Study of Safety and Security Issues in the Working Environment of Small Scale Industries of Old Dhaka

BY

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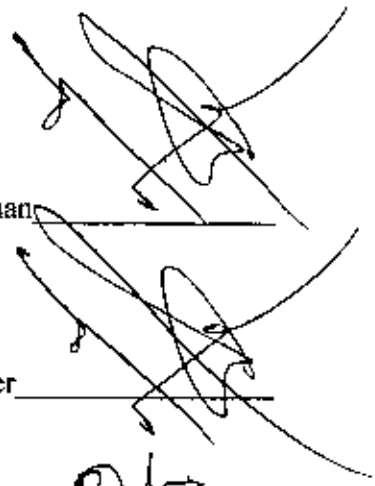
On this day, 24 November 2007, the undersigned hereby recommend to the Academic Council that the thesis entitled "STUDY OF SAFETY AND SECURITY ISSUES IN THE WORKING ENVIRONMENT OF SMALL-SCALE INDUSTRIES OF OLD DHAKA" submitted by Mr. Mohammed Tarek Haider, Student No. 100101008 (P) of the Session October 2001 is acceptable in partial fulfilment of the requirements for the degree of Master of Architecture.



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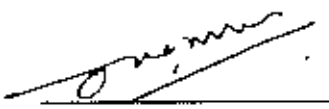

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Abstract

Small and Medium Scale Enterprises (SMEs) employ ten times as many workers as heavy industry in Bangladesh according to World Bank. Again the census of manufacturing industries has enumerated that around 64 percent of the total employment of the Dhaka city provided by the informal sector. Therefore understandably, the working conditions in these industries specially the old part of Dhaka with their small investments and unskilled and illiterate workforce is barely what they should be. In fact, not all factory regulations set by Bangladesh Government are applicable to the Small Scale Industries (SSIs), which employ less than 50 workers.

The concept of safety issues and its applicability in designing better working environment is important because they influence workers' life expectancy, quality of life and work efficiency.

The study aimed to investigate the safety issues in selected four types of Small Scale Industries ie. Plastic recycling and product manufacturing industry, Light engineering workshops, Musical instrument manufacturing industry & Conch shell craft industry located in the areas of Islambagh, Lalbagh, Dholaikhal, Shakharibazar & Bhagolpur in accordance with Bangladesh National Building Code, 1993 and the Factory Rules of Bangladesh.

An extensive survey was conducted on the factory owners and the workers of the Old Dhaka to learn the safety conditions of these Small Scale Industries. A checklist was also prepared to conduct a physical survey in the selected factories of Old Dhaka.

This research study reveals that more than 75 percent of the workers do not use personal protective devices, about 60 percent of the factories do not have any emergency preparedness facilities to tackle in case of any accident or fire. Only 3 percent of the factories use safety signs and symbols in the work premises and 18 percent of the workers have training for their specific jobs, which is a matter of concern in dealing with the safety issues.

This thesis attempts to contribute suggestions with the hope of drawing workers' and employers' awareness and public attention towards unsafe conditions in the working environment of these industries.

As this is just a step to learn the existing situation of the area, a work-thorough investigation with an understanding of employers' attitudes and workers' involvement and coordinated research is required to make the working environment of these industries a more safe place to work.

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Key Terms

Heat stress:	A situation when human body feels thermal discomforts (e g , heat load) in dissipating excess heat and sweating to the surrounding (nearby) environment.
Implementation:	Carry out various steps to provide health and hygiene measures, as well as safety and ergonomic applications for work-place improvement or intervention.
Intervention:	An instrument of something that enhances way of modification, increase work value and control measures to minimize work-related problems, and/or to find some changes for improvement in the workplace.
Occupational safety:	Working situations where injury risks or production loss have not begun, or unsafe act, poor work environment, or non-ergonomic practices are minimised by safety measures and adopting ergonomic means to control work hazards.
Occupational health/safety:	Competence of a healthy work force, safe handling operation, clean or hygienic workplace, suitable work schedule, provision of labour welfare through a maintaining of work regulation and labour legislation.
Poor workplace:	When the work environment is hazardous, non-hygienic, un-safe, non-ergonomic and/or unproductive.
Risk:	Probability of an adverse endpoint (cumulative risk of hazards in workplace, for instance).
Thermal comfort:	A state when a worker feels comfortable in a climate or specific environment without any change of a worker's physiological or metabolic parameters such as sweating rate, variation of oral temperature, heart rate, etc.
Thermal discomfort:	Feeling of heat exhaustion and thirst, heat cramps from the effects of excessive heat-load either from direct heat source, or radiation temperature at workplace.
Working environment:	Work space, illumination, noise, dust, fumes, or humidity level at workplace, climate or environment inside factory premises.
Work hazard:	Source of risks of an activity, conditions of a system, or other local situations that result in a work injury, damage to or loss of equipment, materials, etc.

Workplace improvement:	Process of improving workplace or the state of improved work environment, or the act of and process of improving working conditions (e.g., task, activity, tools).
Workplace intervention:	Improved health, safety and ergonomic applications through collaborative efforts from all the parties concerned, or an efficient use of local resources for good work, increased productivity and less injuries in the workplace.
Work-related injury:	Result of an accident that gives rise to poor health, musculoskeletal disorders or other bad symptoms that results in sick leave, production losses or increased compensation claims.

The key Terms has been extracted from Ahsan MR (2002) Occupational health, safety and ergonomics issues in small and medium-sized enterprises in a developing country. OULU University Press, OULU 2002
and www.wikepedia.com

Abbreviations

ADB	Asian Development Bank [www.adb.org]
BANSDOC	Bangladesh National Scientific and Technical Documentation Centre
BNBC	Bangladesh National Building Code
BSTI	Bangladesh Standard and Testing Institute
BUET	Bangladesh University of Engineering and Technology [www.buet.edu]
DOE	Department of Environment
IEB	Institute of Engineers—Bangladesh [www.ieb-bd.org]
ILO	International Labour Organisation [www.ilo.org]
IMF	International Monetary Fund [www.imf.org]
ISO	International Organisation for Standardisation [www.iso.org]
LEI	Light Engineering Industry
SAARC	South Asian Association for Regional Co-operation [www.saarc.org]
SPSS	Statistical Programme for Social Sciences
SSIs	Small Scale Industries
UNDP	United Nations Development Programs [www.undp org]
USAID	United States Agency for International Development [www.usaid.gov]
WHO	World Health Organisation [www.who.ch]

Chapter 01

PREAMBLE

- Introduction
- Background of the Study
- Research Rationale
- Research Objectives
- Scope and Limitations of the Study
- Organisation of the Thesis
- References

1.1 Introduction

Working condition of an industry involves workplace safety, security and comfort that affect the worker's health, job satisfaction level and production capacity, who are the driving force of national economy. ILO (1999) indicated that approximately 4% of GDP disappear in many countries, soaring even up to four-fold that, on occupational health and safety (OHS) losses due to lack of basic health and safety facilities in workplaces (Ahsan, 2002).

The working condition of the industries in Bangladesh, irrespective of their sizes, has always been a neglected issue. Industrialization changed the basic mentality of investors and factory owners who gave all the affordable attention to the powerful and expensive machinery imported from abroad, while the readily available cheap labour force who were originally farmers or craftsmen were taken for granted as merely a tool for profit maximization. Besides this, being a poor country historically and kept poor by exploitation and oppression by external rulers, the factory owners usually couldn't afford sophisticated and upgraded machinery, which contributed to make the factory environment polluted and unfriendly for human.

Ahmed (1989) says "The workers in Bangladesh from the very dawn of industrialization were easy prey to the exploiters, a term which include both the government and the private industrialists. The factory owners could offer no better environments for the workers; the latter would rather work in dire, unhygienic conditions than not work at all"[1]

The present workplace scenario of small scale manufacturing industries belonging to both formal and informal sector, located in the old part of Dhaka is quite typical of the above statement. Their working environment is non-ergonomic and workers are associated with increased risk of occupational hazards, not only because of probability and severity of injury and accidents but also because of long hours of stressful tasks, old machinery, economic constraints and a lack of enforcement of work regulations and labour legislation.

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[1] Ahmed, Nizamuddin, "Working Conditions in the Industries of Dhaka"; in Dhaka, Past Present Future, Edited by Sharif Uddin Ahmed, The Asiatic Society of Bangladesh, 1989, p 416

1.2 Background of the Study

One of the characteristic components of Old Dhaka is it's numerous small factories and workshops coexisting with the household dwellings as family businesses and small enterprises such as, manufacturing industries of recycled plastic pellet, granules and finished products, machinery spare parts, dice making and welding workshops, conch shell handicraft shops, gold and silver jewelry workshops, musical instrument making workshops etc. usually housed in single storey rented shops or in ground floors of old residential buildings. In this study, these concerns are termed as Small Scale Industries (SSIs) of Old Dhaka.

1.2.1 Definition of Small Scale Industry

Enterprises are categorized as small-scale on the basis of such characteristics as the size of their capital investment, the amount of their annual revenues or the number of their employees. Depending on the context, the number of employees has ranged from one to 500 persons (Jorma Rantanen et al). The most widely accepted definition, given by ILO (1986), says that enterprises having 50 or fewer employees can be called Small Scale Enterprises. In this study, the term SSIs will be applied to industries having one to 10 employees.

1.2.2 The Work Force of SSI

In developing countries, up to 60 percent of the workforce is employed in Small Scale Industries. Although their workers are exposed to perhaps an even greater range of hazards than their counterparts in large industries (Reverente 1992), they usually have little if any access to modern occupational health and safety services.

The workforce of SSIs is characterized by its diversity. In many instances, it comprises the manager as well as members of his or her family. SSIs provide entry to the world of work for young people and meaningful activities to elderly and redundant workers who have been separated from larger enterprises. As a result, they often expose such vulnerable groups as children, pregnant women and the elderly to occupational safety risks. Further, since many SSIs are carried out in or near the home, they often expose family members and neighbours to the physical and chemical hazards of their workplaces and present public health problems

through contamination of air or water or of food grown near the premises (Jorma Rantanen et al). The educational level and socio-economic status of SSE workers vary widely but are often lower than the averages for the entire workforce. Of particular relevance is the fact that their owners/managers usually have had little training in operation and management and even less recognition, prevention and control of occupational safety risks (Ahsan 2002).

1.2.3 Safety and Competitiveness

ILO research suggests that, by and large, the safest-working countries also have the best competitiveness ratings.

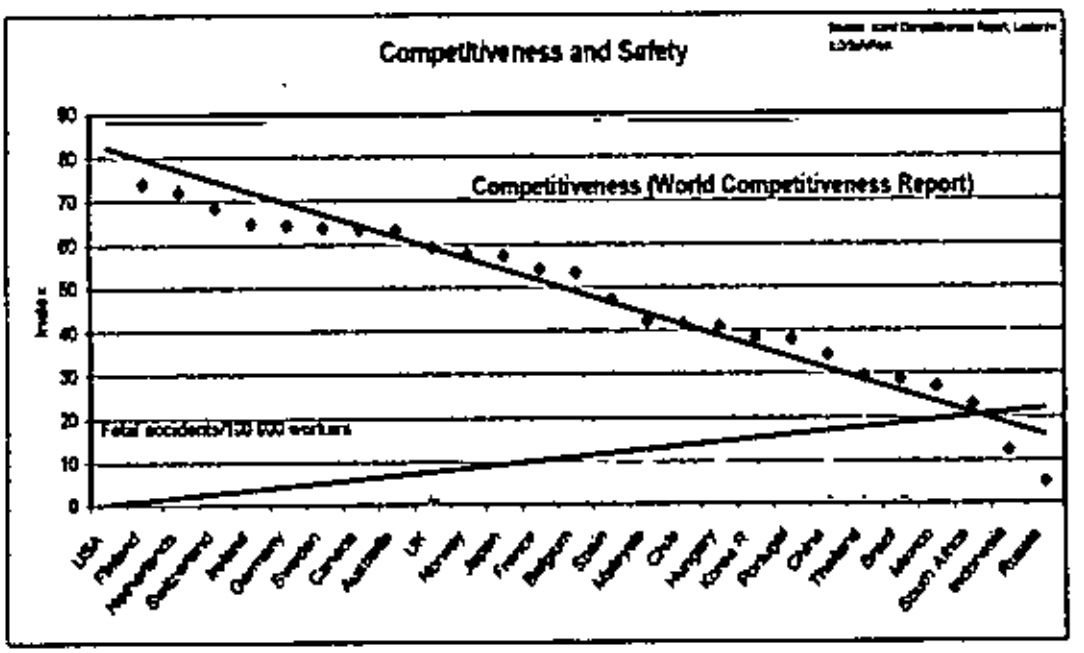

Figure 1.1: Competitiveness and Safety (*Source: ILO, from data by IMD and ILO)*

One of the most authoritative rankings of countries by competitiveness is published each year by the International Institute for Management Development IMD in Lausanne. It currently analyses the competitiveness of 60 economies on the basis of 320 criteria. The ILO plotted selected IMD competitiveness rankings in 2002 against the ILO's own occupational health and safety rankings. The results are set out in Figure1.1. They show a strong link between high safety and high competitiveness.

The same exercise using the competitiveness rankings issued by the World Economic Forum yielded broadly similar results.

1.2.4 Background Studies on SSIs of Bangladesh

Some others (Fariduddin *et al.* 1975, Rahman 1993, Ahmad *et al.* 1997, Sadeque *et al.* 1998) surveyed different workplaces in Bangladesh and analysed local workers' energy expenditure, and health, safety and ergonomic issues. Rahman *et al.* (2000) expressed concern on potential factors of using injury information for injury surveillance at local level in Bangladesh. From these studies, it has been proved that the workers usually worked long hours in unsafe conditions without using any personal protective devices (PPDs), for instance. Most of the workers' health, safety and well being are therefore deteriorating because an interest in OHS has yet to be reached in SMEs. There are long-term trends in occupational exposure—that are a real problem in Bangladesh not only for workers' health and safety risks but also for the society as well. It is also well known that the present status of OHS/ergonomics is still at the rudimentary level in Bangladesh because the factory owners (FO) and employers association (EA) usually considers these elements as a costly luxury. It is also true that they usually lacks money, resources and other elements for providing improved health and safety facilities to all the workers. In Bangladesh, as far as field surveys and workplace inspections are concerned in, only a few such studies and research, however, have been conducted based on in-depth case studies. Workers' physical workload, heat stress and thermoregulatory related studies were conducted (Ahasan *et al.* 1997 a,b,c) but those do not contain all types of empirical data and ergonomic information. There are some other studies conducted by different organisations and individuals (Khan 1988, ILO 1990, BSCIC 1998, NIPSOM 1999), but those are compiled either as reports or other forms of information. Khan (2000) surveyed child workers' health and safety those are working in the capital city.

1.3 Research Rationale

Improved working life contributes to workers' physical, social and mental well being which effects industrial productivity, national economy and social development. A safe and secured workplace is one of the prerequisites of an improved working life.

According to World Bank, SMEs employ ten times as many workers as heavy industry in Bangladesh (World Bank 1999). Small Scale Industries are important contributors of national economies in all over the world. In Bangladesh, most of these Small Scale Industries belong to the informal sector. Therefore understandably, the working conditions in these industries with their small investments and unskilled and illiterate workforce are barely what they should be. In fact, not all factory regulations set by Bangladesh Government are applicable to the Small Scale factories, which employ less than 50 workers.

To find out appropriate improvement solutions and setup specific standards, extensive knowledge about the prevailing system is needed. But there is little workplace data available on this sector, which substantiates the rationale of the present study

1.4 Research Objectives

The broad goal of this study is to improve the working environment of Small Scale Industries of Old Dhaka, which have significant contribution to our national economy. To achieve that goal, proper understanding of the safety security aspect of these type of enterprises, base line data of present condition and identification of problems and prospect is necessary. There has been little work done on the working condition related to safety security in the SSIs in general. A descriptive exploratory research revealing the existing conditions will contribute to further broad-based and specific studies, which will assist policy makers and responsible authorities to formulate specific laws and regulations and implementing tools for Small Scale Industries.

The specific objectives of this study are;

- To review international and national standards and regulations for safety & security in industrial working environment and asses the deviations in the existing conditions.
- To investigate the existing working condition of Small Scale Industries of Old Dhaka with respect to relevant safety and security issues, the parameters of which will be;
    1. Hazards in relation to space: ergonomics, floor surface and building condition.
    2. Lighting conditions: visibility in natural and artificial lighting.
    3. Noise: accidents due to high level of noise.
    4. Hazards: in relation to work process and quality of machinery.
    5. Fire safety: causes, preventive and precautionary measures, control.
- To recommend improvement measures for the working environment existing in the Small Scale Industries of Old Dhaka.

The practical out come of this study would be to contribute in improving the design of the workstation as well as improving a worker's safe manipulation of tools and equipment and control of machinery, critical posture etc. This thesis will help in drawing workers' and employers' awareness and public attention towards unsafe act, conditions and hope to contribute in the implementation of work regulations and labour legislations.

1.5 Scope and Limitations of the Study

The industrial workplaces in Bangladesh are vibrant in regard to non-compliance of work regulations, and thus, allowing a researcher by the factory owners and labour union in their factory premises is not easy. The factory owners are usually afraid about workplace survey and investigation believing that the study would cause them penalty or such action. As a result, actual information is often hindered and the employees avoid direct answers. Therefore this research has to rely on self understanding on certain issues.

A second limitation of the present study is that the questionnaire survey couldn't collect any female workers responses who are working in such small scale factories partly because the work-force of the types of industries surveyed in this study are mostly male-dominated. Therefore, gender-specific safety security issues are not covered in the present study.

1.6 Organisation of the Thesis

This thesis is organised to gain knowledge about existing safety and security conditions of small scale manufacturing industries located in Old Dhaka and evaluate the situation on the basis of national laws and regulations and related international standards. For this purpose, physical survey and questionnaire survey was done in four different types of industries in some selected locations in Old Dhaka.

The primary data obtained from the physical and questionnaire survey and secondary data collected from literature survey were then analysed, compared and interpreted to formulate some recommendations for improvement of the existing condition.

The thesis report is organised in five Chapters; the first Chapter presents the background of the study with it's rationale and objectives.

The second Chapter contains a brief account of the history of Small Scale Industries in Old Dhaka and it's economic importance in the national economy and identifies the safety security aspects of industrial work place and describes the national laws and regulations and related international standards regarding safety security provisions in industries.

The third Chapter presents the adopted research design and survey methodology.

The fourth Chapter analyses and interprets the primary data obtained from the survey in the selected case study industries.

The last Chapter gives recommendations for improvement on different aspects at both policy and intervention level.

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Chapter 02

LITERATURE REVIEW

- A General Overview of the Small Scale Industries in Old Dhaka
- Environmental Aspects Affecting Safety and Security in the Industrial Work Space
- Workplace Standards for Factory Workers Safety and Security According to BNBC, 1993
- Industrial Safety Regulations in Bangladesh
- ILO Standards on Safety Issues
- References

This Chapter discusses the issues closely related to the topic under the study. Relevant literature has been reviewed to get a broad understanding of the different aspects of industrial working environment, which trigger safety and security risks for the workers and the factory itself. These aspects are identified and discussed in this Chapter along with BNBC standards, existing laws and regulations and relevant international standards to mitigate accidents in industrial working environment.

2.1 A General Overview of the Small Scale Industries in Old Dhaka

2.1.1 Existence and Evolution of Small Scale Industries in Old Dhaka

Existence, excellence and evolution of various small scale manufacturing industries are a common topic always included whenever Dhaka's history and tradition as an urban center is discussed. For it's strategic location along the river Buriganga, trade, commerce and small scale manufacturing industries which were nourished under guilds of craftsmen, shaped Dhaka's economic and political formation and reformation through out it's known history which goes as early as the beginning of the 17th century.

From an almost insignificant position Dhaka became the provincial capital and began to grow in size and importance throughout the seventeenth century. The Europeans, especially the Portuguese, the Dutch, the English and the French as well as other traders began to come in larger number from the late seventeenth century. The presence of the Court, of the Army and provincial offices, of manufacturers and of merchants made it the center of political, economic and social life.

An important aspect of the city's economic life was the handicraft industries organised on household basis, many of them under the caste system were the specialty of particular families or classes of people, who drew upon inherited skill (Mohsin, 1991). The same occupational groups used to live in groups and in most cases the same house was used for the factory as well as the residence (Karim, 1954). The position of the city as a manufacturing center is apparent from names of the localities or Mahallas specialized in different types of industries. Some of the names still exist, like, Tantibazar and Juginagar (weaver market), Patuatuli(painters

of textiles), Banianagar (trader's area, particularly of gold and silversmiths), Kagajitola (paper makers), Shankhari bazar (Shell-worker's locality), Kumartuli (potter's area), Sutrapur (carpenter's area)

2.1.2 Manufacturing Sector in Present Day Dhaka City

At present, the manufacturing industries of Dhaka can be categorized into two broad groups: the formal and informal sector. The formal sector is generally considered as officially recognized industrial establishments employing more than 10 workers, while the informal sector is meant to be the unauthorized or unregistered firms. The census of manufacturing industries of Bangladesh has enumerated 8,779 formal industrial of 201 categories, in Dhaka city region employing 1.245,082 workers; while the informal sector of Dhaka provided a list of 230 different types of economic activities, and constitute around 64 percent of total employment of the city. (Hasan, 1999)

The informal sector is generally applied to enterprises which are not officially regulated and which operate outside the incentive as well as tax system of the government and its institutions (Seers, 1970, ILO, 1972, 1977, Amin, 1982). In Dhaka, the informal sector is often defined to include those enterprises which employ less than 10 persons per unit and which simultaneously satisfy one or more of the criteria such as business operation from open premises, housed in a temporary or semi-permanent structure, operation not from any officially assigned place, operation from residence or backyards, and not registered under Factory and Business Establishment Act (Amin, 1982, 1991; Islam and Khan, 1988).

Small factories in the informal sector often provide different raw materials and semi-processed inputs to the formal sector. And in many cases, several small enterprises start in the informal sector, and in with the increase in machinery or turnover, these firms gradually enter in the formal sector.

The informal sector of the city often acts as a jumping pad for the new migrants to the city, before they get employment in the formal sector firms.

2.1.3 Contribution of Small Scale Industries in the Economy

Small Scale Enterprises (SSEs) are gaining importance in national economies all over the developing world. They are employment-intensive, flexible in adapting to rapidly changing market situations, and provide job opportunities for many who would otherwise be unemployed. Their capital requirements are often low and they can produce goods and services near the consumer or client. It is estimated that there are 24,000 small factories and various types of metal and wood workshops, 6000 medium-sized enterprises and a few hundred state owned big industries established in Bangladesh (BSCIC 1998). According to World Bank, SMEs employ ten times as many workers as heavy industry in Bangladesh (World Bank 1999).

The small scale manufacturing industry sector contributes BDT 17234 crore in 2004-05 to GDP (4.68 percent of GDP) with a stable growth rate of 7.91 percent [2]

In terms of export of plastic items from Bangladesh, this sector has exported plastic items worth US $ 44 million to 23 countries in North America, Europe , Asia and the Pacific and Middle East in 2004-2005 fiscal year. In the SAARC region, Bangladesh is also exporting plastic goods to India, Srilanka and Nepal. Plastic sector is now ranked 12th in terms of export oriented sectors of the country. (Waste Concern for the Swisscontact – Katalyst, 2006)

According to the survey conducted by SouthAsia Enterprise Development Facility (SEDF), the annual turnover of the light engineering industry is BDT 9500 crore. Export earning of engineering products is BDT 741 crore during 2005-2006, which is 41 percent higher than that of the previous year. Export earning of engineering products is maintaining a 77 percent CAGR for the last four years. (Sub-Sector study on Light Engineering, Local Enterprise Investment Center, 2006).

[2] [Sub-Sector study on Light Engineering, Local Enterprise Investment Center (2006)].

2.2 Environmental Aspects Affecting Safety and Security in The Industrial Work Space

Different aspects that affect safety and security of industrial working environment will be discussed in this section. These aspects can be related to climatic factors, physical characteristics, industry specific activities and availability of workspace facilities. Some of these aspects are discussed below.

2.2.1 Climatic Factors

Temperature:

A worker's ability to do his/her job is affected by working in hot environments. One of the most important conditions for productive work is maintaining a comfortable temperature inside the workplace. Of course the temperature inside the factory varies according to the season.

The climate of Bangladesh is a tropical monsoon type, with a hot and rainy summer and a dry winter. January is the coolest month with temperatures averaging near 26°C (78°F) and April the warmest with temperatures from 33°C to 36°C (91°F to 96°F). The climate is one of the wettest in the world. Most places receive more than 1,525 mm of rain a year, and areas near the hills receive 5,080 mm). Most rains occur during the monsoon (June-September) and little in winter (November-February). Bangladesh has warm temperatures throughout the year, with relatively little variation from month to month. January tends to be the coolest month and May the warmest. In Dhaka the average January temperature is about 19°C (about 66°F), and the average May temperature is about 29°C (about 84°F).

The country experiences a hot summer of high humidity from late March to late June, a somewhat cooler but still a hot and humid monsoon from late June through October and a cool dry winter from November to the end of February. Day temperature ranges from 7°C to 12°C in the cool months and in the other months it varies between 23°C to 30°C.[3] As a result the interiors of factory buildings are hot

[1] http://www.discoverybangladesh.com/meetbangladesh/climate.html
Business Info Bangladesh [www.bizbangladesh.com] www.discoverybangladesh.com

almost entirely throughout the year. The accompanying humidity creates an almost unbearable stiffing interior climate.

For workers in industries, too much heat can result in the following health and safety problems.[4]

Safety:	**Health:**
- fatigue and dizziness;	- heat stress/strain (distress);
- sweating palms (become slippery);	- heat cramps;
- fogging of safety glasses;	- heat exhaustion/heat stroke;
- possible burns;	- heat rash (prickly heat);
- lower performance/alertness:	- fainting (syncope).

