees and stakeholder groups of respective construction industry should get in touch with the available standards of construction safety.
- Workers and labors should be regulated to work within the domain of safety standards; and it must be brought to their notice that any avoidance of safety during construction shall not be acceptable.
- Hiring of site safety engineers should be promoted on construction projects. They should get involved in all phases of particular construction.
- It should be ensured by responsible individual(s) on site that all safety equipment is available for labors and deputed workers.
- Engineering and enforcement measures should be promoted on the critical towns of Karachi although periodic meetings must be arranged with supporting staff for the solutions of relevant onsite safety issues.
- A collection of site accident data must be shared with all stakeholders, including workers and they should know about the weak and responsible parameters for future improvements.
- All public and private sectors that are more concerned with sustainable developments in Karachi must join hands with competent authorities like Karachi Building Control authority (KBCA) for fulfillment of the laws and violation of safety practices on construction sites.
- Imposition of fines and penalties may be the other solution for this specific issue by enforcement sector but on the other hand education and engineering measures should be on top priority for resolution.

Above all, proper managerial actions should be applied and imposed on construction by key persons. These actions are taken by higher authorities but the impact of these actions is reflected in each activity of construction.

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