There is a great deal of manual work carried out inside Bangladesh factories. Cooler environments will obviously be required. The legislation does not specify the air temperature that is to be maintained inside the factory. Many workers work bare-bodied as the temperature is rarely within comfort zone level (Ahmed. 1987).

Ventilation:

It is not only essential to provide a comfortable temperature inside the factory, one must ensure;

- an adequate supply of fresh air;
- the removal of stale air; and
- the prevention of any build up of contaminants (dust, spot cleaning chemicals, etc).

Ventilation has been defined as the controlled intake of fresh air, its circulation and exhaust" (AIA, 1974). Ventilation can be either natural or mechanical, or a combination of both.

A space has to be ventilated with fresh air as so (Martin, 1984):

1. to provide oxygen required to support human life
2. to act as a dilutant: for carbon dioxide produced from respirating; for body and other odours; for gases in areas such as car parks;
3. to promote air movement throughout the space;
4. to control airborne contamination in industrial process

[1] Partly *Adapted from ILO, A Training Manual for Labour Inspectors by Anterro Vahapassi, (2003)*

There is evidence that lack of 'adequate effective ventilation has frequently resulted in widespread loss of production and consequent loss of profit – through personal discomfort, absenteeism, heat breaks and unofficial strikes – while also incurring increased accident rates, illness rates and scrap ratio" (Drury. 1981)

Natural extractors, in the roof or in the windows, will have to cut out rain and draughts, and can also be used to clear smoke during and after the outbreak of fire.

The physiological comfort of the workers within an industrial building, as with the inhabitants of practically any other building, is largely dependent upon air temperature, surrounding surface temperatures, relative humidity, air movement and uniformity of temperature within the building (Ahmed, 1987). In view of Bangladesh's economic condition, it is understandable that people should rely heavily on natural ventilation to seek comfort within buildings generally. (Ahmed. 1987).

Ahmed says "It is not surprising that 75 percent of the respondents in the survey employ natural ventilation to aid air movement within their factories. The fact that about 70 percent of these surveyed factories also have to use exhaust fans and about 40 percent overhead fans suggests clearly that in these industries natural ventilation is not adequate to facilitate air movement in factory interiors" (Ahmed, 1987).

2.2.2 Physical Characteristics:

Lighting:

From the workers' perspective, poor lighting at work can lead to eye strain, fatigue, headaches, stress and accidents. On the other hand, too much light can also cause health and safety problems such as "glare" headaches and stress. Both can lead to mistakes at work, poor quality and low productivity.

Improvements in lighting do not necessarily mean that one need more lights and therefore use more electricity – it is often a case of making better use of existing lights; making sure that all lights are clean and in good condition; and that lights are positioned correctly for each task. It is also a case of making the best use of natural light.

In Bangladesh daylighting is the most reliable form of lighting in many cases. It has been found from the survey that the electricity supply is generally erratic. Thus, dependence on artificial lighting can lead to loss in productivity and profits (Ahmed, 1987). Even natural light cannot be relied upon to ensure a consistent level of lighting during the day. Overcast sky can produce severe glare (EVANS, 1980).

In contrast to the industries in the developed countries, the industries in Bangladesh are not in a position to ignore daylight and operate wholly on artificial supplies (Ahmed, 1987).

There should be a good general distribution of light over the whole factory interiors; thus, providing a relatively even illumination over the working plane. The tasks in a factory may require other kind of lighting, such as local, direct, diffused, etc (Ahmed, 1987).

Introducing light to the interior, naturally or artificially, may bring along several problems such as veiling reflections and glare. Veiling reflections are high luminance reflections, which overlay the detail of the task. Such reflections can cause discomfort and affect task performance (CIBS, 1984).

Roof lights can achieve a much more even light distribution and, quantitatively, are more efficient daylighter; firstly, because the whole sky hemisphere is available through them whereas at most only about half of it is available through windows; and secondly, because roof-lighting arrives more vertically and hence more intensely on the horizontal working plane. However, the light and shade modeling tends to be duller, and roof lights make a building particularly vulnerable to overheating by the high summer sun (REID, 1984).

Floor Finishes:

Floors in factories serve several important purposes:

- Act as a platform for men, machine and materials
- Used for the movement of men and materials and handling equipments.

The industrial floors undergo heavy wear and are subjected to spillages of oil, chemicals etc., collection of dust, impact loads, machine vibration etc.

According to Harper and Stone, the properties of a good floor finish should include durability, protection of the building structure from traffic and effluents, comfort and safety of the users and good appearances. (Harper, 1960)

Workers of a factory can be subjected to safety risks if a floor is not finished properly as to resist, impact and static loads and free from slipperiness, sparks, sudden changes of levels etc.

Floors should be constructed as per individual requirement of a factory environment. Finishes resistant to chemicals; finishes which are dust free, spark-free and slip-proof; finishes which cause no additional risks in case of fire or when extinguishing materials are applied; finishes which can withstand impact load, wear and tear and some of which can meet more than one requirement can be specified. There are many certain problems when the same factory floor requires different types of finishes owing to widely varying usages. Moreover, generalising can often be costly. (Ahmed, 1987).

Bucknell stresses that 'care should be taken so that there are not sudden changes of surface between one department and another where process is continuous'. (Bucknell, 1953)

2.2.3 Industry Specific Activity Related Factors:

Noise:

Noise is probably one of the most widespread and underestimated of industrial hazards. Noise is a serious problem in Bangladesh industries. Noise has been traditionally associated with industries and in Bangladesh noise is accepted as an obvious outcome of any industrial process.

Noise can cause a variety of effects including:

- Noise can cause stress and interfere with concentration thus affecting ones ability to work. This can be a contributory factor in workplace accidents as workers lose concentration and co-ordination. Over the long-term, this increase in stress can lead to a number of health problems including heart, stomach and nervous disorders;

- Noise can mask or interfere with conversation in the workplace and may contribute to accidents as warning shouts may not be heard;
- Workers exposed to high noise levels often have difficulty in sleeping when they get home and are constantly fatigued with that feeling of being tired all the time.

In a survey of noise levels of 5 industries, it was found in 1984 that workers in those factories were being exposed to levels above 100 dB for periods exceeding 8 hours (Ahmed, 1984.).

In Bangladesh, as in almost any part of the world, managements are reluctant to admit that their industries are noisy to the point of the noise being harmful to the workers. To ask the respondents a direct question such as "whether a noise problem exists in the factory?" would have in all probability prompted replies in the negative (Ahmed, 1987). Such case was found in the industries of Old Dhaka. But the surveyed dB that was found in those industries certainly not speaking their answers.

It is known for a fact that the average Bangladeshi speaks much louder than his European counterpart. Communicative conversation in the noisy factories of Bangladeshis usually achieved by 'shouting' (Ahmed, 1987).

Industrial Pollution:

The air and water of Bangladesh are the recipients of a good deal of industrial pollution. Smoke and dust are released freely into the atmosphere. As regards water pollution is accepted, even by those who drink and bathe in the river water, which nearby factories "almost by right" shall discharge effluents into them. Solids are frequently dumped in the nearest convenient open place without any regard to the environment. This is the general picture of waste management in Bangladesh (Ahmed, 1987).

Smoke, dust, effluents and particles generated by manufacturing process have polluted the atmosphere to a varying degree since the early days of industrialization. More industries meant more emissions and bi-products, harmful or otherwise, and an escalation of the pollution problem (Ahmed, 1987).

Some urban centres such as Calcutta are so polluted, though not directly by industrial processes, that merely breathing its air is equal to smoking 20 cigarettes a day (Sharifuddin, 1985).

Industrial Accidents:

Accidents can happen any time, almost anywhere and to anybody (Ahmed, 1987).

An accident has been defined as 'an unexpected, unplanned, event in a sequence of events that occurs through a combination of causes; it results in physical harm (injury or disease) to an individual, damage to property, a near-miss, a loss, or any combination of these effects" (Bamber, 1986).

Although the ILO, (International Labour Office) points out that "equipment, working environment and worker" are all to some degrees liable to an accident, James categorically states that, "people cause accidents, by what they do or what they neglect to do" (James, 1983), presumably with the "equipment" in the "working environment".

"Every year, throughout the world, millions of industrial accidents occur. Some of them are fatal and some result in permanent disablement, complete or partial; the great majority cause only temporary disablement, which however, may last for several months" (ILO, 1983).

Accidents in manufacturing industries, which caused fatalities, or by whose injuries the affected workers were forced to be absent from work for more than three days numbered 133,553 in 1980 (Ahmed, 1987)

The statistical yearbook of Bangladesh and the Census of Manufacturing Industries do not contain and data relating to accidents and dangerous occurrences in the industries of Bangladesh. Those killed or injured as a result of industrial accidents do not merit any mention in the official statistics. Failure to collect information on the number of accidents and their effects on the workers is one more instance which clearly establishes the attitude towards safety standards in the country (Ahmed, 1987)

According to the factories Rules, 1979, industrial accidents in Bangladesh are classified as "fatal", "serious" and "minor". The first category is self-explanatory. A "serious accident" will deem to have occurred if "there is no reasonable prospect

that he (the worker) will be able to resume his employment in the factory within 20 days". If the duration of absenteeism is more than 48 hours after the accident occurred, such accidents shall be termed "minor accidents" (Ahmed, 1987)

2.2.4 Availability of Workplace Facilities:

Fire Prevention and Precaution:

The number of total accidents due to fire in Bangladesh is steadily increasing.

Although no list of causes for factory fires in Bangladesh is available, one may deduce the more frequent causes by studying the list of causes of all fires. Electrical faults, burning cigarette ends and naked lamps are, judging from the general trend, the major cause of fire in Bangladesh industries. Overheating and friction of machinery, chemical reactions, misfiring of engines, spontaneous ignition, explosions, chimneys, etc are to a lesser degree the causes of factory fires. (Ahmed, 1987)

The fire services do not have virtually any control over the industries with regard to the design, construction and operation of buildings. Factories lack adequate fire fighting equipment.

The distance between buildings and boundary walls is, in most cases, too narrow for access by fire fighting personnel and appliances. Many factories are often without water supply.

Extinguishers are often outdated. Bucket of sand often become receptacles for cigarette butts and other rubbish. The sand in these red buckets is often soggy and not in any state to be used in quelling a fire. (Ahmed, 1987).

Safety Signs and Symbols:

A factory complex consists of several activities, some of which should be accessible only to authorized persons or to persons protected by proper apparel because of reasons of security, safety, health and hygiene. Signs and symbols are also essential to give direction of means of escape during fire, to prohibit smoking, to caution against electric shock, radiation, overhead load, explosion, risk of fire and so on. (Ahmed, 1987).

The regulations apply to signs, which give a health or safety message by use of a combination of geometric shapes, colour and pictorial symbols (Health and Safety Executive, 1980). The regulations require that a health and safety message should also be conveyed, where necessary, by means of a notice. It is the responsibility of the employer "to ensure so far as is reasonably practicable the health and safety of their employee and other persons affected by the work of activity (Health and Safety Executive, 1980).

Signs and symbols for safety and direction are not widely used in Bangladesh factories. Some factories do use signs and symbols but there is little or no relationship between different factories as regards their size, shape, colour, wording, etc. An industrial unit may have a set of signs and symbols, which applies only to that unit. Moreover, all the aspects requiring signs viz. safety from fire, accident hazards, directions, exits, drinking water, etc. may not be covered by signs in particular factory. What exists in a limited number of factories is the selective usage of self-designed signs in particular locations in a factory premises.

It is interesting to note that, although there are many workers who are illiterate, there are more word signs as compared with graphic ones. It will be of no surprise if a survey showed that many of the workers are oblivious to what has been written, apparently for their safety and welfare, in the environments they work in. In an emergency situation, this could spell disaster.

Comparing with the west, where standardization and greater reliance on graphics has been instrumental in successfully conveying necessary, instantly recognizable messages to the workforce, factory management and the government in Bangladesh have not yet grasped the importance of standardization, nor of graphical representation.

Signboards and worded signs are usually in Bengali and English. The government has, however, passed legislation[5] which should see all such signs written only in Bengali.

Most industrial units do not display signs showing fire exits, hazardous substances or processes, noisy areas, locations requiring eye and head protection, warning

[5] The Law, Titled in Bengali, when translated reads, "Use of Bengali Language Law, 1987"

against overhead loads. moving objects, electric shocks, explosions, etc. (Ahmed, 1987)

Security:

Safety and security are frequently misunderstood to mean one and the same thing. particularly with reference to buildings. Marsh is of the opinion that safety means "the protection of the occupants of the buildings (and to a lesser extent their professions) from accidents" whereas "security" is assumed to mean protecting from willful attack those occupants, their possessions and the property" (Marsh, 1985).

It is not possible to design a fool-proof security system but "security must be conceived in terms of reducing opportunities for easy entry to a minimum and by making successful penetration to attractive targets very difficult for the intruder" (Hamilton, 1985).

According to Drury (Drury, 1981). Planning for security is called for in order to prevent:

1. Major, organised theft of finished products and raw materials. Organised crime may have an in-house element.
2. The theft of and interference with company record, such as marketing and sales data, personnel records. production plans, etc. Such theft can cause a great deal of damage to a company.
3. Pilferage by the staff.
4. Sabotage; sometimes organised as a result as a labour dispute or, more rarely, by a competition, but usually by a grudging employee.

Protection of a building, its occupants and its effects fall broadly into four categories (Marsh, 1985).

1. Passive protection – concerned with the design of the buildings, its layout and is materials of construction.
2. Defensive protection – creating a barrier between the would-be assailant and the interior of the building or the site; includes such devices as locks, access systems, security fencing and barriers.

3. Fail – safe protection – if the defensive protection fails, this category comes into operation; includes intruder detection and alarm devices as well as fire detection and alarm system.
4. Specialist protection – not generally used; includes such equipment as close-circuit television systems (cctv), safes, security screens, etc.

2.3 Workplace Standards for Factory Workers Safety and Security According To BNBC, 1993

2.3.1 Factory Buildings:

The buildings described as Occupancy G as per the BNBC fall into the category of Industrial Buildings. The buildings include:

"Any building or portion there of in which materials are fabricated, assembled, or processed by physical, chemical, pharmaceutical, nuclear, mechanical and other processes, in order to alter their characteristics or to produce or manufacture new materials such as buildings may also house incidental storage, and handling or raw and finished material or goods. Examples of such buildings are various mills, factories and plants, automatic laundries, power plants, pumping stations, smoke houses, saw mills, foundries and machine shops, pharmaceuticals, nuclear and irradiation plants."

The above mentioned buildings can be divided into sub-divisions under the low hazard and moderate hazard industries. (Safiullah, 2005)

The buildings under the building code require:

*All buildings must have a passage on the one side leading to a public road.

*Outer walls must be fire-resistant as per the Code.

*Main area of the building must have resemblance with the floor area as per the Code.

*Entry to the building and exit and emergency escape of the building must comply with the Code.

*The building must have adequate light, ventilation and sewerage facilities. Day light, roof opening, natural ventilation of these buildings are as follows:

*Openings of outer roof and windows must not be less than 10 percent of the floor area.

*If windows work as natural ventilation then operable windows must not be less than 5 percent of the floor area.

*Elevator shaft, vent shaft and vertical opening must be covered with such walls that are able to resist fire for at least four hours.

*It must have sprinklers and stand pipe wherever necessary.

*The building should have a fire warning system.

2.3.2 Temperature and Humidity:

Table 2.1: Temperature & humidity for factory comfort

Normal Practice		**Special Practice**	
Dry Bulb Temp.	Relative Humidity	Dry Bulb Temp.	Relative Humidity
25.5°C-26.5°C	60-50	25°C-26.5°C	55-50

Source: BNBC, 1993

2.3.3 Ventilation

The fresh air requirement for factory buildings is recommended at 8 litres per second per person (Martin, 1984). According to factories act, 1961, the minimum permissible rate of ventilation is 5 litres per litre per person. It has been strongly advocated that under no circumstances should a ventilation rate of less than 15 cubic feet per minute per person be used in industrial building (Straaten, 1967).

Ventilation refers to replacing stale air (plus any contaminants) with fresh air (or purified air in the case of air conditioners) at regular intervals In an average workplace, the air needs to be changed between 8 and 12 times per hour and that there should be at least 10 cubic meters of air per worker.[6]

[6] These Figures are given in the ILO manual *Improving Working Conditions and Productivity in the Garment Industry* The UK, Health and Safety Executive recommends that the quantity of fresh air should never fall below 0.28 metres per person per minute

2.3.4 General Noise Level:

In the noise control of industrial buildings the following requirements are to be fulfilled;

a) An acceptable acoustical environment for individual workers and machine operators;

b) Speech communication among operator to the required degree

c) Protection of other workers or office employees

d) Prevention of noise transmission into adjacent building or into the surrounding community (BNBC, 1993).

Table 2.2: Different range of Noise level

Near Jet Engine Thresh hold of Pain	Deafening	140 dB 130 dB
Motor Cycle Acceleration Loud Orchestra	Very Loud	110 dB 95 dB
Noisy factory	Loud	90 dB

Source: BNBC, 1993

Table 2.3: Permissible Exposure Limits for Steady-State

Sound Levl dBA	Time Permitted (Hr-Min)
85	16-00
86	13-56
87	12-08
88	10-34
89	9-11
90	8-00

Source: BNBC, 1993

Prakas 138 on Sound in the Workplace requires that the level of daily sound or the average sound that a worker is encounters during their work shall not exceed 85 dBA.

2.3.5 Lighting:

The Illumination of all work area within a building shall be a minimum of 150 LUX. Supplementary lighting shall be used when illumination by daylight falls below 150 LUX on the working plane. The providing supplementary art lighting when daylight availability becomes insufficient, cool daylight florescent tubes with semi-direct luminaries are recommended. To ensure a good distribution of illumination, the mounting height should be between 1.5 and 2.0 meter above the workplane for a separation of 2.0 to 3.0 meter between the luminaries (BNBC, 1993).

Recommended values of illumination:

Sheet Metal Works	- 200 LUX
Plating Shops (Polishing)	- 200 – 500 LUX
Machine Shops	- 500 – 300 LUX

2.3.6 Mechanical Exhaust:

All rooms and areas having air with dust particles sufficiently light enough to float in the air odors, fumes, spray, gases, vapours, smoke or other noxious or impurities in such quantities as to be irritating or injurious to health or safety or which is harmful to building and materials or has substances which create a fire hazard, and special room or shall have air exhausted to the outdoors in accordance with this section (BNBC, 1993).

2.3.7 Fire Extinguishing Tools and Water Supply:

1. The factory should have at least four buckets having capacity of two gallons each for each 1.000 square feet floor and these must be maintained and each bucket;

- Should be of proper standard as per the Bangladesh Standard Specification.
- They should be kept at proper places as approved by the inspector and will not be used except for dousing fire and;
- Apart from the places where fire can be originated from flammable or other sources and water can not be used, in those places buckets must be filled with water always.

But the chief inspector can soften the provisions of the article on the basis of written record.

2. If the floor of the factory is more than 1,000 square feet and where fire can be originated from flammable liquid, electric equipments and other flammable objects besides flammable metals in that case soda or acid or similar kind of fire extinguishing movable materials should be kept for each 5,000 square feet space in addition to those buckets mentioned.

3. The factories where fire can be originated from flammable liquid or paint, fire extinguishers must be kept there as per the sub-rule (2) and these should be made of carbon tetrachloride, dry powder, carbon dioxide and carbonbromo mythen or of similar kind.

4. The factories where fire can be originated from electric devices, fire extinguishers must be kept there as per the sub-rule (2) and these should be made of carbon dioxide, dry powder or carbon tetrachloride or of similar kind.

5. The factories where fire can be originated from magnesium, aluminum or zinc powder or flammable objects, the fire extinguisher like liquid carbon dioxide or things like foams are prohibited there and to put out the fire, adequate fine dry sands, stone particles and other unburnable objects should be stored.

6. If automatic fire extinguishing equipment are set up in the factory building or rooms as per approval of the fire extinguishing organisation or fire insurance company then the conditions of this sub-rule can be made flexible but he can issue a certificate to this end that how much the conditions were made lenient.

7. Each fire-extinguishing tool as describe in the sub-rule (2);

- Must be of proper standard specification.
- It must be placed at the proper place as approved by the inspector and kept ready always for use as per the printed directions of the manufacturer and;
- It should be checked out at specific interval as per the recommendation of the manufacturer and discarded, if needed.

8. Adequate spare charge should be preserved for each kind of fire extinguishing device in every factory so that it can be used in time of need.

9. As far as possible each and every worker of the factory or at least one fourth of the workers appointed separately for one single section has to be trained about the uses of the portable fire extinguishing devices.

10. Each factory must have a trained staff whose only responsibility would be to look after the fire extinguishing equipment and their maintenance.

11. The director of the factory has to make an all-out plan to properly implement the fire extinguishing provisions and other steps if the factory is on fire.

2.3.8 Prohibition of Smoking and Uses of Open Fire:

According to BNBC, 1993 Notices both in Bangla and English should be hung about the prohibition of smoking and uses of open fire at the specified places of possible dangers as directed by the inspector and pre-cautionary measures taken to prevent the eruption of fire. (Safiullah, 2005)

2.4 Industrial Safety Regulations in Bangladesh

The concerned authority (Ministry of Labour and Employment; Ministry of Industry, DIFE, DOE, BSTI) has not enacted health and safety protection measures for the workers employed in SMEs. It is mainly because of some flexible legislation. In Bangladesh, factories with fewer than 50 workers employed (in small-scale workshops or factories) are not subject to all regulation (Factory Act 1965, Factory Rules 1979).

2.4.1 Safety Provisions of the Factory Law

In the article 22 and in the rules 51, 52 and 53 the fire protection and precautionary measures are described. During the danger period including fire extinguishing measures and the alarm etc. are described in the article 23 while the article 37 deals with equipment related warnings. In the article 23 and rule 44 safety of the running machines are described while the article 25 and the rule 45 prohibits the young men to work with the dangerous machines. The article 26 and the rule 41 give the warnings about the electricity-related dangers. The article 27 says about the

wideness of the nearby road where automatic machines are installed, 28 article states that projected part of a churning rod should be put in an enclosure, 29 article asks the concerned authorities to control the pace of spinning machines to ensure safety while the article 33 and the rule 47 stressed the need for ensuring safety of pressure plant. The article 34 emphasis on the safety of floor, staircase and passage of movement, the article 35 reads about the safety measures of pit, pump and tunnel mouth and the rule 50 dictates about the minimum size of the manhole. The article 36 clearly prohibits for the workers to carry excessive weight and the rule 48 it clearly defines what age group of workers can carry how much weight. The safety of eyes of a worker is ensured in the article 37 and rule 49. The articles 41 and 42 ensure the safety measures against explosives, flammable smoke and gas etc. In addition to these safety measures the article 38 empowers the inspector to enquire about the faulty equipments and tools and to examine their durability while the article 39 empowers him to take preventive measures to avoid the building collapse and the danger of equipments (Nasim, 2005).

2.4.2 Temperature & Ventilation:

(1) Effective measures shall be made in every establishment for securing and maintaining in every work-room adequate ventilation by the circulation of fresh air; and

(2) Temperature in every room shall be kept in such conditions as will secure to workers therein-reasonable conditions of comfort and prevent injury to health

(3) For the purpose of sub-section (2), the walls and roofs of rooms shall be of such material and so designed that such temperature shall not be exceeded but be kept as low as practicable;

(4) where the nature of the work carried on in the establishment involves, or is likely to involve, the production of excessively high temperature, such adequate measures as are practicable, shall be taken to protect the workers there from by separating the process which produces such temperature from the work-room by insulating the hot parts or by other effective means.

(5) If it appears to the Government that in any establishment or class or description

of factories excessively high temperature can be reduced by such methods as white-washing, spraying or insulating and screening outside walls or roofs or windows or by raising the level of the roof, or by insulating the roof either by an air space and double roof or by the use of insulating roofing materials, or by other methods, it may prescribe such of those or other methods to be adopted in the establishment (Chowdhury, 2003).

2.4.3 Lighting:

(1) In every part of an establishment where workers are working or passing, there shall be provided and maintained sufficient and suitable lighting, natural or artificial, or both.

(2) In every establishment all glazed windows and skylights used for the lighting of the work-room shall be kept clean on both the outer and inner surfaces and free from obstruction as far as possible under the rules framed under sub-section (3) of section 14.

(3) In every establishment effective provision shall so far as is practicable, be made for the prevention of -

(a) Glare either directly from any source of light or by reflection from a smooth or polished surface, and

(b) The formation of shadows to such an extent as to cause eye strain or risk of accident to any worker (Chowdhury, 2003).

2.4.4 Cleanliness:

(1) Every establishment shall be kept clean and free from effluvia arising from any drain privy or other nuisance, and in particular, -

(a) Accumulation of dirt and refuge shall be moved daily by sweeping or by any other effective method from the floors and benches of workrooms and from staircases and passages and disposed of in a suitable manner;

(b) The floor of every workroom shall be cleaned at least once in every week by washing, using disinfectant where necessary or by some other effective method;

(c) Where the floor is liable to become wet in the course of any

manufacturing process to such extent as is capable of being drained, effective means of drainage shall be provided and maintained;

(d) All inside walls and partitions, all ceilings or tops of rooms and walls, sides and tops of passages and staircases shall-

(i) where they are painted or varnished, be repainted or revarnished at least once in every five years;

(ii) where they are painted or varnished and have smooth impervious surfaces, be cleaned at least once in every fourteenth month, by such methods as may be prescribed;

(iii) in any other case, be kept white- washed or colour-washed and the white-washing or colour-washing shall be carried out at least once in every fourteen months: and

(e) The dates on which the processes required by clause (d) are carried out shall be entered in the prescribed register (Chowdhury, 2003).

2.4.5 Dust and Fume:

(1) In every establishment in which, by reason of the manufacturing process carried on, there is given off any dust or fumes or other impurity of such a nature and to such an extent as is likely to be injurious or offensive to the workers employed therein, effective measures shall be taken to prevent its accumulation in any work- room and its inhalation by workers, and if any exhaust appliance is necessary for this purpose, it shall be applied as near as possible to the point of origin of the dust, fumes or other impurity, and such point shall be enclosed so far as is possible.

(2) In any establishment no stationary internal combustion engine shall be operated unless the exhaust is conducted into open air, and no internal combustion engine shall be operated in any room unless effective measures have been taken to prevent such accumulation of fumes there from as are likely to be injurious to the workers employed in the work-room (Chowdhury, 2003).

2.4.6 Artificial Humidification:

(1) In any establishment in which the humidity of the air is artificially increased, the water used for the purpose shall be taken from a public supply, or other source of drinking water. or shall be effectively purified before it is so used.

(2) If it appears to an Inspector that the water used in an establishment for increasing humidity which is required to be effectively purified under sub-section (1) is not effectively purified, he may serve on the Manager of the establishment an order in writing, specifying the measures which in his opinion should be adopted, and requiring them to be carried out before a specified date (Chowdhury, 2003).

2.4.7 Overcrowding:

(1) No work-room in any establishment shall be overcrowded to the extent that it is injurious to the health of the workers employed therein.

(2) Without prejudice to the generality of the foregoing provisions, there shall be provided at least 9.5 cubic metre of space for every worker employed in a workroom

Explanation - For the purpose of this sub-section no account shall be taken of a space, which is more than fourteen feet above the level of the floor of the room.

(3) If the Chief Inspector by order in writing so requires, there shall be posted in each work-room of a establishment an establishment specifying the maximum number of workers who may, in compliance with the provisions of this section, be employed in the room.

(3) The Chief Inspector may, by order in writing exempt, subject to the conditions as he may think fit to impose, any work- room from the provisions of this section if he is satisfied that compliance therewith in respect of such room is not necessary for the purpose of health of the workers employed therein (Chowdhury, 2003).

2.4.8 Protection of Eyes:

Effective screens or suitable googles shall be provided for the protection of persons employed in or in the immediate vicinity of the following process:

a) dry grindings of metal and metal articles applied by hand to a revolving wheel, or disc driven by mechanical power: turning (external or internal) of non-ferrous metals or of cast iron, or articles of such metals or such iron, where the work is done dry, other than precision turning where the use of googles or screen would seriously interfere with the work, or turning by means of hand tools;

b) welding or cutting of metals by means of electric oxyacetylene or similar processes;

c) felting, cutting out cold rivets or bolts, chipping or scaling, and breaking or dressing for stone, concrete slag and the like by hand tools or other portable tools (Chowdhury, 2003).

2.4.9 Precautions in Case of Fire.

According to Bangladesh Labour Code, 2006, *Section 62*.

(1) Every establishment shall have an alternative stair connected to every stair connected to every floor as a means of escape in case of fire and be equipped with fire extinguisher as may be prescribed by the rules.

(2) If it appears to the Inspector that any establishment is not provided with the means of escape prescribed under sub-section (1), he may serve on the employer of the establishment an order in writing specifying the measures, which, in his opinion, should be adopted before a date specified in the order.

(3) In every establishment the doors affording exit from any room shall not be locked or fastened so that they can be easily and immediately opened from inside while any person is within the room, and all such doors, unless they are of the sliding type, shall be constructed to open outwards, or where the door is between two rooms, in the direction of the nearest exit from the building and no such door shall be locked or obstructed while work is being carried on in the room.

(4) In every establishment every window, door, or other exit affording means of

escape in case of fire, other than the means of exit in ordinary use, shall be distinctively marked in red in Bengali language by some other effective and clearly understood sign.

(5) In every establishment there shall be provided effective and clearly audible means of giving warning in case of fire to every person employed therein.

(6) A free passage-way giving access to each means of escape in case of fire shall be maintained for the use of all workers in every room of the factory.

(7) In every establishment wherein more than ten workers are ordinarily employed in any place above the ground floor, or explosives or highly inflammable materials are used or stored, effective measures shall be taken to ensure that all the workers are familiar with the means of escape in case of fire and have been adequately trained in the routine to be followed in such case.

(8) In every establishment wherein fifty or more than fifty workers are employed a demonstration of fire extinguishing at least once a year must be held and the employer shall maintain a record book specified for this purpose.

2.4.10 First-Aid Appliances:

The first-aid boxes or cup-board shall be distinctively marked with a red cross on a white background and shall contain the following equipment:-

For factories in which the number of persons employed does not exceed ten or in the case of factories in which mechanical power is not used does not exceed fifty persons, each first-aid box or cup-board shall contain the following equipments:-

1. 6 small size sterilized dressings,
2. 3 medium size sterilized dressings,
3. 3 large size sterilized dressings,
4. 3 large size sterilized burn dressing,
5. 1 (loz.) bottle containing a 2 percent alcoholic solution of iodine,
6. 1 (loz.) bottle containing rectified spirit
7. one pair of scissors,
8. 1 copy of first-aid leaflet, and

9. analgesic tablets, ointment for burns and suitable surgical antiseptic solution. (Chowdhury. 2003).

2.5 ILO Standards on Safety Issues:

Workers in the informal sector both urban and rural face major safety and health problems. Definitions of this sector vary. It covers a wide range of precarious jobs, mainly in developing countries, in which the worker does not have any formalized relationship with an employer. Some of the tasks are inherently hazardous – for example, the manual collection and recycling of waste. More generally, informal workers tend to have a poor working environment and very unsatisfactory welfare facilities. As occupational health services are virtually non-existent, meaningful safety statistics are a rarity. However, the injury and illness rates are at least the same or higher than in the formal sector[7]. Often, informal workers' cramped living spaces are also their workplaces. They and their families are therefore continuously subject to occupational hazards and pollution. The informal sector has grown at unexpected speed. According to a recent ILO report [8], it now accounts for about half of the workers in the world. In some countries, such as Bangladesh, Mali, Nepal and Pakistan, it represents 70 percent of total employment. Over the past decade, it is estimated to have created over 90 percent of the new jobs in Africa. The lack of legal and social protection, representation and rights at work which characterizes informal employment is prevalent in many countries, the ILO says, and is an inherent part of the current path of globalization. The report stresses that, unless the root causes of informality are addressed, there can be no sustainable move towards recognized, protected, decent work. It sets out an integrated strategy to deal with these causes.

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[7] Loewenson R. Health impact of Occupational Risks in the Informal Sector in Zimbabwe, ILO Geneva, available at: http://www.ilo.org/public/english/protection/safework/papers/infzimb/index.htm

[8] ILO: *Decent work and the informal economy*, Report VI, International Labour Conference, 90th Session, June 2002. Geneva. ISBN 92-2-112429-0. Online at http://www.ilo.org/public/english/standards/relm/ilc/ilc90/pdf/rep-vi.pdf

On safety and health as in other fields, the ILO adopts two main types of standard: Conventions (which are rectifiable and binding) and Recommendations (more detailed, often supplementing a Convention).

Currently, there are more than seventy ILO Conventions mainly or partly related to questions of safety and health. Many others deal with matters that are also clearly relevant to the safety and health agenda – for example, freedom of association, collective bargaining, labour inspection, gender equality and child labour.[9]

ILO health and safety standards cover four main categories:

Guiding policies for action: These include the Occupational Safety and Health Convention (No. 155) and its accompanying Recommendation (No. 164), which prescribe the progressive application of comprehensive preventive measures and the adoption of a coherent national policy on occupational safety and health. They also establish responsibility of employers for making work and equipment safe and without risk to health, as well as the duties and rights of workers. Further prominent examples are the Occupational Health Services Convention (No. 161) and its accompanying Recommendation (No. 171), and the List of Occupational Diseases Recommendation (No. 194).

Sectors: some of the most hazardous sectors are covered by specific Conventions - for example, mining, construction and dock work. An important recent addition is Convention No. 184 on Safety and Health in Agriculture, adopted in 2001 together with the accompanying Recommendation No. 192.

Specific risks affecting more than one sector: for example, chemicals, ionizing radiation, benzene, asbestos, occupational cancer, air pollution, noise and vibration.

Protection measures: for example, the guarding of machinery, medical examination of young workers or the maximum weight of loads to be transported by one worker.

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[9] ILO Codes of Practice on occupational safety and health are online at www.ilo.org/public/english/protection/safework/cops/english/index.htm

In addition, the ILO has issued more than thirty Codes of Practice on occupational health and safety.[10] These are intended as practical guides for public authorities and services, employers and workers concerned, specialized protection and prevention bodies, enterprises and safety and health committees. Codes of Practice are not legally binding instruments and do not aim to replace the provisions of national laws or regulations, or accepted standards.

Other practical ILO contributions include a number of health and safety programmes conducted in cooperation with other international and national organisations. An example is the International Programme on Chemical Safety.[11]

2.5.1 Industrial Accidents

Judging from the general standards of safety prevailing in the industries, there are reasons to believe that not all accidents are reported by the industries, including those surveyed.About two million people are killed by their work every year, according to ILO's most recent estimates. But these deaths are just part of the problem. An estimated 160 million people on this planet have work-related diseases. In one third of these cases, the illness causes the loss of 4 or more working days. Meanwhile, the number of work accidents worldwide, fatal or non-fatal, is put at 270 million a year. Fatalities are not fated. Accidents don't just happen. Illness is not random. They are caused. Most of the world's work-related deaths, injuries and illnesses are preventable.

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[10] ILO standards can be consulted online via www.ilo.org/ilolex
For the main ILO standards on safety and health, see
www.ilo.org/public/english/protection/safework/standard.htm#cr

[11] See www.who.int/pcs/index.htm

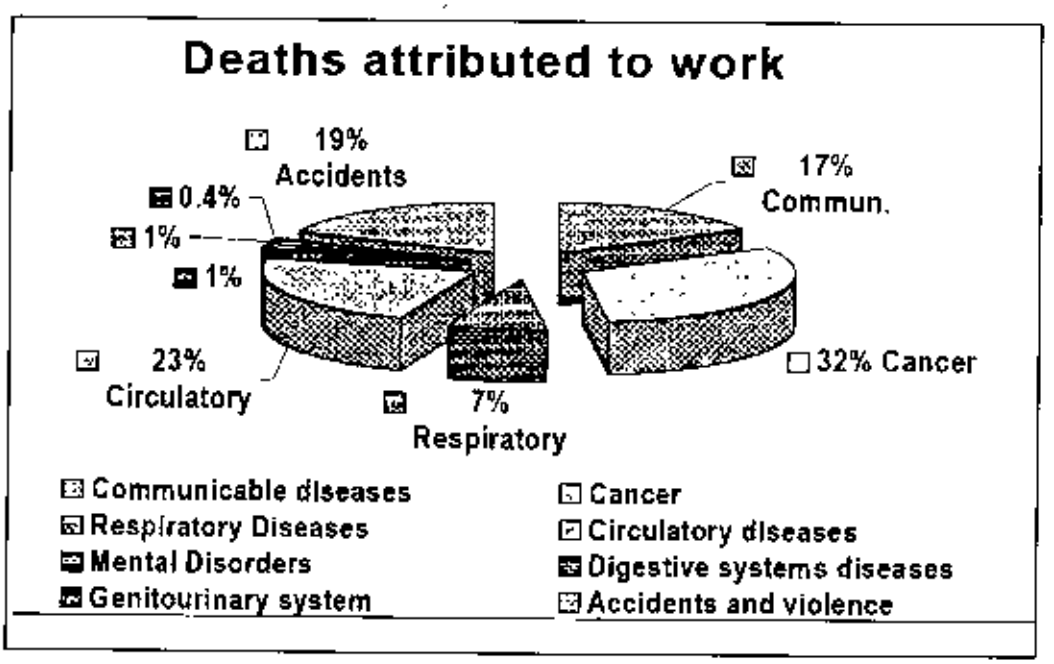

Figure 2.1: Main causes of occupational fatalities worldwide Source: ILO SafeWork.

As may be seen, the four biggest killers are:

- Work-related cancer (32 percent)
- Work-related circulatory diseases (23 percent)
- Occupational accidents (19 percent)
- Work-related communicable diseases (17 percent)

2.5.2 Main Contributing and Preventable Factors for Occupational Accidents:

Lack of company/enterprise safety and health policy, structure, worker/employer collaborative mechanism, lack of occupational safety and health management system

- poor safety culture
- lack of knowledge, available solutions, awareness, information centres

- lack of or poor government policies, lack of or poor legal enforcement and advisory system, lack of or poor tripartite cooperation
- lack of incentive-based compensation system (experience rating)
- lack of or poor occupational health services
- lack of research and proper statistics for priority setting
- lack of effective training and education system at all levels

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Chapter 03

RESEARCH METHODOLOGY AND DATA COLLECTION

- Research Methodology
- Selection of Case Study Areas
- Statistics on the Selected Small Scale Industries
- Sample Selection and Design of Questionnaire Survey
- Analytical Techniques Used in the Study
- References

This Chapter describes the research strategy adopted and the steps followed to achieve the objectives of the study as outlined in Chapter 1

3.1 Research Methodology

The present study is the outcome of an exploratory research, which is based on primary data analysis from field survey and supported by secondary data from related literature.

3.2 Selection of Case Study Areas

Some particular areas, which have greater concentration of small scale manufacturing industries (Figure 3.1) had been selected as case study areas, they are;

- Islambagh
- Lalbagh
- Dholaikhal
- Shakharibazar &
- Bhagolpur

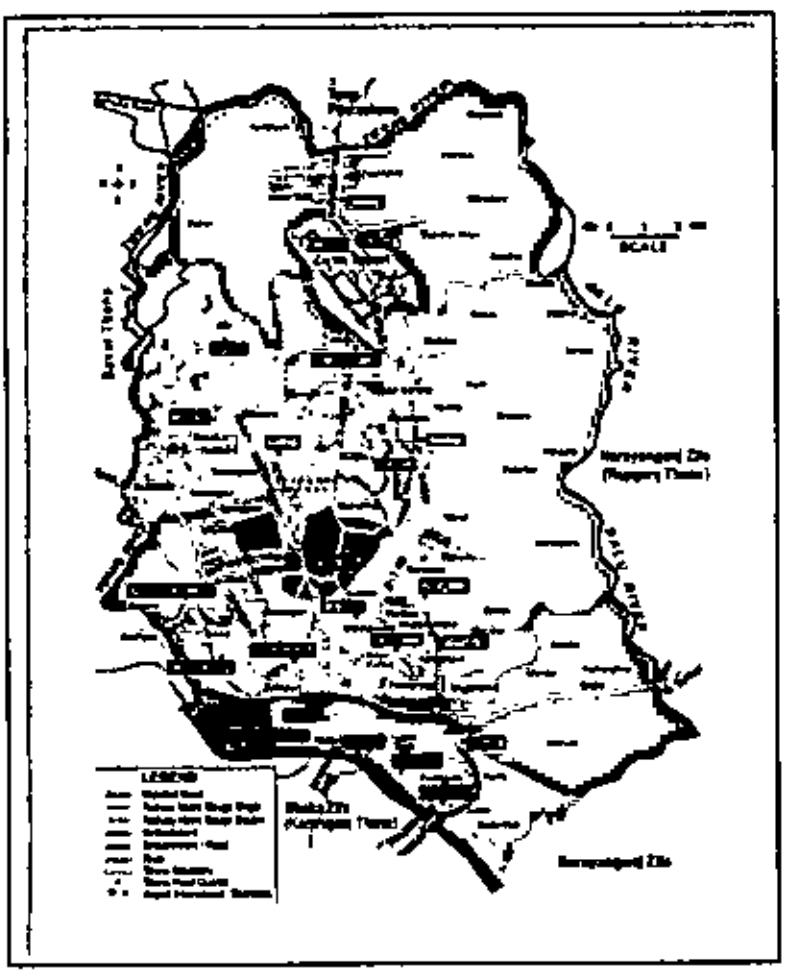

Figure 3.1: The red marked area indicates the surveyed area of Old Dhaka.

For the purpose of comparative scenario analysis of safety security situations, four types of manufacturing industries (Figure 3.2) have been selected and studied in groups for the present study, they are;

- Plastic recycling and product manufacturing industry
- Light engineering workshops
- Musical instrument manufacturing industry &
- Conch shell craft industry.

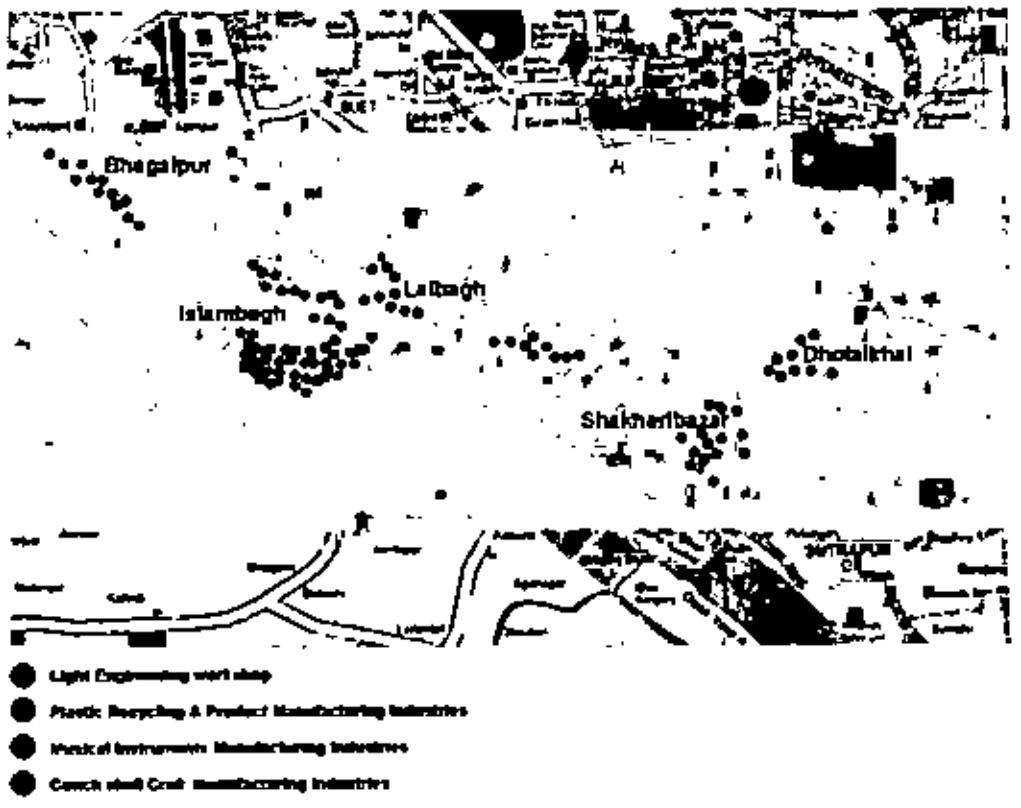

Figure 3.2: Locations of surveyed Small Scale Industries in Old Dhaka

3.2.1 Location Characteristics of the Surveyed Small Scale Industries in Old Dhaka.

Islambagh, Lalbagh

Located in the Lalbagh thana, Islambagh is the earliest industrial location in Old Dhaka indigenous industries, and a number of small firms occupy the area among

Figure 3.3: Collected used pet bottles for recycled manufacturing factories.

ready for marketing

which plastic recycling and product manufacturing and light engineering industries are most frequently found. Figure 3 3 shows the input of recycled used bottles as source material for the finished plastic goods production in Figure 3.4.

Dholai khal

Situated on the bank of the river Buriganga in the old part of Dhaka city, Dholaikhal is a small block covering only 550 sq yards in the present Dhaka Metorpolitan area. A busy centre of trade and commerce, Dholaikhal area has earned a reputation for small scale engineering workshops based on innovative technology (Banglapedia, 2006). There are innumerable small workshops for repair or manufacturing of many types of household items and machinery parts. Figure 3.5 shows a dice making factory of the area.

Figure 3.5: Dice making factory at Dholaikhal

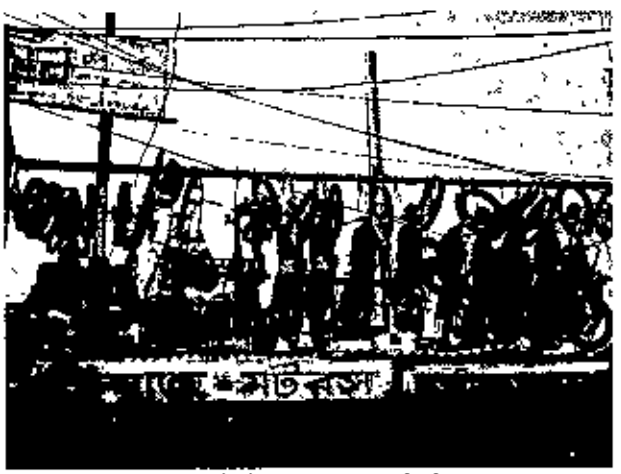

Figure 3.6: Recycled motor parts industry at Dholaikhal – A typical picture of the area.

Major business activity in the area is the sale of automobile parts and spares, sanitary fittings and computer accessories also retooling of old and used motor parts, making lathe machines, Figure-cutters and numerous improvised mechanical tools, housed approximately in 2,500 to 3,000 workshops. A typical scene of the area is seen in Figure 3.6.

The light engineering workshops and servicing units located in the Dholai Khal area of Old Dhaka have made remarkable strides in manufacturing spare parts, components, accessories etc on the basis of models/samples imported from abroad. But these small entrepreneurs are working under serious limitations, which include lack of precision tools, out-dated or obsolete machinery, lack of technical and training assistance, shortage of funds, insufficient space, lack of designs and samples and lack of quality raw materials.

Shakhari bazaar

Located near the intersection of Islampur road and Nawabpur road the two main arteries of the old city, Shakharibazar has its unique urban fabric, intricate artistry and craftsmanship along with vibrant culture and tradition nurtured for centuries. The houses in the area have the characteristics of their own which are still evident in many of the structures. According to a cover story conducted by Star Weekend Magazine (dated; April 21, 2006) on Shakharibazar, it is a 600 ft. long narrow street lined by thin slices of brick buildings 200-300 years old. These buildings are 10-20ft. in width and 70-100 ft. in length going up to 2-3 storeys (Figure 3.7). A few buildings are 4 stories high. The structures built on the narrow slices of each plot have had a frontage with a façade not more than six feet wide and a small front door; slim and long corridors.

Figure 3.7: A typical Shakharibazar street

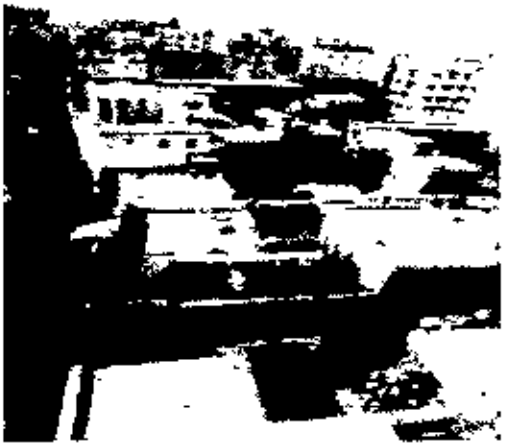

Figure 3.8: Urban fabric of Shakharibazar.

The corridors will lead to the stairs running along to climb the three or four storied houses Almost every house has a tiny central courtyard. In Figure 3.8 the aerial view of the buildings with courtyard is shown for taking light and air inside the rooms which is an urban fabric of the area A number of these time-old structures were destroyed in a recent collapse because of the impermissible load of constructions on top of the buildings. Most of them are quite unsafe to live in.

The area got its name from the craftsmen of shakha who are called 'Shakharees'. Shakha, a richly decorated bangle crafted from slices of Shankha or Conch shells is the symbol that indicates that a Hindu woman is married. Apart from Shakha a number of other traditional crafts are widely seen in the mohalla, to name a few are, musical instruments, paper crafts, shoal-pith or crafts using jute straw and Styrofoam sheet, Clay Statues for Puja or other religious purpose, stone craft etc. In recent times there has been a remarkable rise in the goldsmith shops in Shakharibazar

There are about 150 families from the Shakharee or Shankha Vaniks involved in the Shankha Shilpa Craft. Other than the 'Shankharees', there are another 150 families involved in the traditional crafts e.g. musical instruments, Shola-pith, the craft of making decorative artifacts from paper and jutestick and Styrofoam and clay statues for religious purposes.[12]

Most of the workers use traditional methods, techniques and tools to manufacture the products. Product Precision is wholly dependent on the workers experience. As there are very narrow aisles between the buildings fire spreads up from one building to other in no time. In recent times many incidents with fire have created awareness among the workers but they have very little notion of tackling the hazard.

3.3 Statistics on the Selected Small Scale Industries

Plastic Recycling and Product Manufacturing Industry:

According to Bangladesh Plastic Goods Manufacturer and Exporters Association (BPGMEA), there are 2997 plastic industries (Figure 3.9) located in different parts

[12] Star Weekend Magazine, April 21, 2006

of Bangladesh. Around one third (around 1000 industries) of the SMEs (mainly plastics and related enterprises) are located in the Lalbagh-Islambagh cluster (Waste Concern for the Swisscontact – Katalyst, 2006)

Table 3.1: Type of Plastic Industries in Bangladesh

Category	Small	Medium	Large
Number	1965	980	52

Waste Concern for the Swisscontact – Katalyst, (2006)

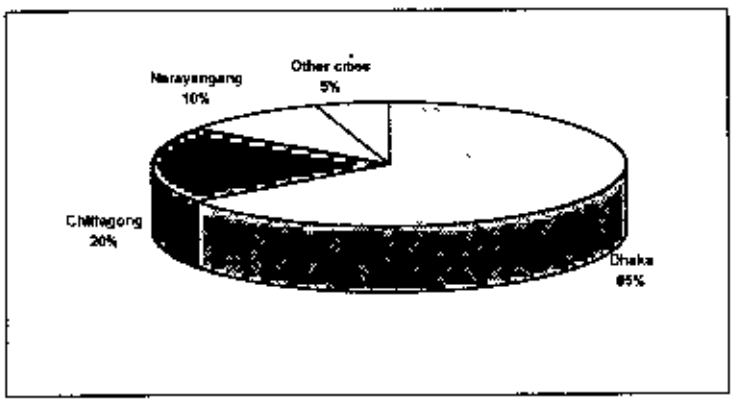

Figure 3.9: Location of Plastic Industries in Bangladesh

Light Engineering Workshop (LEW):

According to the statistics of the Bangladesh Engineering Shilpa Malik Samity, there are about 30,000 light engineering workshops across the country. Of them, 10,000 to 12,000 workshops are in the old parts of Dhaka, especially in the Dholaikhal, Shampur, Shutrapur, Narinda and Nawabpur area. The second largest cluster of Light Engineering Industries (LEIs) is at Bogra. Some of the LEIs are also situated at Jessore, Chittagong and Comilla region. (Sub-Sector study, 2006)

Conch shell Craft Industry:

According to the Shankhari Bazar Shangkha Shilpa Karigar Samity, the organisations for the dwellers of Shankhari Bazar, there are at present 36 proprietors, owning fifteen shops, with a total number of 104 workers employed by them.[13]

[13] www.newagebd.com, Shangkha Shilpa: A diminishing craft, April 29-May 5, 2005

Musical Instrument Manufacturing Industry:

There is no statistics on the number of musical industry located in Dhaka. According to the general secretary of Dhaka Swarna Shilpi Sramik Shangha about 20,000 craftsman is involved in these industries of Dhaka.[14] But the actual number of factories are not found

3.4 Sample Selection and Design of Questionnaire survey

The Small Scale Industries located in the Islambagh, Lalbagh, Shakhari bazaar, Dholai khal and Bhagolpur were surveyed to find out the existing situation related to work place safety and security. Among the surveyed factories, the largest portion (52.5%) is comprised of Plastic Recycling and Product Manufacturing industry, the second largest (30%) based on number of enterprises is Light Engineering Workshops. Then there are the typical Old Dhaka's traditional industries of conch shell crafts and musical instrument manufacturing workshops. Table 3.2 shows the proportion of each type of factories among the total surveyed industries.

Table 3.2: Surveyed industries of Old Dhaka

type of industry	location	number	percentage
Plastic recycling industry(pellet/granule+product)	Islambagh, lalbagh, Bhagolpur	58	52.5%
Light engineering workshops	Dholaikhal, Islambagh, lalbagh	33	30.0%
Musical instrument workshop	Shakhari bazar	8	7.5%
Conch shell craft manufacturing industry	Shakharibazaar, Bhagolpur	11	10%
Total		**110**	

Source: Physical survey, July, 2007

There is no data available about the actual number of Small Scale Industries in Old Dhaka, mainly because a large part of these SSIs belong to the informal sector,

[14] The daily newspaper, Shamokal, 23 October, 2007

therefore do not have any kind of formal registration. Therefore, a minimum of 110 numbers of factories employing less than 10 workers, have been taken as sample cases for questionnaire and physical survey. Two individuals from each factory, one owner or management representative and one worker i.e, a total of 220 persons responded to the questionnaire.

The safety & security aspects were identified by through literature survey and direct physical survey of the selected factories. It was understood that accidents in the typical working environment prevailing in the Small Scale Industries situated in Old Dhaka can occur due to;

- Poor physical condition of the work place;
    - Bad surface quality of floor and wall due to poor finishing and bad wiring.
    - Excess room temperature, lack of proper air circulation and lighting.
    - Deafening sound level
- Unsophisticated and low quality machinery and lack of maintenance.
- Worker's lack of skill and proper training required for a specific job.
- Worker's lack of awareness towards danger and malpractice, such as, smoking.
- Worker's lack of concentration due to excess workload or long work-shifts.
- Absence of proper cautionary signs in the work place, proper personal protective devices and emergency preparedness facilities.

The design of the structured questionnaire was done with the aim to get relevant data regarding issues listed above.

Two sets of questionnaire were prepared for two types of respondents to learn the existing safety and security conditions in the selected 4 types of SSIs. They are as follows:

1) Owner of the factory or the management representative
2) Employee of the factory

A checklist was also prepared to conduct a physical survey in the selected factories.

3.5 Analytical Techniques Used in the Study

Data derived from the questionnaire survey were systematically analysed using the computer program SPSS 12.0 and interpreted to describe the existing safety security situation of the Small Scale Industries in Old Dhaka. To get more authentic overview of the existing condition, the responses of the owner/management representative and workers have been analysed using two different sets of variables. Another set of variable was used for analysing the physical survey data. Variables are listed in appendices A2.

3.6 References

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Chapter 04

INDUSTRIAL SAFETY & SECURITY CONDITION IN THE CASE STUDY AREAS

- General Characteristics of the Surveyed Factories
- Case study 01: Plastic Recycling and Product Manufacturing Industries
- Case study 02: Light Engineering Workshops
- Case study 03: Musical Instrument Manufacturing Industry
- Case study 04: Conch shell Craft Manufacturing Industry

This Chapter will present the survey findings of case study industries. Data obtained from the questionnaire and the physical survey in the case study industries are analysed and interpreted individually in comparison with each other.

4.1 General Characteristics of the Surveyed Factories

The present study was done on manufacturing industries, which belongs to the informal sector employing less than 10 workers. General information about business type, characteristics of factory buildings, surrounding land use, production processes and socio economic profile of the employees of the surveyed industries are discussed in the following sections.

4.1.1 Ownership Type of Business

It was a general notion that small scale manufacturing industries located in Old Dhaka are usually family business carried out from generation to generation. But the survey carried out in July 2007 revealed that only 18 percent of the surveyed industries are owned and run by family members. Private entrepreneurs own a bulk of 67 percent. Figure 4.1 gives the data on ownership types of business in the surveyed areas.

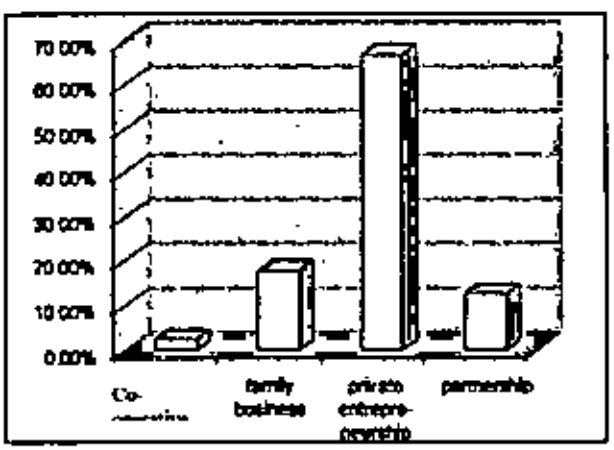

Figure 4.1: Ownership types of businesses

4.1.2 Buildings Used for Factory Establishment

More than 70 percent of the factories are housed in rented buildings, only one-fourth of the factory buildings are owned by the business owner. One in every five factories

is established in a residence or a residential building. One-third of the factories are set-up in buildings not meant for industrial use.

In Lalbagh-Islambagh area these buildings are usually single storied with temporary roofing The purpose of ventilation and lighting are served by manipulating the roofs (Figure 4 2) which increases the theft risks for the assets inside the factory

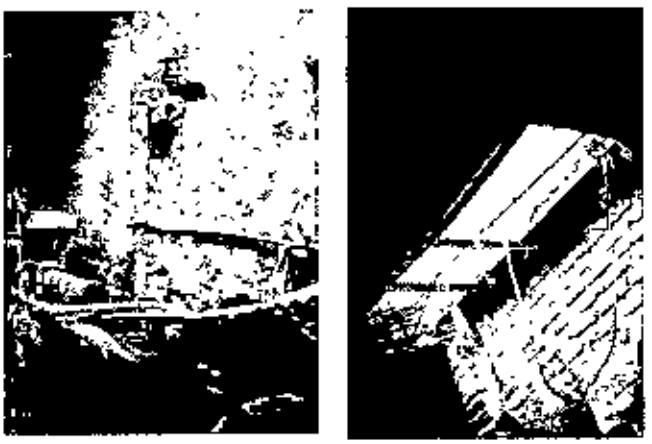

Figure 4.2: Temporary roofing system-a source of natural light and ventilation

The narrow roads of Shakharibazar with high-density population and old architectural buildings do not have minimum citizen facilities. However the community is living in damp and unhealthy buildings, which are at high risk of collapsing at any moment (Figure 4 3). The ground floors are being used to house Small Scale Industries Simultaneous use of a building for residence and industry is the urban fabric of this area. The Dhaka City Corporation identified 91 buildings after surveying 157 buildings in the area as risky buildings for demolition after the collapse of a five-storey building on June 9, 2004[15].

Figure 4.3: Dilapidated buildings at Shakharibazar areas

The factory buildings of Dholaikhal are essentially single storied shop like establishments sitting side by side along the streets

[15] http://www.newagebd.com/2007/jul/12/front.html

From Figure 4.4 it is evident that 70 percent of the surveyed industries are rented A minimum of only 3 percent of which are leased Original uses of factory buildings are shown in Figure 4.5

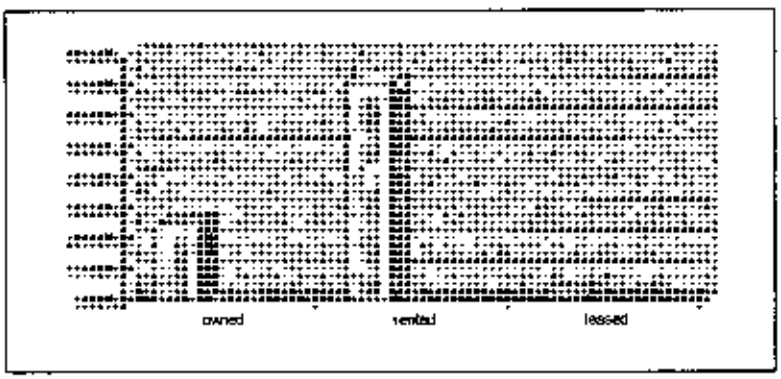

Figure 4.4: Ownership types of factory buildings

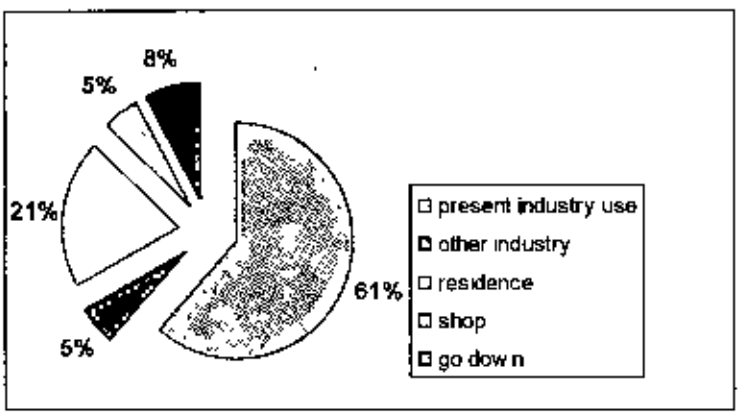

Figure 4.5: Original uses of factory buildings.

4.1.3 Surrounding Land Use Pattern

The factories are generally situated in mixed land use areas. The adjacent sites are mostly used for residential, commercial and small-scale industrial purposes In some cases schools and mosques are also situated on the adjacent sites 35 percent of the surveyed factory-sites have a residential portion.

4.1.4 Factory Workers Socio-economic Profile

The workers employed in these factories come from all age groups, ranging from 16 to 62 years of age 40 percent of them are illiterate and only 10 percent have secondary level education The monthly income of the workers ranges from Taka 1000 to Taka 7000 with an average of Taka 3154 only shown in Table 4.1.

Table 4.1: Socio-economic profiles of the workers

Age		Education level		Income	
Under18	2.6%	No schooling	40%	1000-2500	34.2%
18-50	94.8%	Primary	50%	2501-5000	60.5%
Above 50	2.6%	Secondary	10%	5001-7000	5.3%

Source: Questionnaire survey, July 2007

4.1.5 Labour Quality

The average number of workers is less than six and average proportion of skilled labourer is 68 percent. Here, 'skilled' refers to two types of labourer, first, who have formal training for their specified jobs and second, who have previous experience in the same type of job but no formal training. Table 4.2 gives the survey findings of general labour quality. Comparative scenario of skilled level among different types of industries are shown in Figure 4.6. Only 18 percent of the workers have training for their specific jobs.

Table 4.2: General labourer quality

Avg. no. of labourer	Avg. proportion of skilled lab.	Factories having 100% sk.lab.	Factories with 50% or more sk.lab.	Factories with less than 30% sk.lab.
5.5	68%	20%	62.50%	7.50%

Source: Questionnaire survey, July 2007

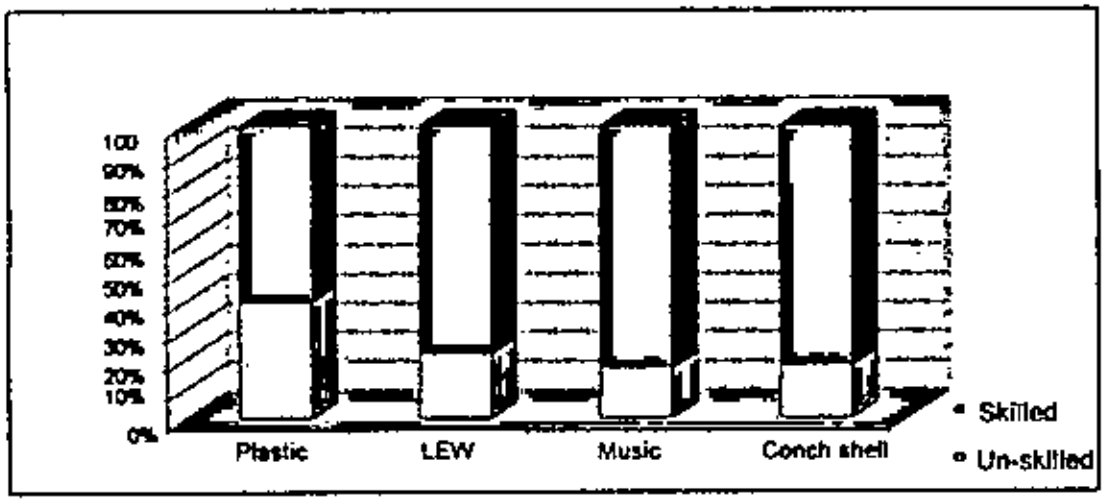

Figure 4.6: Proportion of skilled and unskilled worker in different types of industries

4.1.6 Production Process & Machinery

The production processes followed in the surveyed factories are both manual and mechanical type. A considerable proportion i.e 15 percent (Table 4.3) of the factories have exclusively manual production process, they use only small tools or hand driven machines. The plastic recycling and product manufacturing factories have totally power driven machineries. Table 4.3 shows that Machinery servicing is usually done in case of breakdowns in 41 percent of the factories. The practice of machinery servicing in regular intervals are followed only in 54 percent of the factories.

Table 4.3: Production process& Machinery

Production process		**Machinery servicing**	
Type	Percentage	Practice	Percentage
Manual	15.4%	Regular	54%
Mechanical	33.3%	Irregular, when required	41%
Both	51.3%	Never	5%

Source Questionnaire survey, July 2007

None of the factories follow the rule of 8-hour work-shift. Workers have to work 12 to 14 hours continuously in 60 percent of the cases. Table 4.4 shows the work shifts data of the surveyed factories.

Table 4.4: Work shifts in surveyed factories

No. of shifts		**Shift duration**	
Single shift	**57.5%**	9 -11 hrs	**40%**
Double shift	**42.5%**	12-14 hrs.	**60%**

Source: Questionnaire survey, July 2007

4.1.7 Occurrence of Accidents and Emergency Preparedness

According to the responses of the factory owners, no accidents happened in last one year in 88 percent of the factories, although almost one in every ten factories reported about electric short circuits and fire occurred in 2.5 percent factories in the last one year Table 4.5 shows the occurrences of accidents in the surveyed factories

Table 4.5: Occurrences of accidents in factories

Type of factory accidents	Rate of occurrence
Electric short circuit	9.5%
Fire	2.5%
None	88%

Source: Questionnaire survey, July 2007

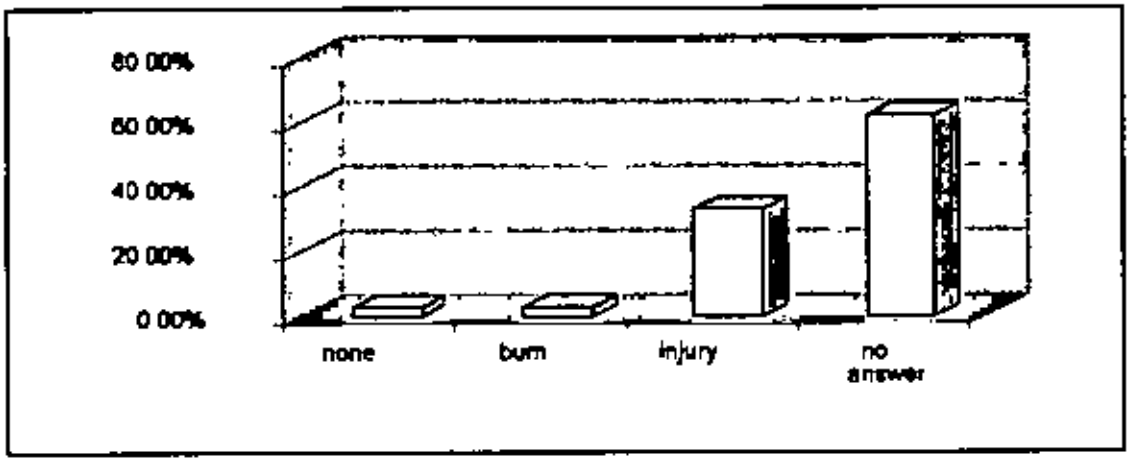

Figure 4.7: Personal accident occurred while working

While asked about personal accident occurred while in duty, one third of the workers reported about cut and various types of injuries but a large portion of them avoided answering (Figure 4.7). More than 56 percent of the factories have no emergency preparedness facilities on site. Figure 4.8 shows availability of emergency preparedness facilities in the surveyed factories Only 10 percent of surveyed industries have first aid box and 18 percent have the facilities of fire extinguisher.

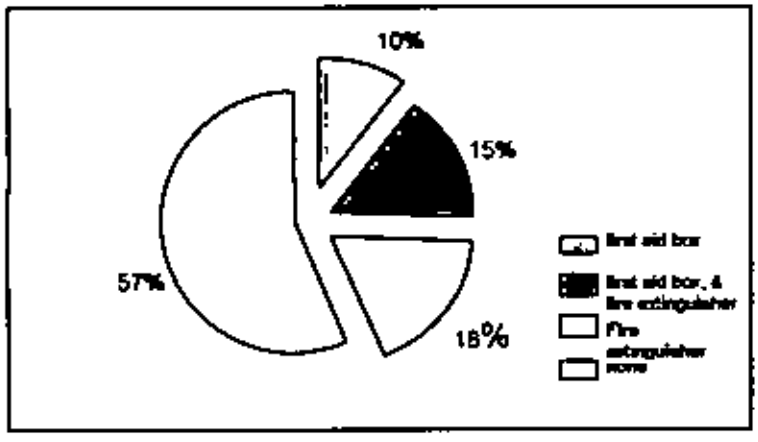

Figure 4.8: Emergency preparedness facilities available

4.2 Case study 01: Plastic Recycling and Product Manufacturing Industries

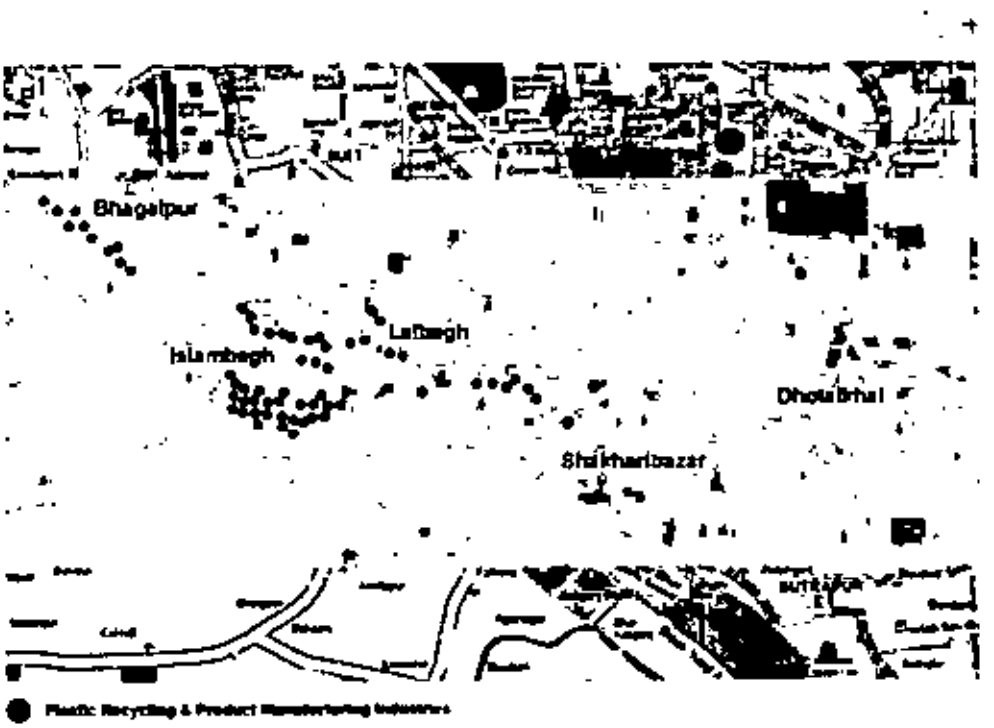

Figure 4.9: Location of surveyed Plastic Recycling & Product Manufacturing Industries

4.2.1 General Overview of the Recycled Plastic Product Manufacturing Industry

The plastics sector is one of the largest manufacturing sectors in Bangladesh, with a large and dynamic cluster located in Lalbagh-Islambagh. The current domestic Plastics market is worth around 8 billion BDT, 7 billion BDT of which comes directly from foreign exchange earnings through the export of garments accessories The remaining 1 billion was generated by exports of other plastic items (www.katalystbd.com). There are about 3000 small, medium & large plastics manufacturing units in the country. The plastics industry enjoyed a growth rate of almost 20 percent per annum during the 1990s. This impressive growth rate created many jobs for the urban poor. Plastic industries located in the Lalbagh-Islambagh area usually parts of the plastic recycling sector of Dhaka city who collects plastic wastes from the wholesalers and produces pellets and granules of different colours and then uses them to manufacture new products like toys, household good such as bucket, mug, toys etc. Figure 4.9 shows the location of these types of industries.

4.2.2 Existing Safety & Security Condition in the Factories

Two types of factories were surveyed for the study; the first type uses plastic waste as raw material and produces different colored pellets and granules. The second type uses pellets and granules as raw material and produces different household goods such as, plastic buckets, mugs, chairs, stools etc. 60 percent of the businesses are owned by private entrepreneurs, 19 percent partnership and rest of the 19 percent are family businesses. Average income of the business owners is around Taka 20,000.00 Average number of workers employed in the surveyed factories is 7 and their average income is Taka 3250.00. (Data source: questionnaire survey, July 2007) 76 percent factories have two work shifts. 71 factories run 24 hrs. 75 percent of the workers have to work continuously 12 hours.

4.2.2.1 Skill Level of Workers

Lack of formal training is a common feature of the labour force involved in this sector. On the job training i e experience in a similar job is the only way to learn and a trade and achieve excellence for a worker. Table 4.6 shows that the skills of the workers in the surveyed factories are generated through experience. Training for workers & foreman is nil with machine operator & technician have training of 22 percent and 33 percent respectively.

Table 4.6: Skill level of workers employed in the surveyed factories

Job	Training	Experience	Avg. length of exp (yrs.)
Machine Operator	22%	100%	4 3
Technician	33%	100%	
Worker	0%	100%	
Foreman	0%	89%	

Source: Questionnaire Survey, July 2007

4.2.2.2 Physical Condition of Workplace

Space Per Worker

Clear space for working in industries gives workers flexible movement and reduces physical stresses while working. But from the survey it was found that average factory space per worker is 56 sqft[16], 60 percent to 70 percent of which is occupied by the large machines used in these type of factories, i.e actual space left for the worker is around 17 sft According to the labour and industrial law of Bangladesh, in a factory environment a worker should be provided at least 9.5 cubic meter of clear space, which comes to 23 sft (apprx.) clear floor space. The physical survey revealed that in almost 75 percent cases the effective space left for the workers for movement is extremely insufficient. A poor workspace layout with exposed wiring shown in Figures 4 10, 4.11, 4.12 and 4.13. While a better wall condition with concealed wiring and better workspace in a mechanized plastic product manufacturing factory is shown in Figures 4.14 and 4 15 respectively

[16] Average factory-space- per- worker is calculated from dividing the total floor area of the factory by the number of worker in a single work-shift.

Figure 4.10: A worker working in a poor congested pellet granule-manufacturing factory.

Figure 4.11: A congested workspace in a pellet granule-manufacturing factory.

Table 4.7: Space per worker

Avg. space/worker in sft.(including machinery)	**Proportion of surveyed factories**
Less than 30sft	10%
30 – 150sft	67%
More than 150sft.	23%

Source: Physical survey, July 2007

Surface Quality of Rooms

From the survey it was found that in more than 40 percent factories, wall and ceiling are damp or physically damaged while 19 percent factories have un-finished floors which can cause injuries to the workers and other accidents like electric-short-circuits as all kinds of wiring are usually exposed (Figure 4.12). Surface quality of room in plastic factories is shown in Table 4.8

Figure 4.12: A plastic recycling factory with poor wall condition and exposed electrical wiring.

workspace layout

Figure 4.14: A plastic product-manufacturing factory with better wall condition and concealed electrical wiring

Figure 4.15: A plastic product-manufacturing factory with better workspace layout

Table 4.8: surface qualities of rooms in plastic factories

Wall		**Floor**		**Ceiling**	
Good	57%	Finished	81%	Good	57%
Partly damaged	43%	Unfinished	19%	Partly damaged	43%

Source: Physical survey, July 2007

Environmental Features

Due to insufficient provision for natural ventilation we could see the use of mechanical exhaust fan (Figure 4.16) in the surveyed plastic industries through roof and top of sidewalls in order to get rid of the hot temperature prevailing in the room. Again we could see that the main door often being used as a provision for ventilation which again make the industries unsecured The average sound level is well below the permissible exposure limits defined by the BNBC code But room temperature and humidity is way above the factory comfort level Table 4.9 gives a total scenario of the environmental features available in this type of industries in comparison to the recommended standard of BNBC, 1993

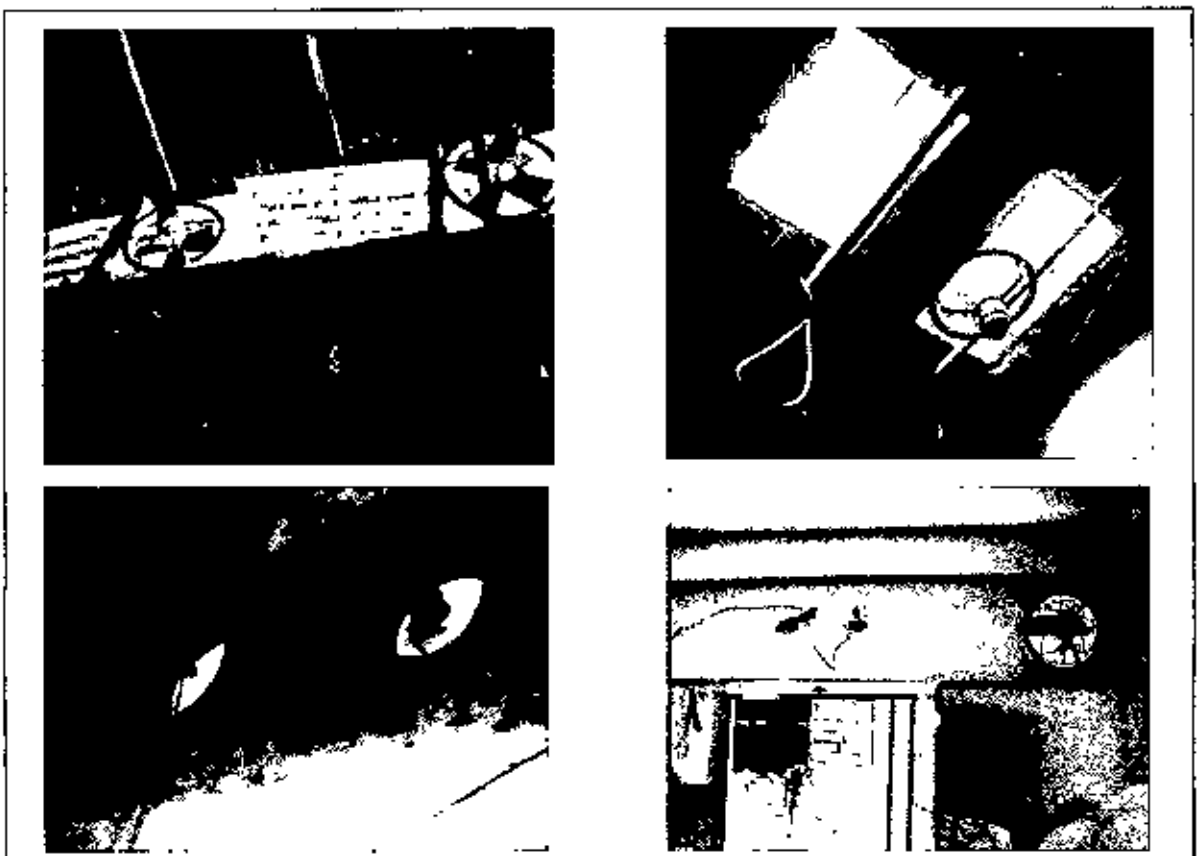

Figure 4.16: Different locations of exhaust fans in plastic recycling and product manufacturing industries

Table 4.9: Environmental features

Natural ventilation (window & ventilator)		Exhaust fan	Avg. temp. (DBT)	Recom. Temp (DBT)	Avg. humidity	Recom. humidity	Avg. sound level (dB)	Recom. sound level(dB) (10 – 2hrs. exposure)
Available	100%	90 5%	36.5°C	25.5°C - 26.5°C*	87	60-50*	79.6	87*
Not available	0%	9 5%						

Source: Physical survey, July 2007 & BNBC, 1993 * **BNBC 1993**

Lighting Condition

As most the industries are single storied the provision of natural light from sidewalls especially from the roof is a common scenario. As a result from the survey it was found that 90 percent of the factory have the availability of natural light (Figures 4.17 & 4.18) Again one in every 10 surveyed factories is found to be devoid of natural light source and 29 percent factories do not have proper illumination provisions shown in Table 4.10.

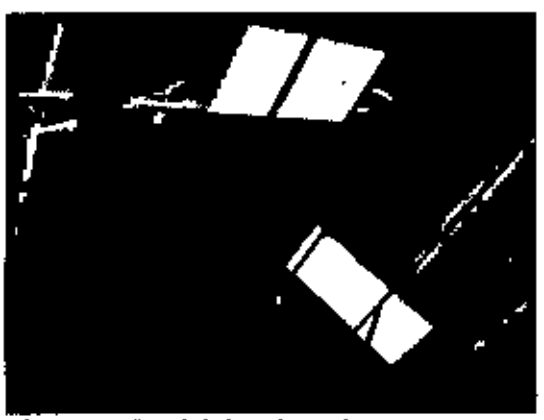

Figure 4.17: Lighting through temporary roof structure

Figure 4.18: Workers working in a naturally lit environment

Table 4.10: Existing Illumination level in work areas

Avg. LUX in w.area	LUX at working area	Proportion of surveyed factories	Recommended LUX
423	Below 100	29%	150 - 300*
	100-500	57%	
	Above 500	14%	

Source Physical survey. July 2007 & BNBC, 1993 * **BNBC 1993**

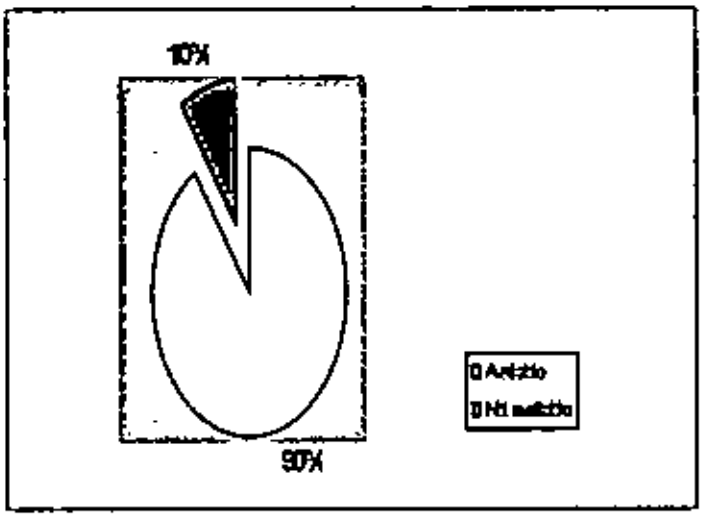

Figure 4.19: Availability of natural lighting

4.2.2.3 Problems Faced while Working

High temperature in the work place is the main problem faced by the workers, which is mainly due to the heat generation from the machine as recycled plastics need to be melt to make the pellet and raw materials for the final production.

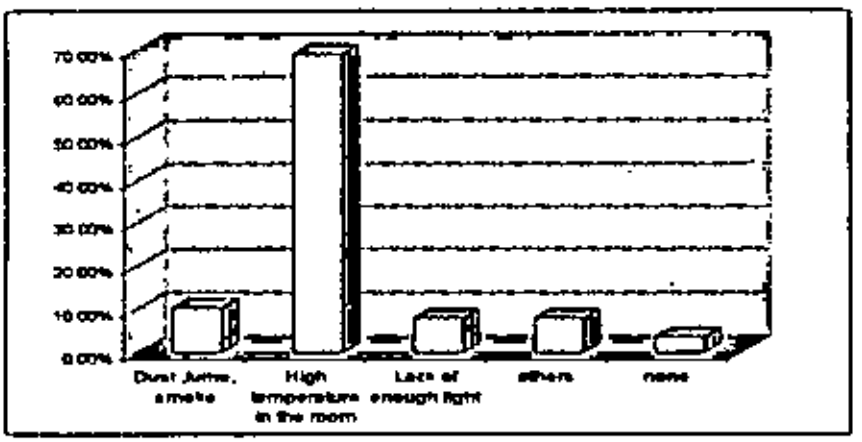

Figure 4.20: Problems faced by plastic factory workers

4.2.2.4 Accident Occurrence

Burn and cut are common accidents that occur to the workers in these factories but they are usually reluctant to admit these incidents. In the last one year time, fire in the factory premises occurred in 5 percent cases and electric short circuit happened to 18 percent of them. Personal accident occurrence rate is 29 percent and factory level accident occurrence rate is 23 percent.

4.2.2.5 Awareness About Workplace Safety and On-Duty Behavior

Smoking at Workplace:

In 50 percent of the factories smoking is not prohibited due to lack of awareness about it's consequences. But where smoking on duty is not encouraged, use of 'no smoking' signs are negligible (Table 4.11). In more than 90 percent factories, there were no use of safety signs and symbols in the work place.

Machinery servicing is done regularly only in 62 percent factories, others do it in case of a break-down (Figure 4.21). Use of personal protective devices (PPD) is ignored in most factories (Figure 4.22). More than 40 percent factories do not have any kind of emergency preparedness facilities (Figure 4.23). A very seldom found fire extinguisher is shown in Figure 4.24 but the interesting part is this extinguisher has never been used and the expiry date is over 9 months back. This is only to show the inspector when they come for inspection.

Table 4.11: Smoking at plastic factories

practice	percentage
Display of No smoking sign	4.5%
Smoking not restricted	50%
Smoking strictly prohibited	45.5%

Source: Physical survey, July 2007

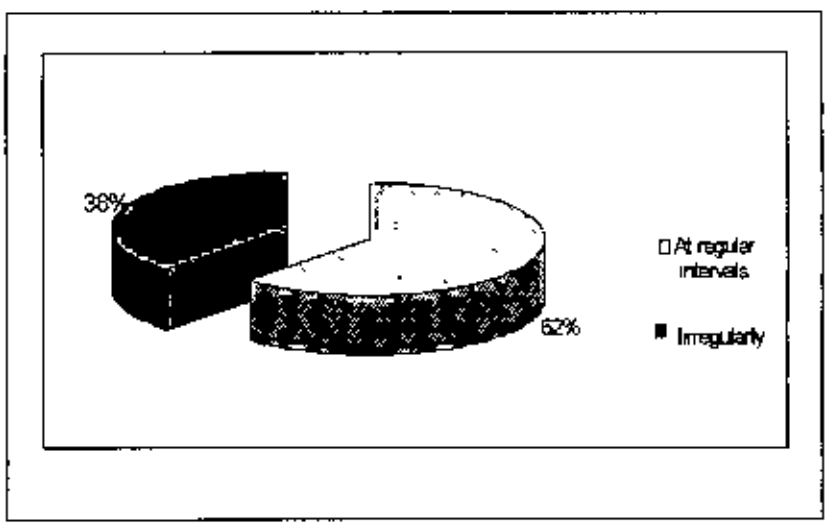

Figure 4.21: Machinery servicing in plastic factories

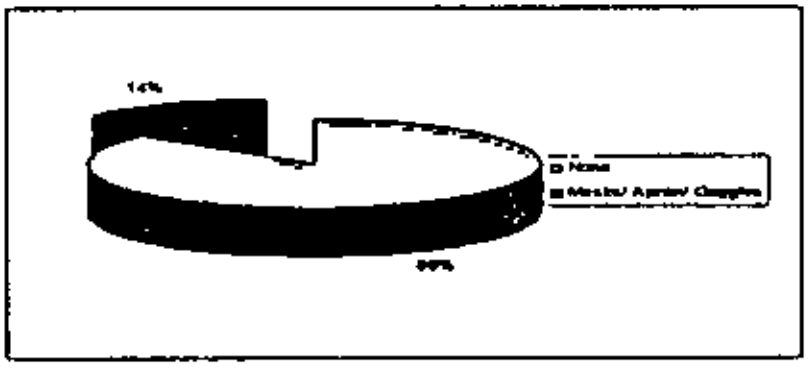

Figure 4.22: Use of PPD in plastic factories

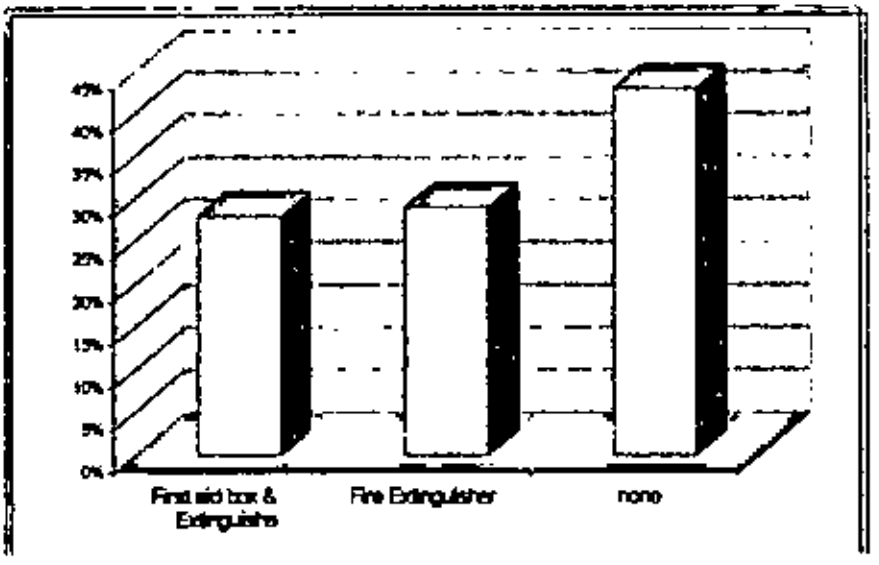

Figure 4.23: Availability of emergency preparedness facility

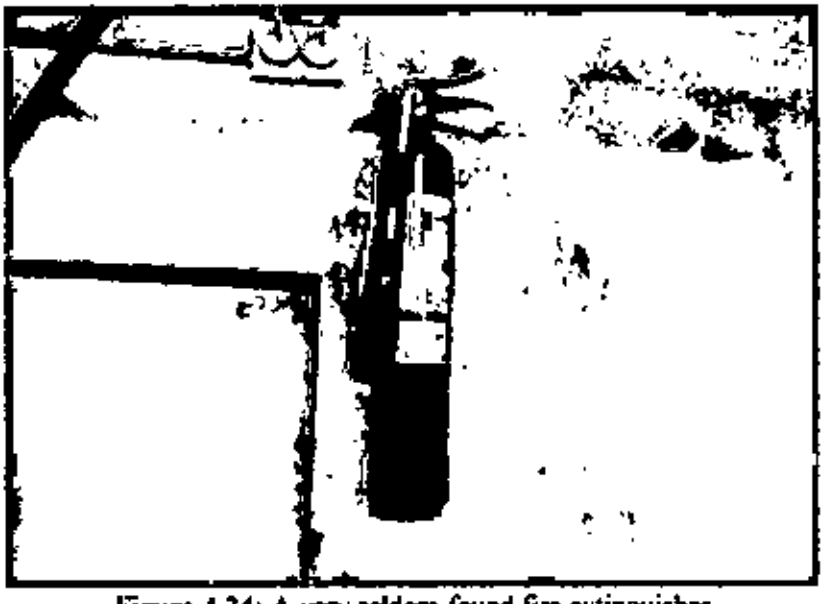

Figure 4.24: A very seldom-found fire extinguisher.

4.3 Case study 02: Light Engineering Workshops

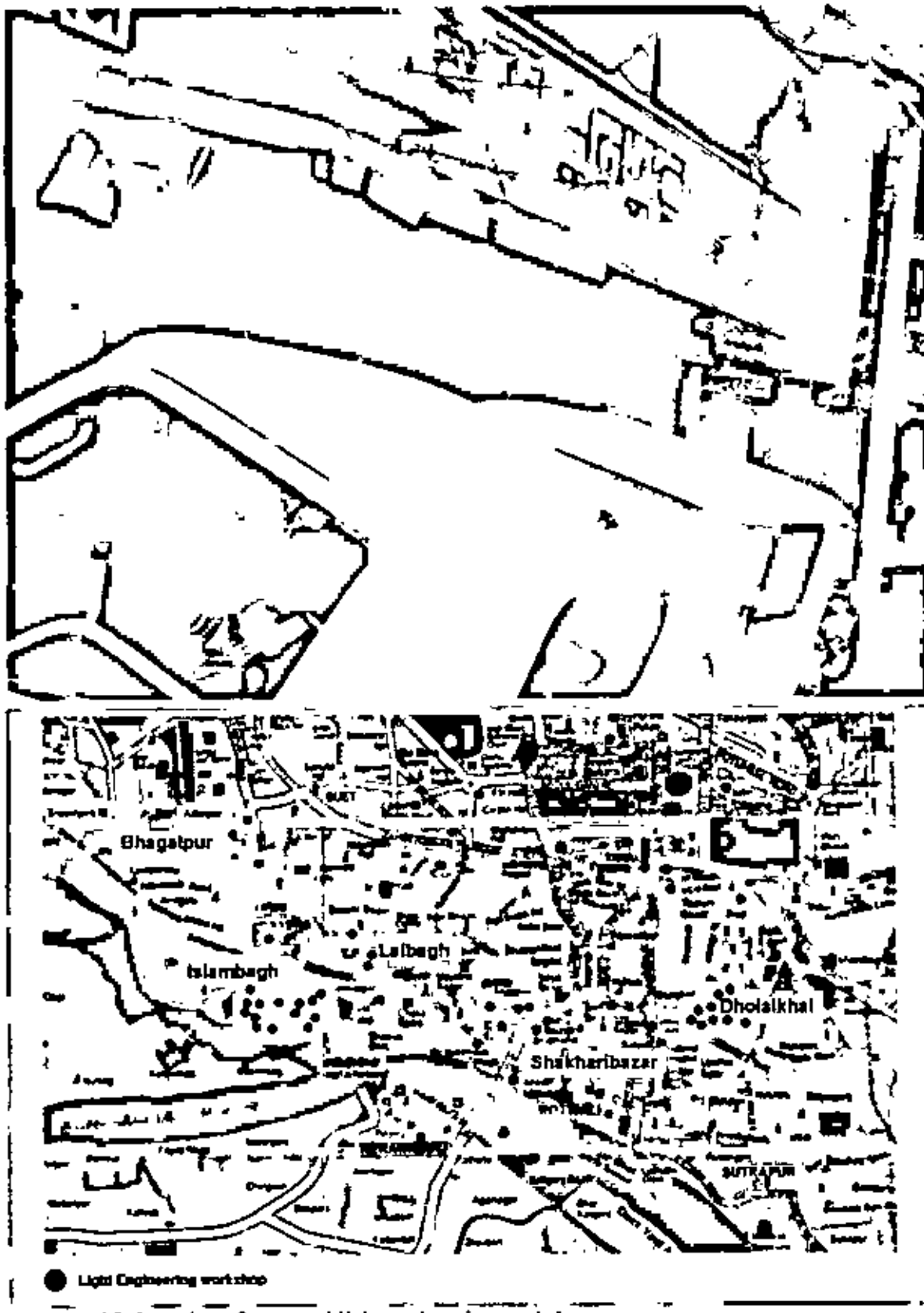

Figure 4.25: Location of surveyed light engineering workshops

4.3.1 General Overview of the Light Engineering Industry

Light engineering workshops in Old Dhaka fall into the category of SME, employing about 5 to 7 persons on average and managed and financed by the owner. (source:Banglapedia).According to an SEDF study, the average asset of these firms is only Taka 2,662,300.

In context of Bangladesh, LEI can be classified into the following four segments:

(1) Foundry Shop

(2) Machine Shop

(3) Combination of foundry and machine shop

(4) Repair Shop

A light engineering workshop requires different types of machines at different stages. Like furnace, induction-melting furnace, molding machine, jolt and squeeze type pneumatic molding machine, spectrophotometer, hardness tester and others. Most of the machines are locally produced. Some firms have second hand machines procured from neighboring country. A few companies have machines produced in China. Modern Technology required for manufacturing world-class products is absent. Machining process is dependent on lathe machine. In absence of advanced technology, precision is one of the problems in machining.

Scrap iron is the main raw material used in this sector. Scrap iron is collected from ship breaking. Small amount of raw material is produced locally

These firms meet most of the local demand for various engineering parts and appliances – from crankshafts to fishing trawler engines. A limited number of products are exported in small quantities Among these products, bicycle exports have seen a healthy growth (source: Executive Times, Sep, 2006). Figure 4.25 shows the location of these types of industries.

Working condition in LE firms is quite hazardous to health. The firms produce harmful fume and suspended particles The firms do not take any precautionary measure against environmentally hazardous activities.

4.3.2 Existing Safety & Security Condition in the Factories

The light engineering workshops surveyed for the study, are of two types, the first type mainly does repairing and finishing works of used machine parts. The second type uses ship scraps to produce shatter grills, fan dices and machine spare parts etc. More than 70 percent of the businesses are owned by private entreprenеurs, 18 percent are family businesses. Average income of the business owners is around Taka 11,500. Average number of workers employed in the surveyed factories is less than 4 and their average income is Taka 2890. In 72 percent cases workers have to work 10-12 hrs. in a single shift, however 9 percent of surveyed factories run 14 hrs. continuously. (Data source: questionnaire survey, July 2007)

4.3.2.1 Skill Level of Workers

Lack of formal training is a common feature of the labour force involved in this sector. On the job training i.e experience in a similar job is the only way to learn and a trade and to achieve excellence for a worker Table 4 2 shows the skill level of workers employed in the industries.

Table 4.12: Skill level of workers employed in the LE factories

Job	Training	Experience	Avg. length of exp. in yrs.
Machine Operator	0	100%	5.45
Technician	100%	100%	
worker	12.5%	100%	

Source: Questionnaire Survey, July 2007

4.3.2.2 Physical Condition of Workplace

Space Per Worker

Average factory space per worker is 56 sqft , 60 percent to 70 percent of which is usually occupied by the machines and material storage purpose in these type of factories (Figures 4.26 and 4.27), i.e actual space left for the worker is around 17 sqft According to the labour and industrial law of Bangladesh, in a factory environment a worker should be provided at least 9 5 cubic meter of space, which comes to 23 sft (apprx.) floor space. The physical survey revealed that in 60 percent cases the effective space left for the workers for movement is extremely insufficient Average space per worker in LEW is shown in Table 4 13

Figure 4.26: A congested working space typical in light engineering workshops of Dholaikhal.

Figure 4.27: A worker carrying out his work on a footpath due to lack of space inside the workshop.

Table 4.13: Average space per worker in LE workshops

Avg. space/worker. (Including Machinery in sft.)	Proportion of surveyed factories
Less than 30 sft.	36%
30 – 100 sft.	55%
More than 100 sft.	9%

Source: Physical survey, July 2007

Surface Quality of Rooms

LE workshops in Old Dhaka are usually characterized by their cramped work places with filthy and poor physical conditions In more than 55 percent factories, wall and ceiling are damp or physically damaged (Figures 4.28 and 4.29) while 91 percent factories do not have a finished floor which can cause injuries to the workers and other accidents like electric-short- circuits as all kinds of wiring are usually exposed. Table 4.14 gives a picture of the surface quality of this type of industries.

Figure 4.28: Poor surface quality in a light engineering workshop

Figure 4.29: Ill maintained damp wall surface with unguarded window

Wall		Floor		Ceiling	
Good	45.5%	Finished	9%	Good	36%
Partly damaged	54.5%	Unfinished	91%	Partly damaged	64%

Source: Physical survey, July 2007

Environmental Features

Insufficient natural and mechanical ventilation provision in one third and three-fourth of the surveyed factories respectively. Average sound level is well below the permissible exposure limits defined by the BNBC code. But room temperature and humidity is way above the factory comfort level. Table 4.15 gives a total scenario of the environmental features available in this type of industries in comparison to the recommended standard of BNBC, 1993. The use of exhaust fans in LEW is shown in Figure 4 30 Some LEW has ventilators which is shown in Figure 4.31.

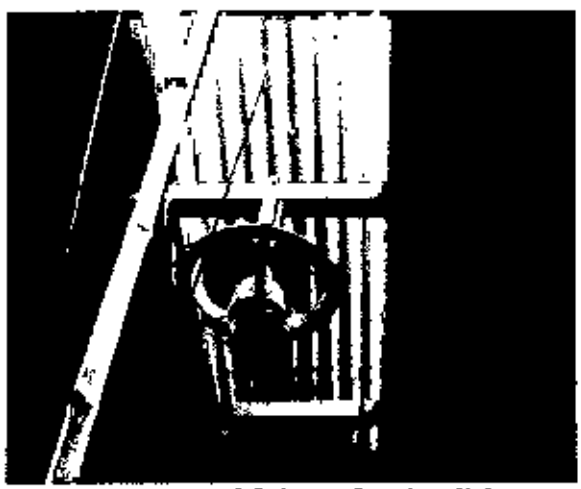

Figure 4.30: Use of Exhaust fans in a light engineering workshop

Figure 4.31: Ventilators in a light engineering workshop.

Table 4.15: Environmental features

Natural ventilation (window & ventilator)		Exhaust fan	Avg. temp. (DBT)	Recom. Temp (DBT)	Avg. humidity	Recom. humidity	Avg. sound level (dB)	Recommended sound level (dB) (10 -12 hrs. exposure)
Available	64%	18%	36°C	25.5°C	89		71	
Not available	36%	82%		-26 5°C *		60-50*		87*

Source: Physical survey, July 2007 & BNBC, 1993 * **BNBC 1993**

Lighting condition

Almost two-third of the surveyed factories do not have natural light source and 36 percent factories do not have proper illumination provisions. A poorly lighted working environment in a LEW is shown Figure 4.32. The existing illumination level in work areas is shown in Table 4.16

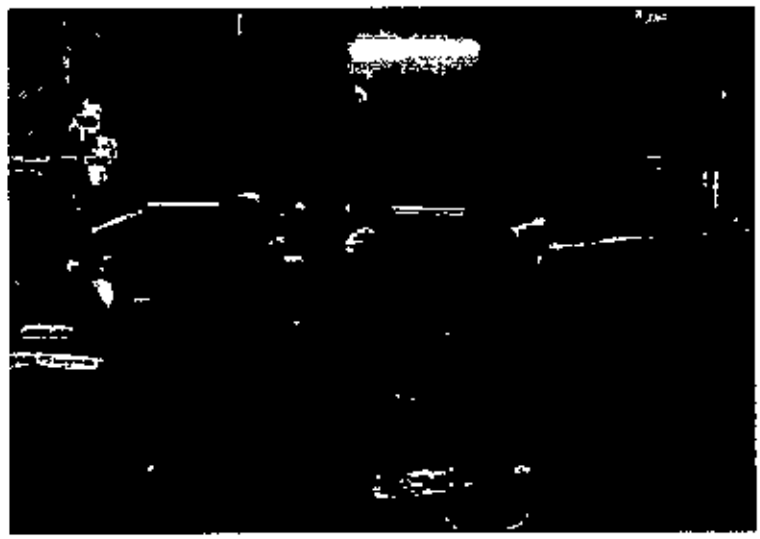

Figure 4.32: workers working in poor lighting condition

Table 4.16: Existing Illumination level in work areas

Avg. LUX in w.area	LUX at working area	Proportion of surveyed factories	Recommended LUX
171	Below 150	36%	150 – 300*
	150-above	64%	

Source Physical survey, July 2007 & BNBC, 1993 * **BNBC 1993**

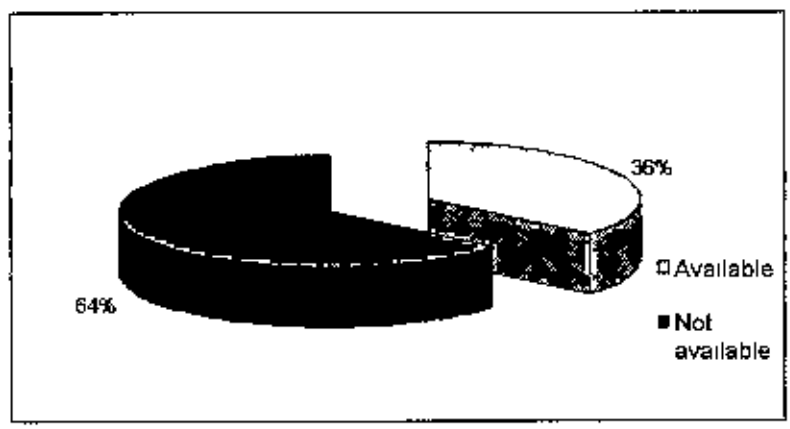

Figure 4.33: Availability of natural lighting

4.3.2.3 Problems faced while working

Workers are mostly suffered by the dust, fume and smoke produced in the process and high level of room temperature. Figure 4.34 shows the data which the workers faced while working.

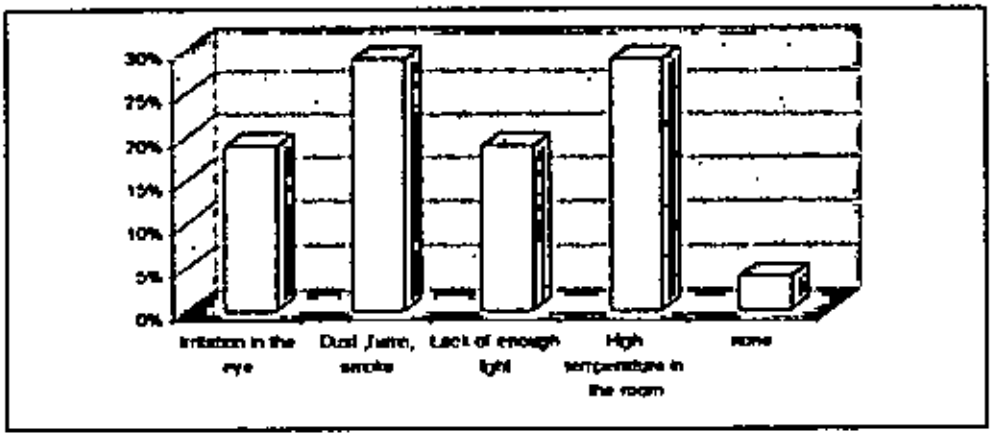

Figure 4.34: Problems faced by LE factory workers

4.3.2.4 Accident occurrence

Injuries due to cut are a common accident that occur to the workers in these factories but they are usually reluctant to admit these incidents. No factory level accidents were reported in the last one-year time. From the Figure 4.35 it is evident that the workers are afraid to provide any information even though they deal with accidents almost everyday.

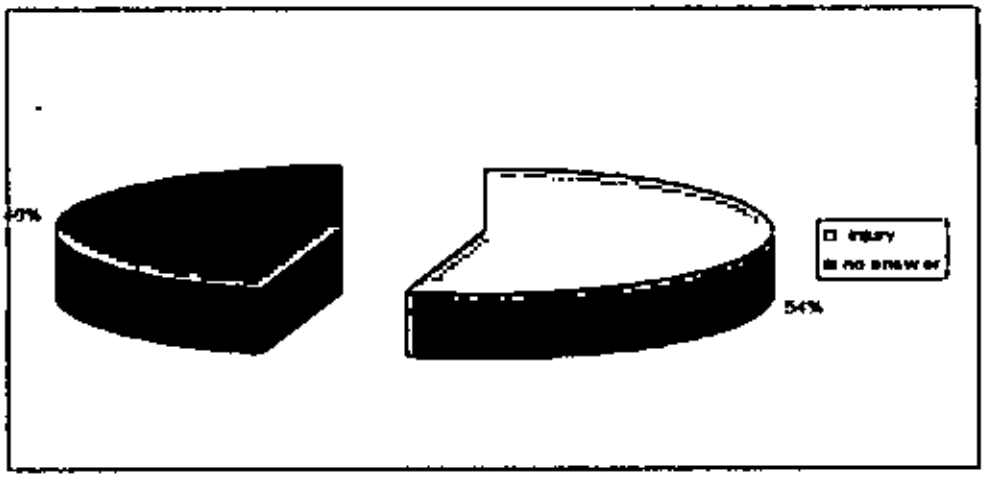

Figure 4.35: Personal accident occurred while working

4.3.2.5 Awareness about workplace safety and on-duty behavior

In 54 percent of the factories smoking is not prohibited due to lack of awareness about it's consequences. But where smoking on duty is prohibited, use of 'no smoking' signs are absent (Table 4.17). No use of safety signs and symbols were seen in the surveyed LE workshops.

Machinery servicing is done regularly only in 54 percent factories while 9 percent of the surveyed factories does not do servicing at all (Figure 4.37). In 50 percent of the factories workers do not use any kind of personal protective devices (PPD) shown in Figure 4.38, 4.39 and 4.40, which are extremely necessary in these type of workshops to protect eyes. Only 9 percent of the surveyed factories have a first aid box as their only emergency preparedness equipment (Figure 4.36).

Table 4.17: Smoking at workplace

Practice	Percentage
Display of No smoking sign	0
Smoking not restricted	54.5 %
Smoking strictly prohibited	45.5 %

Source: Physical survey, July 2007

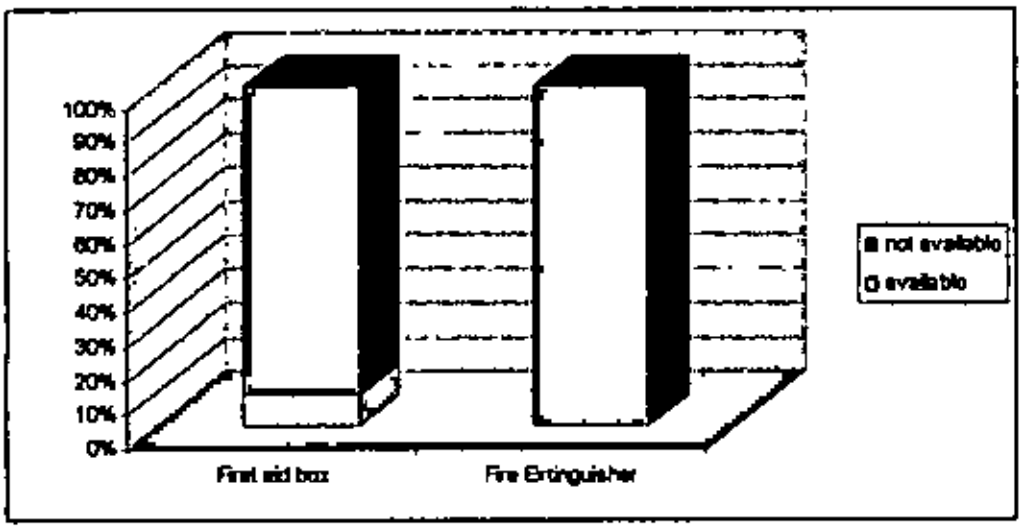

Figure 4.36: Availability of emergency preparedness facility

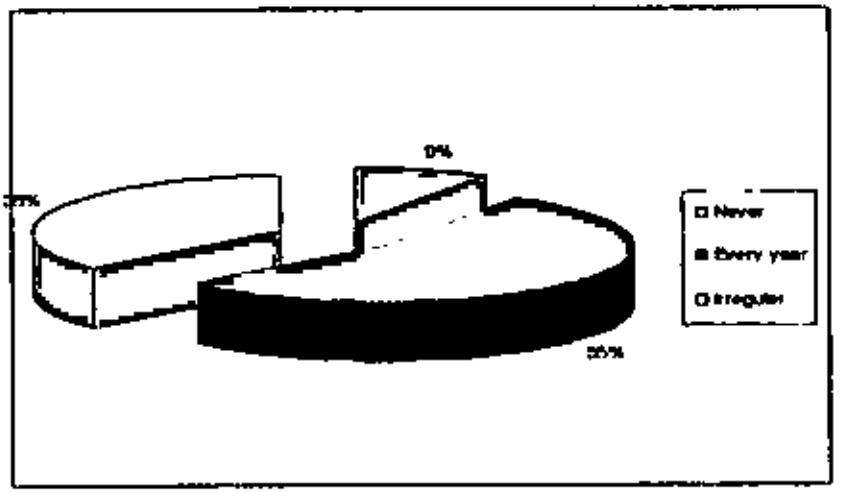

Figure 4.37: Machinery servicing

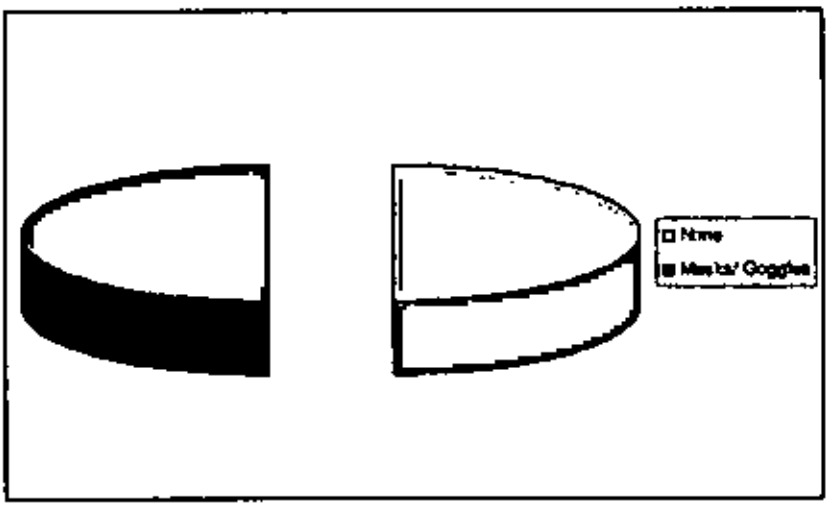

Figure 4.38: Worker's use of PPE

Figure 4.39: A child working in a light engineering workshop with bare hand and without any protective device – a common scenario of this type of industries at Dholaikhal.

Figure 4.40: A child helps in welding work at a light engineering factory.

4.4 Case study 03: Musical Instrument Manufacturing Industry

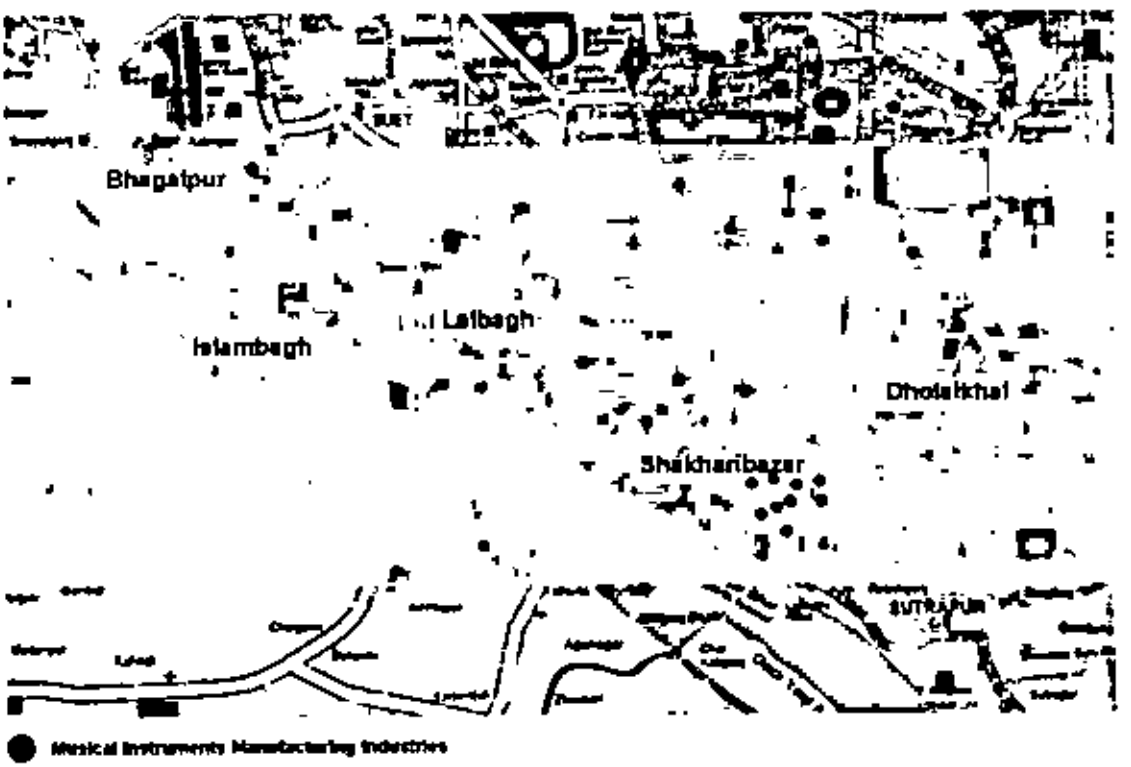

Figure 4.41: Location of surveyed musical instrument manufacturing industry

4.4.1 General overview of Musical instrument manufacturing workshops

Old Dhaka is the home of many musical instrument-manufacturing shops, which simultaneously houses making, selling, and repairing of traditional acoustical instruments. Owned by Hindu families from generations, 85 percent to 90 percent of the people working at these shops are of the Schedule Caste (NewAge-xtra April-May, 2005). They are extremely skilled workers who find comfort in working together

Numerous small tools are used in the wholly manual process of making and repairing the instruments. The workers usually suffer from strain in the eyes and respiratory distresses caused by wood dust, but they don't feel that the use of machinery would make things better for them. This is because they believe that the quality is ensured by hands and the use of technology will make them professionally insecure. Figure 4.41 shows the location of these types of industries.

4.4.2 Existing safety & security condition in the surveyed factories

The surveyed workshops are small-scale business concerns which are housed in a portion of the owner's residences in 66 percent cases, employing two workers or craftsman on average. These workshops manufactures traditional musical instruments like, Dhol, Tabla, Tanpura , Harmonium etc by using wood, leather, Kane etc. They also do repairing jobs for these types of instruments. Average monthly income of the business owners is around Taka 11,650. and average monthly income of the employees is Taka 3800 Workers usually have to work 9 to 10 hrs continuously (data source: questionnaire survey, July 2007)

4.4.2.1 Skill level of workers

Workers engaged in this type of workshops usually learn their trade from earlier

Table 4.18: Skill level of workers employed in the surveyed factories

Job type	Training	Experience	Avg. length of exp.(yrs.)
Craftsman	33%	100%	5.3

Source: Questionnaire Survey, July 2007

generation craftsmen in the family or on-the-job training. Table 4.18 shows that only 33 percent of the workers have training for this type of industries. But they develop their skill level through an average experience of 5-6 years.

4.4.2.2 Physical condition of workplace

Space per worker

Average factory-space- per- worker is 57.6 sqft , almost 80 percent of which is occupied by the storage of raw material and finished product display, i.e actual space left for the worker is around 11.5 sqft. According to the labour and industrial law of Bangladesh, in a factory environment a worker should be provided at least 9.5 cubic meter of space, which comes to 23 sft (apprx) floor space. The physical survey revealed that in almost 66 percent cases(table 4.19) the effective space left for the workers for movement is extremely insufficient.

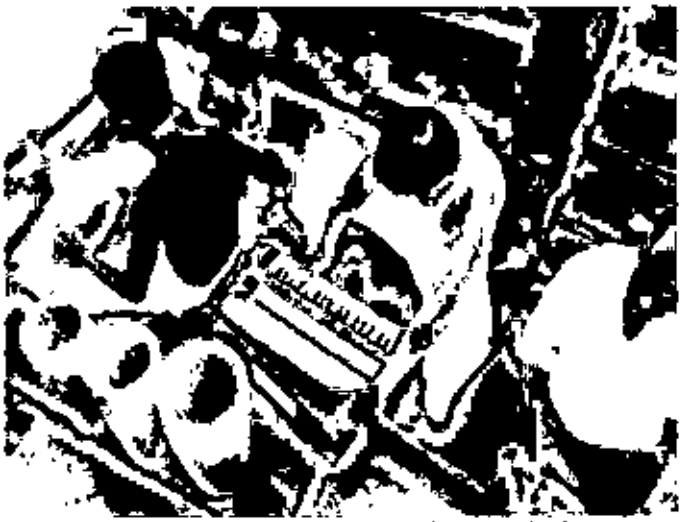

Figure 4.42: Congested work space in a musical manufacturing industry

Table 4.19: Average factory-space- per- worker in surveyed factories

Avg.space/wkr. In sft. (including tools)	Proportion of surveyed factories
Less than 30 sft.	0%
30 – 50 sft.	66%
More than 50 sft.	33%

Source: Physical survey, July 2007

Surface Quality of Rooms

Usually the workspace surface quality of these workshops are good as the same area is also the sales and display center for their goods (Figure 4.43). Physical conditions of the buildings are good In 80 percent factories (Table 4.20) wall, floors and ceiling condition of the interior is good. All kinds of wiring are usually concealed.

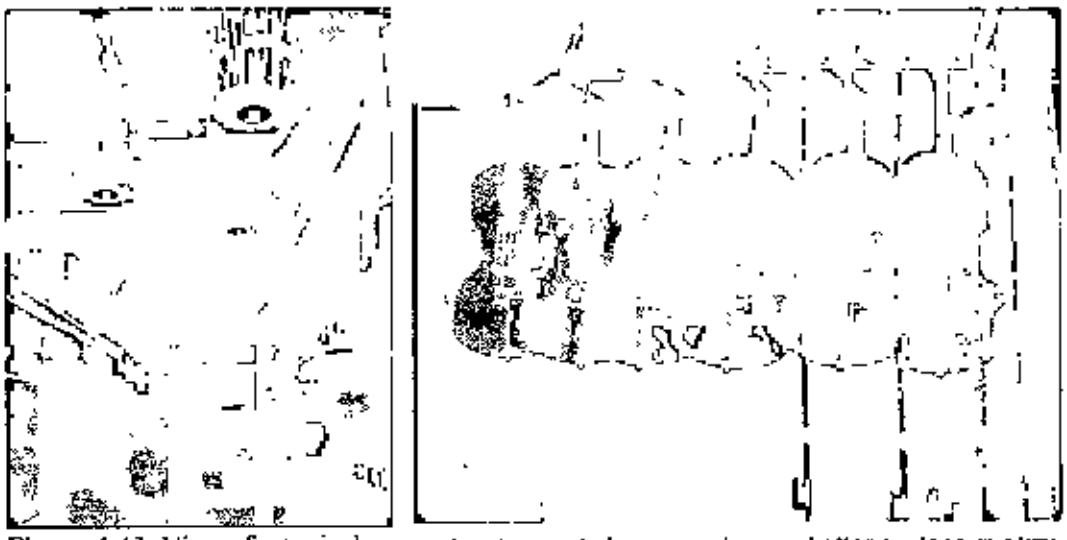

Figure 4.43 View of a typical musical instrument showroom having better surface quality

Table 4.20: Surface quality of rooms in surveyed workshops

Wall		**Floor**		**Ceiling**	
Good	80%	Finished	80%	Good	80%
Partly damaged	20%	Unfinished	20%	Partly damaged	20%

Source Physical survey, July, 2007

Environmental Features

None of the surveyed factories had any window or ventilator or exhaust fans, air is only passed through the doors of the working spaces The work process does not create high noise level but room temperature and humidity level is way above the factory comfort level. Table 4 21 gives a total scenario of the environmental features available in this type of industries in comparison to the recommended standard of BNBC, 1993.

Table 4.21: Environmental features

Natural ventilation (window & ventilator)		Exhaust fan	Avg. temp. (DBT)	Recommended Temp(DBT)	Avg. humidity	Recommended humidity	Avg. sound level (dB)	Recommended sound level (dB) (9 – 10 hrs. exposure)
Available			32°C	25.5°C - 26.5°C*	80	60-50*	59	89*
Not available	100%	100%						

Source: Physical survey, July 2007 & BNBC, 1993 * **BNBC 1993**

Lighting Condition:

None of the surveyed workshops had natural light source, moreover, the existing lighting condition is extremely insufficient for the specific type of job. Figure 4 44 shows that Poor lighting facility which forces the workers to work outside their working premise Existing illumination level in work area is shown in Table 4.22.

Figure 4.44: Poor lighting facility force them to work outside their working premise

Table 4.22: Existing illumination level in work areas

Avg. LUX in w.area	LUX at working area	Proportion of surveyed factories	Recommended LUX (fine assembly work)
208	Below 200	33%	700*
	200-300	66%	

Source. Physical survey, July, 2007 & BNBC, 1993 * **BNBC 1993**

4.4.2.3 Problems faced while working

Workers are mostly suffered by the dust, fume and smoke produced in the work-process and lack of enough light. Figure 4 45 gives an understanding of the

problems faced by the workers while working. Dust, fume, smoke and lack of sufficient lighting are the problem in the working area of these types of industries.

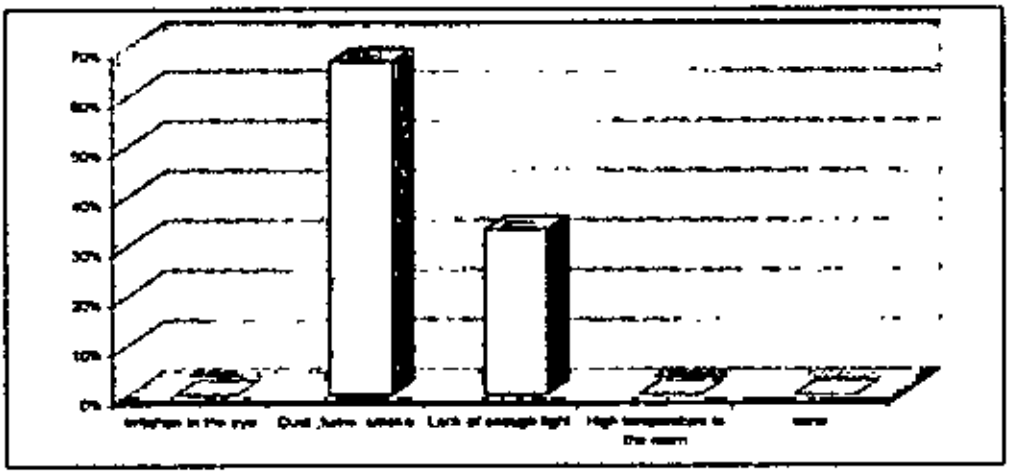

Figure 4.45: Problem faced by the workers

4.4.2.4 Accident occurrence

No personal accidents were reported in these type of factories (table 4.23) not because they did not happen at all but because in two third of the cases the respondents avoided to answer the enquiry. 33 percent of the respondents answered that they did not have any work related accidents during last one year.

Table 4.23: Factory accidents occurred in last 1 one year

Electric short-circuite	none
Gas pipeline leakage	none
Fire	none

Source: Questionnaire Survey, July 2007

4.4.2.5 Awareness About Workplace Safety and On-Duty Behavior

Smoking at Workplace:

Smoking is not restricted in these types of workshops.

Servicing of Tools

Servicing of tools is never done as according to the workers it is not required.

Worker's Use of PPE

No use of personal protective devices was seen in the surveyed factories.

Emergency Preparedness Facility Availability:

No emergency preparedness facility is available. No use of safety signs is seen in the surveyed factories

4.5 Case study 04: Conch shell Craft Manufacturing Industry

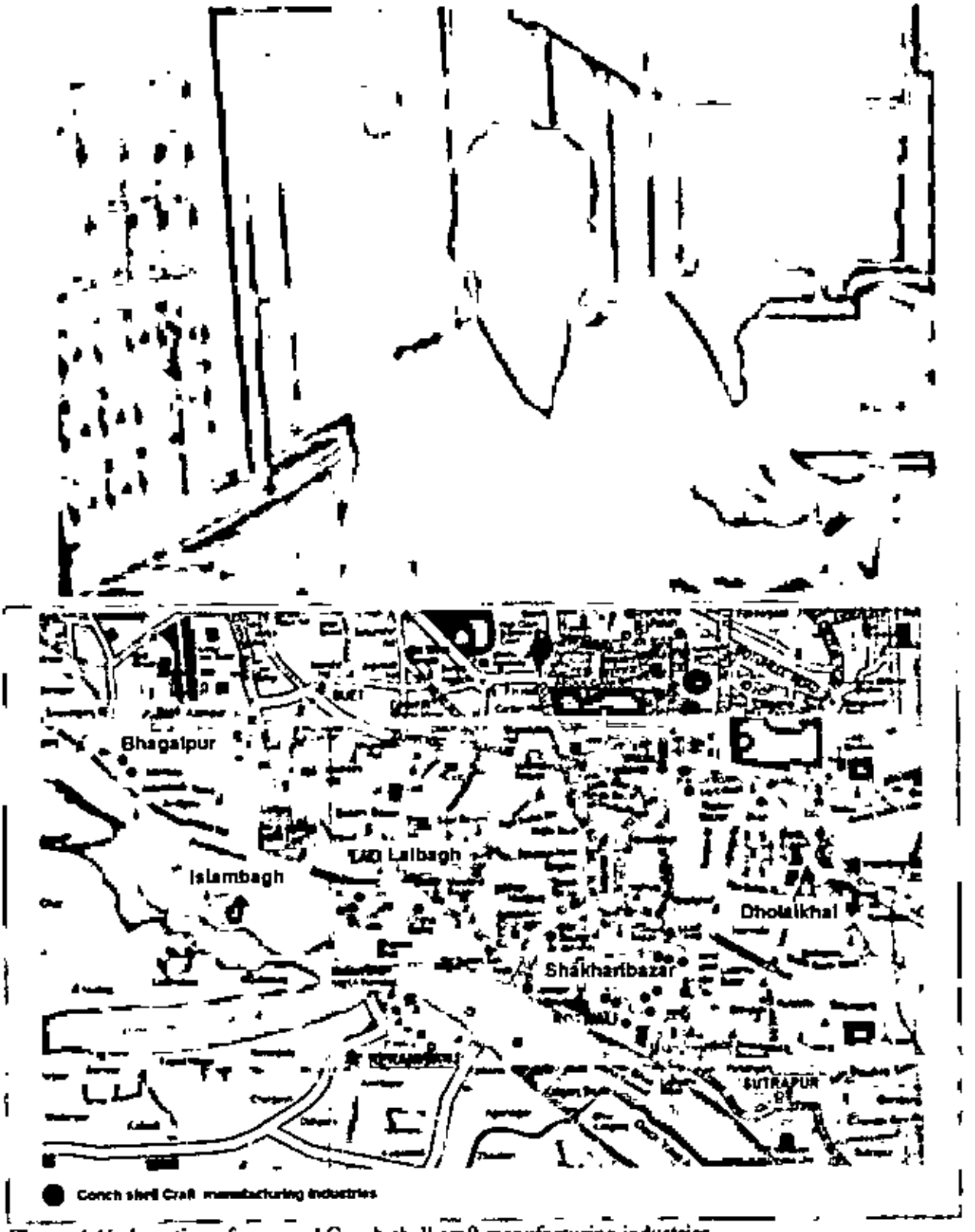

Figure 4.46: Location of surveyed Conch shell craft manufacturing industries

4.5.1 General Overview of the Conch shell Craft and Manufacturing industries

This delicate art, shangkha shilpa, is so time-old that archaeologists suggest images of the conch shell bangles and the like as evident in terracotta art, much earlier than the 17th century. The karigars or workers of shangkha shilpa, are traditionally called shangkha banik. James Wise (1883) had written about the shakharis and recorded in his journal that of the total 11,453 artisans, 835 used to live in Old Dhaka. The karigars usually make three pairs of shankhas from a middle size conch shell Figure 4 46 shows the location of these types of industries. A total of six different professionals are needed to make each shankha, starting with the designing, sketching, cutting, carving, polishing and the like.

4.5.2 Existing Safety & Security Condition in the Surveyed Factories

One in every two surveyed factories was found to be situated along with a residential unit. All of the surveyed factories are owned by private entrepreneurs except one co-operative concern

Average monthly income of the business owners is Taka 11,000 Average number of employee in this type of factories is 5 and their monthly income is Taka 2,850. In 50 percent of the factories workers have to work continuously for 12 hours, and the rest varies from 9 to 10 hrs.(data source: Questionnaire survey, July 2007).

4.5.2.1 Skill Level of Workers

On the job training is the only way to learn the skill The new employees learn from the experienced craftsmen working in the same workshop. The co-operative shamitics formed by the "shakharees" make arrangements to give some sort of training for the new comers. Table 4.24 shows the skill level of the workers in these industries.

Table 4.24: Skill level of workers

Job	Training	Experience	Avg. length of exp. in yrs.
Craftsman	25%	100%	4 5

Source: Questionnaire Survey. July 2007

4.5.2.2 Physical Condition of Workplace

Space Per Worker

Average factory-space- per- worker is 33 sft, almost 70 percent of which is occupied by the storage of raw material and finished product display, i.e actual space left for the worker is around 10 sft. (Table 4.25)

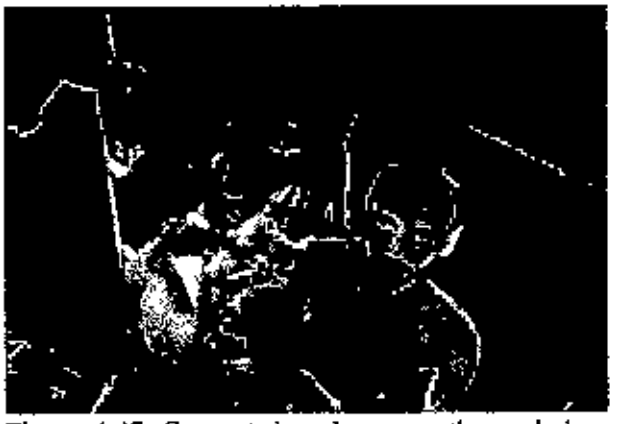

Figure 4.47: Congested workspace at the workplace

According to the labour and industrial law of Bangladesh, in a factory environment a worker should be provided at least 9.5 cubic meter of space, which comes to 23 sft (apprx) floor space. The physical survey revealed that in almost 80 percent cases the effective space left for the workers for movement is extremely insufficient. Figure 4.47 shows the congested workspace in conch shell craft manufacturing industries.

Table 4.25: Average factory-space- per- worker in surveyed factories

Avg. factory-space/wkr. In sft. (including stores and tools)	**Proportion of surveyed factories**
Less than 30 sft.	50%
30 – 50 sft.	50%

Source: Physical survey, July 2007

Surface Quality of Rooms

The surface quality of rooms is usually satisfactory because they are housed in a traditional environment rather than a mere commercial way of some manufacturing business. The workers usually work sitting on the floor (Figure 4.48) Surface quality of the room is satisfactory. Table 4.26 shows the result of the surveyed industries

Figure 4.48: Interior of a conch shell craft factory

Table 4.26: Surface quality of rooms in surveyed workshops

Wall		**Floor**		**Ceiling**	
Good	75%	Finished	100%	Good	75%
Partly damaged	25%	Unfinished		Partly damaged	25%

Source: Physical survey, July 2007

Environmental Features

Of the surveyed factories 50 percent do not have any window or ventilator or exhaust fans. Air is only passed through the doors of the working spaces. The work process does not create high noise level but room temperature and humidity level is way above the factory comfort level Figure 4 49 gives a typical scene of the mahallas. As all the buildings have a narrow front street with common sidewalls, gives almost no exposure natural light in the ground floors of the factory. Table 4.27 gives a total scenario of the environmental features available in this type of industries in comparison to the recommended standard of BNBC, 1993.

Figure 4.49: The factories situated along the two sides of narrow streets do not have adequate exposure of natural light.

Table 4.27: Environmental features

Natural ventilation (window & ventilator)		Exhaust fan	Avg. temp. (DBT)	Recom. Temp (DBT)	Avg. humidity	Recommended humidity	Avg. sound level (dB)	Recom. sound level (dB) (10 - 12hrs. exposure)
Available	50%	25%	34.25°C	25.5°C - 26.5°C *	70	60-50*	75.25	87*
Not available	50%	75%						

Source: Physical survey, July 2007 & BNBC, 1993 * BNBC 1993

Lighting Condition

Three-fourth of the surveyed factories did not have provision for natural light and the average illumination level is below required standards of BNBC (Table 4.28) Although Figure 4.50, it is seen that the court being a source of natural light for the residences in the upper floors but the natural lighting condition inside the factory in Figure 4.51 is very poor. Artificial light creating glare causing workers eye injuries Figure 4.52 shows that only 25 percent of natural light is available in the these types of surveyed industries.

Figure 4.50: Court being used as a source of natural light for the residences

Figure 4.51: Artificial light creating glare

Table 4.28: Existing illumination level in work areas

Avg. LUX in w.area	LUX at working area	Proportion of surveyed factories	Recommended LUX (jewelry making work)
531.25	100- 1000	33%	1300*
	Above 1000	66%	

Source: Physical survey, July 2007 & BNBC, 1993 * BNBC 1993

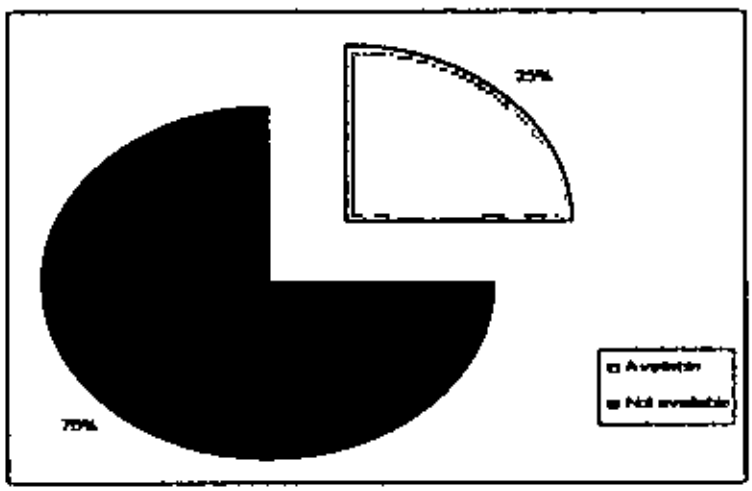

Figure 4.52: Availability of natural lighting

4.5.2.3 Problems Faced While Working

The shakharees and the jewelry makers usually suffer from conch shell dust while cutting and finishing the ornaments and the high temperature produced from the heating and melting processes. Figure 4.53 shows the problems faced by the workers while working in the surveyed industries

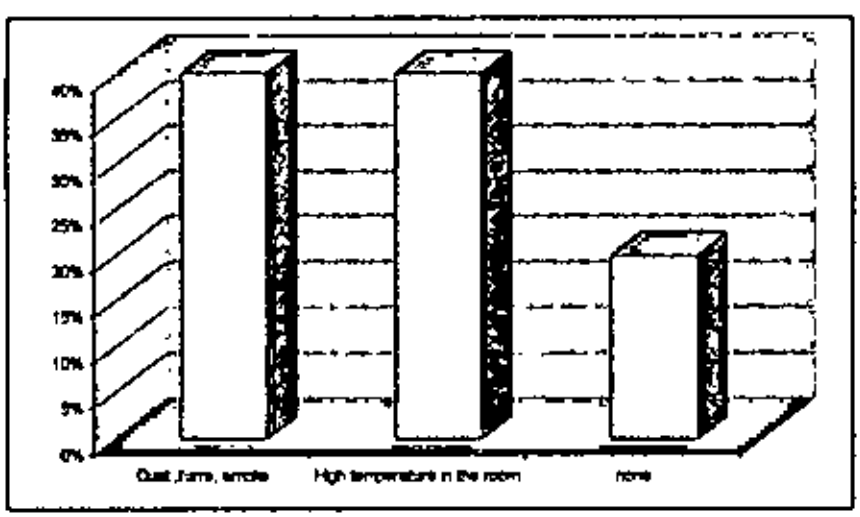

Figure 4.53: Problems faced while working

4.5.2.4: Accident Occurrence

Cut and small injuries are common for workers of this industry, but no factory level accidents in last one year are reported From the Table 4 29 it is quite clear that workers are afraid to talk in this issue as 50 percent of them did not answer this question

Table 4.29: Personal accident occurred while working

Accidents	Percentage
Injury	50%
No answer	50%

Source. Questionnaire Survey. July 2007

4.5.2.5 Awareness About Workplace Safety and On-Duty Behavior

Smoking at Workplace:

Smoking is not restricted in 50 percent of the surveyed workshops. In other cases it is restricted verbally, no visual signs are used. Figure 4.54 shows that there is no awareness on the implementation of safety signs and symbols in the surveyed industries

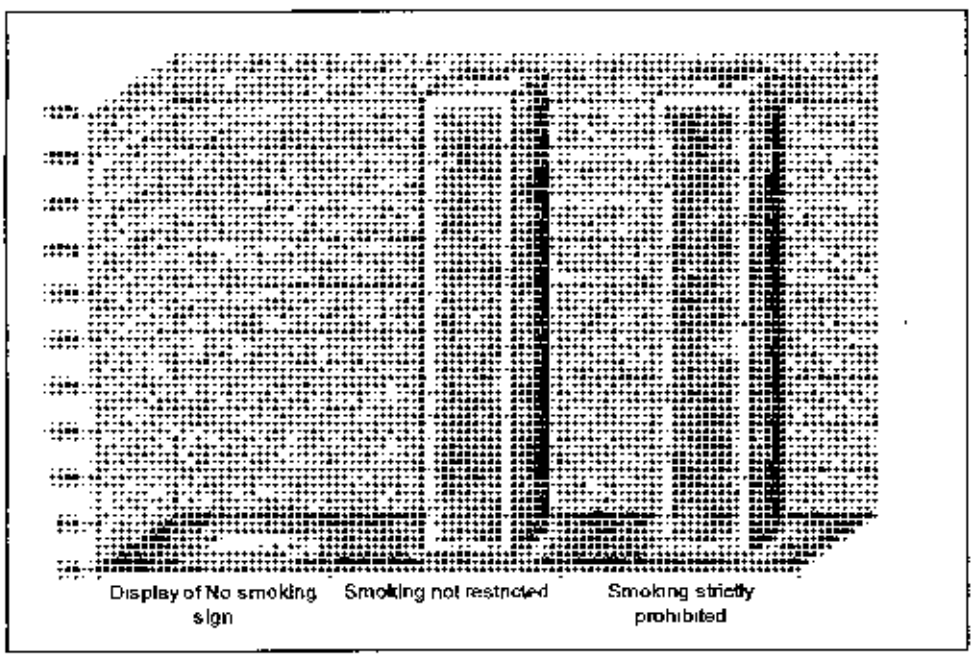

Figure 4.54: Smoking at workplace

Servicing of Tools

Servicing of tools is never done in 50 percent factories as according to the workers it is not required (Figure 4.55).

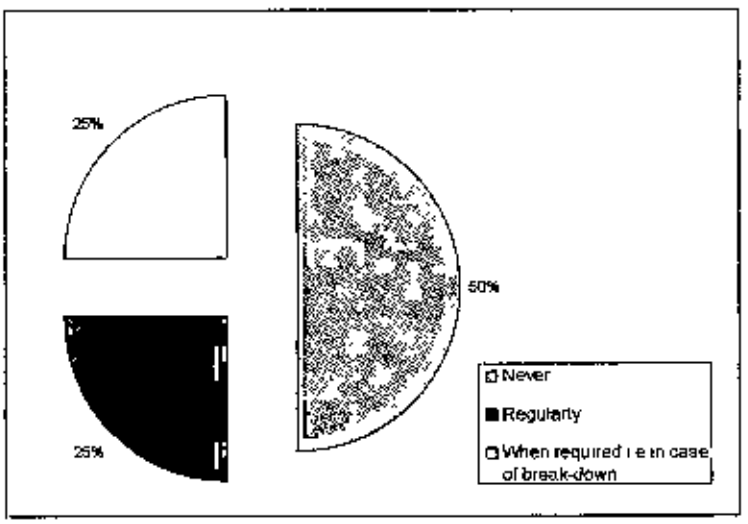

Figure 4.55: Servicing of tools

Worker's use of PPE

Only in 25 percent factories workers use masks but in other cases they don't use any protective devices Figure 4.56 gives an idea that the workers are totally unaware of using masks as personal protective device.

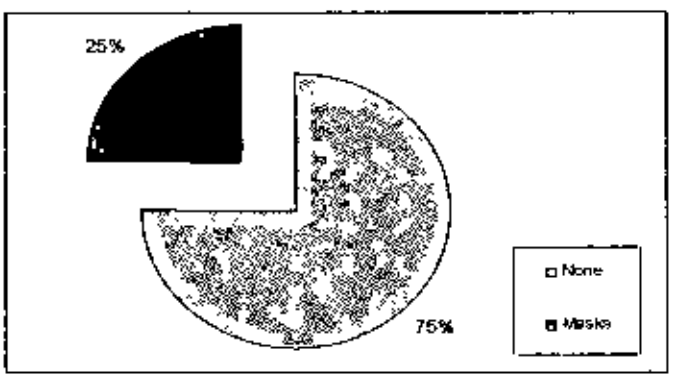

Figure 4.56: Worker's use of PPE

Emergency preparedness facility availability:

No emergency preparedness facility is available. No use of safety signs is seen in the surveyed factories.

Chapter 05

CONCLUSION AND RECOMMENDATIONS

- Summary of Findings
- Conclusion
- Recommendations
- Recommendations for Further Study
- References

This Chapter contains two main parts. The first part provides a brief summary of the overall findings and conclusions. The second part contains the recommendations to bring a broad-based improvement in the working environment in the Small Scale Industries of Old Dhaka.

5.1 Summary of Findings

The following sections summarize the survey findings regarding different factors, which affect the workplace safety in the case study areas.

5.1.1 Comparative Analysis of the Factors Affecting Safety of Surveyed SSIs.

A comparative analysis of indoor temperature, noise level, humidity and average available clear space per worker with BNBC, 1993 is shown in Table 5.1

Table 5.1: Comparison matrix featuring the existing situation in the surveyed industries and BNBC standards

	PRPMI	LEW	MIMI	CCMI	BNBC
Indoor Temperature (°C)	36.5 °C	36 °C	32 °C	34 °C	26.5 °C-25.5 °C
Sound Level (dB) Exposure of 10-12 hours	80 dB	71 dB	59 dB	75 dB	87 dB
Average Humidity in percentage	87	89	80	70	55
Clear Space per worker (Sft.)	17 sft.	17 sft.	11.5 sft.	10 sft.	23 sft.

Source: Physical survey, July 2007 & BNBC, 1993

Legend.

PRPMI - Plastic Recycling & Product Manufacturing Industries

LEW - Light Engineering Workshop

MIMI- Musical Instruments Manufacturing Industries

CCMI - Conchshell Craft Manufacturing Industries

BNBC- Bangladesh National Building Code

The above Table shows that indoor temperature of all four types industries on average are 8°C higher than what BNBC has recommended. The most severe situation exists in the Plastic Recycling & Product Manufacturing Industries and Light Engineering Workshops. The reason behind this is the production process of

these types of industries that creates heat and the poor ventilation condition of the workspaces adds to make the condition even worse. This high temperature is responsible for fatigue, dizziness and sweating of palms which in many cases lead to slip of tools, fogging of safety glasses, possible burns and lower performance.

It is evident from the Table that sound level is well within the allowable level and therefore not likely to create any safety problem. Although high range of sound level is a common problem where mechanized industrial activity takes place, the surveyed Small Scale Industries do not have this problem because they do not usually use heavy power driven machineries. These factories use small hand tools, manually driven machinery and in some cases small power driven machinery.

The average relative humidity (RH) inside all the surveyed factories is 45 percent higher than the recommended BNBC standards.

Inadequate clear space per worker in the workspace is a common scenario in all 4 types pf surveyed industries. The situation is more severe in the traditional type of industries ie. Musical Instruments Manufacturing Industries, Conchshell Craft Manufacturing Industries. Lack of space for easy movement and uncomfortable posture is responsible for long-term postural defects.

5.1.2 An Overview of Accident Occurrence and Safety Measures Taken in the Surveyed Factories

The Table states the accident occurrence rates in the surveyed industries according to the responses of the management and workers.

Table 5.2: Accident occurrence and Safety Measures taken in the surveyed factories

	PRPMI	LEW	MIMI	CCMI
Personal accident occurrence	29%	54%	0%	50%
Fire/electric short circuit	23%	0%	0%	0%
Emergency Preparedness facility available	56%	9%	0%	0%
Use of PPD	14%	50%	0%	25%
Use of safety signs & symbols	10%	0%	0%	0%
Smoking restriction imposed	45.5%	45.5%	0%	50%

Source: Questionnaire Survey, July 2007

But there are reasons to believe that the numbers do not portray the actual reality about accidents. There is no system of authentic reporting and documentation of accidents that occur at personal level or at factory level. On the contrary, the employees tend to avoid answering to these types of queries. Table 5.2 shows that, the industries where detail precision works are carried out, i.e. in LEWs and Conch shell craft shops, personal accidents such as cuts burns, eye injury etc occurs more. Fire in factory premises did not occur in traditional type industries and also in LEWs where mainly non-flammable metallic objects are used and stored. Plastic industries are comparatively more vulnerable to fire hazards for their characteristic production process where ample heat is produced while extrusion, melting and palletizing is done.

Personal protective devices are either never used or not effectively used. In the LEWs only 50% workers use the Eye-protective mask or goggles while working with the Oxyacetylene ray. Use of Safety signs and symbols in the factory premises are negligible as people are not at all aware of its necessity.

5.1.3 Relation Between Worker's Skill and Accidents

The study found that, in such cases where workers are using heavy machineries, such as in plastic industries and light engineering industries, exposure to formal training and occurrence of personal accidents are directly related.

Table 5.3 shows a comparison between accident occurrence to trained and untrained workers.

Table 5.3: Comparison of accident occurrence rate between trained and untrained workers of plastic & LEIs

Personal accidents occurred to	**Plastic industry**	**Light engineering industry**
Trained workers	33.3%	50%
Untrained workers	38.5%	55.5%

Source: Physical survey, July 2007

If we consider all type of factories regardless to mechanical or manual production process, the occurrence of personal accident to untrained workers who learnt the job informally is higher than that of trained workers. Figure 5.1 shows the Comparison of personal accident occurrence rate between trained and untrained worker.

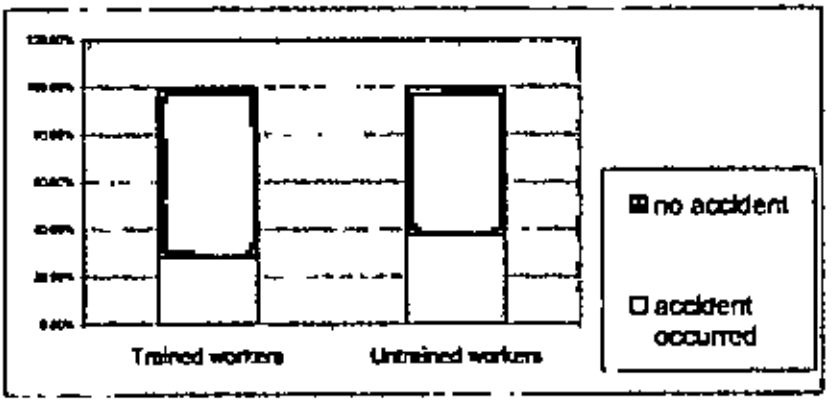

Figure 5.1: Comparison of personal accident occurrence rate between trained and untrained worker.

5.1.4 Relation between production process & accident occurrence:

The survey found that factory level accidents, such as, fire, electric short-circuit, machine break-down etc occurred more in factories which use large machineries. On the other hand personal accidents occurrence is more than factory accidents in factories that uses manual tools for manufacturing (Figure 5.2).

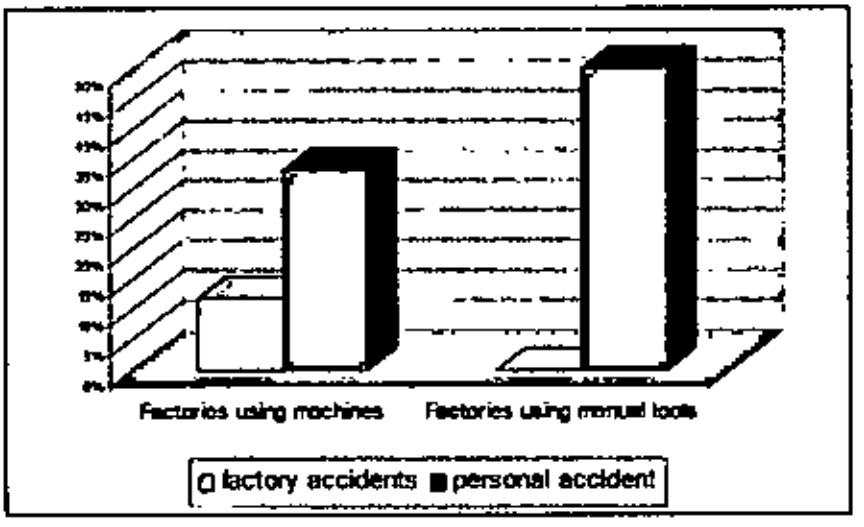

Figure 5.2: Occurrence of accident

The first phenomenon can be explained by saying that use of low quality and un-sophisticated machinery; lack of knowledge about using them properly and lack of

proper maintenance makes the machine dependant factories more vulnerable to factory level accidents. The reason behind the second phenomenon is lack of formal training for the specific job of a worker. The workers have to learn by actually doing without any formal orientation about the job. Lack of education is also a contributing factor.

Although each industry has its own procedure, system and process of completing a product, the unawareness on safety and security issues in these industries are more or less common. Because of the economic constraints that they have, forced them to join without any knowledge and awareness on the safety and security issues in these industries. Again the implication of laws and the regulations are not exemplary which to some degree make them aloof on the safety and security issues. If taken care of the safety and security issues these industries can contribute more for the country.

5.2 Conclusion:

Systematic work-related research and an unbiased collection of data through extensive field investigation are very important, not only for an increase in production, but also for the need of decreasing accidents and injuries and protecting workers' health and the environment. The information complied and work-related data presented in this thesis, however, cover no more than a preliminary approach for SSIs towards the design of a better work environment.

5.3 Recommendations:

Recommendations have been divided into two parts. The first part is based on the basis of different environmental and physical aspects that affect the safety and security issues of the working environment of the SSIs. And the second part will deal with the policy level recommendations with a view to raise awareness among the users of the factories.

Recommendations to mitigate the environmental aspects affecting the safety and security issue are discussed below.

5.3.1 Temperature:

Excessive temperature in the working environment is a great area of concern in the surveyed SSIs of Old Dhaka. Table 5.1 will give an idea that how much the temperature in the working environment differs from the BNBC, 1993. Some adjustments could be made to reduce the heat of the working environment are:

- ensuring that the external walls are smooth in texture and painted in a light colour to help to reflect the heat;
- improving the heat reflection of the roof;
- improving heat insulation of walls and ceilings (investigate the possibility of dry lining walls or adding an insulated ceiling below the roof. Although this is an expensive option it should be considered in the plans for all new buildings and local, cheap materials should be used as far as possible);
- ensuring that the factory is shaded as far as possible by natural means (trees, bushes, hedges etc) or with shades on windows, doors etc., (note that any shades should not inhibit access/egress for safety reasons).

5.3.2 Ventilation:

Buildings which are to be ventilated by natural means should be longitudinal and oriented towards the face of the prevailing wind.

Legislation concerning the indoor temperature should be promulgated.

Where it is not possible to maintain the recommended temperature by natural means, mechanical means such as exhaust fans and ceiling fans should be employed. It should be borne in mind that a successful natural ventilation design will save the costs required in using mechanical corrective measures. A thermometer should be suitably placed in each room to measure the room temperature.

Ventilation rate is very important for industries in Bangladesh because much of the work is done manually. Both in terms of volume of air per minute per person and air velocity, studies should be undertaken in Bangladesh factories so that suitable recommendations may be made.

5.3.3 Lighting:

Efforts should be made to put across the message that "better light" produces higher industrial efficiency leading to higher profits. The realization of this fact and implementation of measures to achieve it are likely to mean better conditions for the workers and increased production, better conservation of materials and profits for the industrialists.

On the other hand, owners should be made to realize that cheaper but poorer lighting design actually results in poor performance by the work-force, labour dissatisfaction, loss of production, etc., all of which will nullify the savings which are supposedly made.

To reduce the dependency on electricity and to cut costs the management should exploit the available daylight.

Some measures could be taken to improve the condition. They are as follows;

- Choosing appropriate visual backgrounds for walls, ceilings etc;
- Finding the best place for the light source to avoid glare etc;
- Using the most appropriate lighting devices and fixtures;
- Avoiding shadows;
- Ensuring regular cleaning and maintenance
- use of light colours for walls and ceilings, particularly those which are adjacent to openings could be made to improve the condition of the working environment without excessive financial involvement.

5.3.4 Noise:

From the survey it was found that noise level of the surveyed SSIs were within the limit of the BNBC, 1993 code. Still the noise level can be managed to keep in decent level by taking the following steps.

i) Controlling the noise at source:

Ideally, any machines in the factory should conform to national and international standards and not produce noise levels above 85 dB in the first place.

ii) Controlling noise along the path between the source and the workers:

If it is not possible to control the noise at source, then methods can be used to minimize the spread of the sound waves around the factory. Sound waves travel through the air rather like the ripples on water if one throw a pebble into a pond – the waves spread out from the source. Accordingly, any method that can be used to stop the spread or absorb the sound waves can effectively reduce the noise problem. Such methods include:

- Use of sound absorbing materials where possible on the walls, floors and ceilings;
- Placing of sound absorbing screens between the source of the noise and workers;
- Use of sound absorbent materials, particularly locally produced;
- Build sound-proof control areas and rest rooms;
- If possible, increase the distance between a worker and the source of the noise.

iii) Controlling the noise at the worker:

The most common form of noise "control" is the use of personal protective equipment in the form of hearing protectors. They work on the principle of preventing damaging sound waves from reaching the sensitive parts of the inner ear. There are basically two types of protectors – ear plugs and ear muffs

An attempt should be made immediately to register the noise levels and undertake octave analyses of the noise present in these industries, if only to indicate the noise scenario in each industry. In cases where the level is higher than 90 dBA, the exposure time should be reduce in order to protect the health of the workers, and also to increase production.

There are some other low-cost measures should be taken in consideration, such as;

- Urgent implementation of Legislation should be to limit the permissible noise level and exposure time in harmony with international practice.
- Posting of signs to warn workers and the public about high-level noise.

- Provision for special lectures to explain to workers and management the effects of and precaution against high-level noise.

Recommendations to mitigate the physical aspects affecting the safety and security issue are discussed below.

5.3.5 Safety Signs and Symbols:

The success of safety signs will depend great deal on how well they have been publicized for the benefit of the workers. It will be necessary to convey the meaning and implications of each sign to the workers. Considering that many cannot read or write, the idea of orally testing the knowledge of each individual worker regarding safety signs and follow-on seems to carry weight.

It is necessary to test the effectiveness of any proposed set of signs on groups of workers before finalizing it as a standard for the whole country.

5.3.6 Fire Prevention and Control:

The whole subject matter of fire prevention, precautions and control needs to be reviewed in Bangladesh. Laws should be enacted and guidelines provided so that it may be possible for factory owners to adopt practical measures to counter the threat of fire in different types of factories.

Causes of fire must be ascertained so that the faults may be corrected

Access for firemen and fire-fighting appliances should be provided both from inside and outside the buildings.

"No Smoking" signs should be boldly displayed and workers must be educated to understand the need to refrain from smoking in specified areas.

Electrical equipment and wiring must be properly designed. Installed and maintained.

Sound alarm system must be installed to warn employees in case of fire.

All the workers should be involved in regular fire drills.

5.3.7 Industrial Accidents:

All factory workers should be insured against death and injury from industrial accidents. This will be an incentive to the owners to improve safety standards and regularize inspection.

To adopt safety measures industrial owners and workers must be educated.

Inspection of safety measures should be carried out regularly by the management and the enforcing authority.

Proper record of the casualties should be monitored and maintained regularly by each industry to reduce the incident.

The differentiation between fatal, serious and minor should be maintained largely to ascertain the appropriate degree of compensation.

Recommendations at policy level with a view to raise awareness among the users of the factories are as follows:

5.3.8 Workplace Intervention:

Workplace intervention means improved health, safety and ergonomic applications through collaborative efforts from all the parties concerned. It is also treated as an efficient use of local resources for good work, increased productivity and fewer injuries in the workplace.

The workers must be well aware of what workplace intervention is (Kogi *et al.* 1999), and how work-related stress factors might influence someone to implement local measures. They should follow good, time proven examples of work organisation styles to enhance efficiency and productivity.

For workplace intervention, it is also important to grasp the possibilities of how 'team spirit' through group work initiative as well as self-initiative spirit can help less educated or inexperienced people work nicely, and how to include them constructively in harmony with health, hygiene and safety conception as well as production objectives. In this regard, Westlander *et al.* (1993) expressed concerns on general strategies for intervention studies and research.

Possible ways to improve the working environment are:

• suspension and removal of hazardous activity or non-hygienic conditions at all levels

• simplification and/or change of layout, and implementation of ergonomic measures

• greater scrutiny of work methods, particularly from the grass root level

• recognition of workers' labour, social support and allowing welfare or fringe benefits

• setting up a health and safety commission under the auspices of a neutral watchdog body, the national health and safety council (NHSC)

• revising labour law, updating work regulation, and enacting labour legislation

• articulating a consolidated structure for regulating labour law and legislatory issues

5.3.9 Participatory Action:

The participatory approach (PA) is one of the best techniques in facilitating the recognition of workers' own efforts to restore heath and safety.

It also improves motivation by helping factory owners (FO)/employers association (EA) to understand the benefits of a safe and hygienic workplace. The major prerequisites of PA are having the adequate time, place and opportunity to participate in the process of sustainable workplace improvement. However it acknowledges explicitly the competence and the workers' skill for improving their working conditions through collaborative efforts.

Since PA brings a mutual understanding or shared ability to communicate with each other, it could therefore be utilised for building joint effort in providing expertise, consultation and guidance to improve health and safety. PA works better in certain situations when it acts within the area of job freedom and relevance to workers' own interests. Solution-oriented actions are also useful for participatory planning (Noro & Imada 1991).

PA should therefore be pursued through a better performance of ensuring workers' involvement, and the employers' contribution for providing health/safety facilities. Otherwise: the participatory process will not provide opportunity for the personal growth of workers as well as industrial growth for the country.

5.3.10 Low Cost Measures:

Simple changes in the industrial workplace can bring massive advantages to better productivity, safety and health. Local measures are also believed to be an influential tool for enhancing the impact of workplace intervention. Low-cost measures (LCM) will probably be accepted quickly and will be the best option for reducing the probability of workers hurting themselves from work injuries. This is also because most of the factory owners (FO) and employers association (EA) in Bangladesh can not afford to buy expensive tools or make sudden changes of layout, for instance. The workers in these workplaces can improve their body motions and reduce physical stress or postural discomforts by—

- enlarging the span of workers' control over strenuous tasks or postural movement
- adjusting work and keeping suitable distance when repetitive tasks are concerned
- adjusting job-tasks, fixture/fittings, tools/equipment with the correct anthropometrics
- controlling dexterity, stature and movement to specific job-tasks
- placing the needed materials in front of the workers
- storing materials within easy reach considering people's average working height, distance. between point of action and body parts (head, arm, leg, finger) position, etc.
- using adjustable tools, fixtures. fittings and furniture for better work performance

Since Small Scale Industries of Old Dhaka are poor economically, it is thus to be recommended that they follow local solutions which are low-cost and easily available. Local technology or available means for developing such tools has also made it possible to transfer the worker from a risky environment to better place (Schuster 1995).

5.3.11 Job Training and Vocational Education:

Currently, many people in Bangladesh who complete basic literacy (or primary education) courses do not have the opportunity to continuously use and enhance their vocational skills in order to make them an effective tool for improving their social and economic life. It has been also observed that many workers have a low

access to job training and vocational education (JTVE), though it is a very appropriate means for learning and practicing about health and safety. JTVE has multiple positive impacts (Gold 1995, Kogi 1995), since it reduces work-related risks and job stress, and enhances worker's skill and employability.

JTVE enhances workers' motivation, usefulness of safe acts, relevance of newly acquired knowledge, and increases the level of new work experience. JTVE will surely bring appropriate knowledge to deal with potential measures, and help workers to improve working conditions and encompass the maintenance and promotion of workers' health and work performance. JTVE helps to prepare workers to adjust to a different situation, such as the maintenance and design of shift work, productivity planning and safety precautions.

JTVE raises workers and employers knowledge for identifying problems and implementing solutions. In this regard, Johnston *et al.* (1994) explored the efficacy of such training for occupational injury prevention. It is true that JTVE has an impact on reduction of injuries, improvement of safety morale, and most importantly, an intuitive understanding of health and hygiene needs.

Job training and vocational education (JTVE) certainly helps workers' personal values and improves their consciousness of health and safety. To address the multi-skilling process as an integral part of JTVE in Bangladesh, some guidelines can be found in the Inspection Manual (1986) and other sources (e.g., BANSDOC) that world be beneficial for strengthening workers' and employers' safe operation with correct tools, or safe handling of hazardous materials, for instance. It is being recognised that JTVE can promote change in a workstation design through a change in workers' behaviour, or changes the perceptions of local workers.

It is likely that the effectiveness of JTVE will benefit more if the following matters are emphasised to:

- promote a comprehensive skill training program and enhance non-formal education
- offer technical expertise to help setting up programs on health and safety skills
- support improved post-literacy education and integrate techno-medical consequences

• promote ergonomic literacy with functional knowledge to give workers' understanding on health, hygiene and safety measures as well as ergonomics application

• ensure that workers are able to apply literacy skills to real opportunities in real place in real time

• strengthen and develop practical courses (e.g., goal or action oriented) for continuing education and skill development programs

• link learners with opportunities for employment generation, workplace improvement and safe behaviour at work

5.3.12 Implementation of Workplace Improvement:

Three key points useful for facilitating the implementation of workplace improvements on the initiative of managers and workers of Small Scale Industries.

The *first point* is that the industry-wise trade association network can facilitate maintaining safety and health, because the risk situations are common among the participating industries. The *second point* is that support tools such as action checklist, good examples and implementation guides are effective in confirming benefits in terms of both better safety, health and higher productivity.

The *third point* is that an interactive group work can lead to multiple improvements in many Small Scale Industries.

5.4 Recommendations for Further Study:

Further, work-related hazards need to be identified not only for safety studies but also for appropriate workplace intervention. A work-related research needs well-defined materials (e.g., subjects, work culture, working climate, shift system), reliable methods of work-related field studies and an in-depth discussion of the results. New ideas and methodology could be developed to carry out further field surveys aiming for the sustainable improvement of working conditions not only in the Small Scale Industries of Old Dhaka but all over Bangladesh.

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APPENDICES A1

Questionnaire to find out the present condition of the working environment in the Small Scale Industries of Old Dhaka in terms of Safety and Security issues.

Student no: 100101008
Student's name: Md. Tarek Haider
Thesis Supervisor: Dr. Nizamuddin Ahmed
Professor in Architecture, BUET
Date: _____

How to complete this questionnaire?

- Tick the corresponding box to indicate correct options
- Tick as many options as are appropriate in each question
- Fill in the boxes or spaces with suitable answers
- Fill as many boxes as are appropriate in each question

Factory Owner/Management Questionnaire:

1. **Personal information:**
   - Name: ----------
   - Age: ---------- Sex----------
   - Monthly income:----------
   - Educational qualification:

No Schooling	Primary School	Secondary School	Higher Secondary School	Graduate	Masters.

2. **Type of industry**

_____

Raw Materials End Product By-Product

_____ _____ _____

_____ _____ _____

3. **Location Area, address**

_____

4. **Ownership Type:**

Government	☐	Family Business	☐
Private Entrepreneurship	☐	Partnership	☐

5. Type of jobs performed in the industry

Manual	☐	Both	☐
Mechanical	☐		

6. Reasons for locating industry on present site (Tick as many appropriate)

Availability of raw materials	
Availability of skilled labour	
Availability of inexpensive labour	
Easy transportation system	
Exemption from taxes	
Cheap land	
Cheap rent	
Others	

7. Industry building is

Owned	
Rented	Rent Amount:
Leased	

8. Industry building was

Constructed for present industry use	
Altered / renovated from other use/s	
Specify previous use/s of the building	

9. Do you work in the factory? yes ☐ No ☐

If yes , what type of job? ----------

While working, have you encountered any accident? (During last 1 year)

Cut	
Burn	
Eye injury	
other	

10. Working Schedule of the factory

	Shift 1	Shift 2	Shift 3
Time			
Persons			

11. Number of employees in the industry

Unskilled workers (Not Trained/Experienced)	Skilled workers

12. Emergency Preparedness for workers available on site include

	Yes	No
First aid box		
Fire Extinguisher		
Others		

13. "No smoking" signs are

Strictly observed	
Casually observed	
Ignored	
Not displayed	

14. Servicing of machinery are done

weekly	
monthly	
quarterly	
yearly	
More than that	
Never	

15. During last 1 year, did you have any occurrence of

Electric short-circuit	
Gas pipeline leakage	
Fire	

Workers Questionnaire:

1. **Personal information:**
   - Name: ----------
   - Age: ---------- Sex----------
   - Monthly income:----------
   - Job Experience in this industry: ----------
   - Educational qualification:

No Schooling	Primary School	Secondary School	Higher Secondary School	Graduate	Masters.

2. **Name of the factory**

_____

3. **What type of job do you perform?**

---

4. **Work schedule**

Shift	
Time	
No. of co-worker	

5. **Where do you stay or reside?**

On factory site	On other site	House personally rented

6. **during production, normal conversation is possible inside the factory when two persons are separated by a distance of**

1`-0"	3'-0"	6`-0"	12'-0"	More

7. **Do you have any training for the job?**

yes	
no	

8. "No smoking" signs are

Strictly observed	
Casually observed	
Ignored	
Not displayed	

9. Do you use the following item as safety measure during working hours

	Yes	No
Aprons		
Masks		
Goggles		

10. What type of problems do you face while working?

Irritation in the eye	
Dust ,fume, smoke	
Breathing problem	
Lack of enough light	
High temperature in the room	
Others	

11. Did you have occurrence of accidents during last 1 year.

	Nos.
Work procedure related accidents	
Fire accidents	
Machine breakdown	
Injury	
Burn	
Others	

12. Servicing of machinery are done

weekly	
monthly	
quarterly	
yearly	
More than that	

13. Emergency Preparedness for workers available on site include

	Yes	No
First aid box		
Fire Extinguisher		
Others		

Physical survey:

1. Building located on the site: General Information

Construction Year	Building use		Total area in sft.	No. of floors
	factory			
	factory & residence			
	others			

2. Number of entry and exits into site.

	Number	Width
Pedestrian only		
Vehicular entry + exit		
Vehicular entry		
Vehicular exit		

3. Work space area.

Work space dimension					
Room no:	Length	Width	Height	No. of windows	No. of doors

4. Adjacent land use

Next to site (Left)	
Opposite to site	
Next to site (Right)	

5. Work space interior condition. (Put mark in the appropriate choice)

Wall		**Floor**		**Ceiling**	
Good		Finished		Good	
Partly Damaged		Unfinished		Partly Damaged	
Mostly Damaged		Damaged		Mostly Damaged	
Damp		Damp		Damp	

Lighting						
Natural		**Artificial**		**Lux in working area**	**Ventilation**	
Through Window		200 wt. – 400 wt			Natural Ventilation No.	
Through Roof		600 wt. – 800 wt			Exhaust Fan No.	
Not Available		1000 wt. – 200 wt				

6. Layout of service lines

	Electricity	Gas
Concealed		
Exposed		
Overhead		
Underground		

7. Signs of warning, direction, and instructions are given

In words	
Example	
Pictoral	
Example	
None	

APPENDICES A2

Variables Used for Questionnaire Data Analysis

	Variables used for Owner/Management Representative Responses	Variables used for Workers Responses	Variables used for Physical Survey Data
1	Industry identification code	Location of the industry	Industry identification code
2	Location of the industry	Type of industry	Age of building structure
3	Type of industry	Respondent's occupation	Building uses
4	Respondent's occupation	Sex	Area (sft.) of factory
5	Sex	Age	No. of floors in factory
6	Age	Income	No. of entry
7	Income	Education level	Width of entry (ft.)
8	Education level	Daily working hour	Existence of vehicular entry
9	Ownership type of business	Timing of shifts	No. of rooms
10	Reason of locating factory here	Co-worker number	Area (sft) of rooms
11	Ownership of factory buildings	Job description of respondent	Height of rooms
12	Amount of rent	Place of living	No. of windows
13	Building originally constructed for	Allowable distance for normal conversation	No. of doors
14	Raw material	Personal accident occurred while working	Wall condition
15	End product	Emergency preparedness facilities available	Floor condition
16	Production process	Habit of smoking	Ceiling condition
17	Number of employee	Practice of machinery servicing Training	Natural lighting provision
18	Number of work shifts	How many years of experience	Wattage of artificial light
19	Timing of shifts	Problems faced while working	Lux in work area
20	No. of worker in day shift	Use of Protective Device	No. of natural ventilator
21	No. of Worker in night shift		Temperature in degree

			centigrade
22	No. of skilled worker		Relative Humidity
23	No. of unskilled worker		No. of exhaust fans
24	Job description of respondent		Layout of electric lines
25	Personal accident occurred while working		Layout of gas line
26	Emergency preparedness facilities available		Use of safety signs
27	Use of no smoking signs		Adjacent land use (left)
28	Practice of machinery servicing		Adjacent land use (right)
29	Factory accident occurred		Adjacent land use (opposite)

APPENDICES A3

TES 1332 Digital Lux Meter

SPECIFICATIONS

- Display: 3-1/2 digit LCD
- Measuring Range: 20/200/2000/20000/200000 LUX
- Overrange Display: Highest digit of (1) is displayed
- Resolution: 0.1 LUX
- Accuracy: ± 3% rdg ± 0.5 %(Calibrated to standard incandescent lamp.2856°K)
- Spectral response: CIE Photopic (CIE human eye response curve)
- Spectral Accuracy: CIE VI Function f'1<=6%
- Repeatability: ± 2%
- Temperature Characteristics: ± 0.1% /°C
- Measuring Rate: Approximately 2.0 time/sec
- Photo sensor: Silicon Photodiodes
- Operating Temperature and Humidity: 0°C~40°C(32°F~104°F) & 0~80% RH

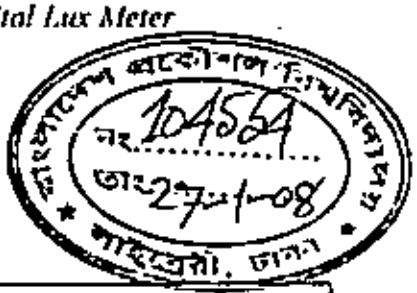
Ranges (LUX)	Allowance
0-200/0.1	± 3% rdg ±0.5%
0-2000/1	f.s. (<10000 LUX)
0-20000/10	± 4% rdg ±10 dgt
0-200000/100	f.s.(10000LUX)

FEATURES

- Accurate and instant response
- Data hold function
- Special sensitivity close to CIE photopic Curve
- Cosine Angular corrected
- Analog output jack for recording
- CNS 5119 class II

TES 1332 Digital Lux Meter

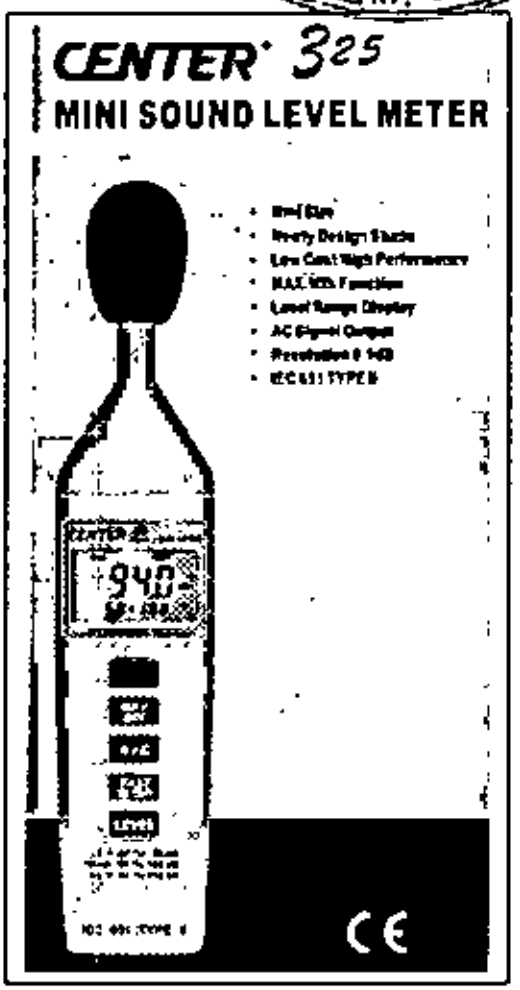
APPENDICES A4



Center® 3[25] Mini Sound Level Meter

SPECIFICATIONS:

- Mini size
- Low cost; High performance
- Max/Min Function
- Level range display
- AC signal output
- Resolution: 0.1 dB
- IEC 651 Type II



Center® 3[3] Mini Sound Level Meter