REFORM OF BUILDING CODES, REGULATIONS, ADMINISTRATION AND ENFORCEMENT IN KUWAIT: WITHIN THE LEGAL, ADMINISTRATIVE, TECHNICAL, & SOCIAL FRAMEWORK

By

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بِسْمِ اللّهِ الرَّحْمَنِ الرَّحِيمِ

والحمد الله رب العالمين

"قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ"

"Knowledge Verse" from the Holy Quran:

In the name of god, the most gracious, The dispenser of grace:

2:32 ***They replied: "Limitless art Thou in Thy glory! No knowledge have we save that which Thou hast imparted unto us. Verily, Thou alone art all-knowing, truly wise."***

ABSTRACT

The majority of building code development and implementation practices are normally connected with the progress of construction community changing awareness, needs and perspectives, advanced technology in construction and new level of knowledge. Unproven practices and the technology of building code development and implementation in case of insufficient and outdated codes, the use of unproven advanced codes of other countries, or the infringement of the existing codes, in most cases, could lead to a large number of shortcomings of minimum requirements of public health, safety and general welfare, and poor quality of buildings. Every aspect of a building code development and implementation practice could be influenced by insufficiencies and infringements in building codes/regulations that could cause buildings failures. Generally, the success of a building code development and implementation practice is directly connected with the involved insufficiencies and infringements in the framework of building code (legal, Administrative, technical, & social), i.e. faults of building code development and implementation should be successfully resolved in order to come to an end of a building project assuring code's objectives (public health, safety and general welfare).

One of the early research problems of building code development and implementation practice was conducted by Productivity Commission (2004) where the research organized and categorized the causes of shortcomings of BC according to four main functions of building code, including legal, administrative, technical, and social functions. Productivity Commission Research had been the starting point of research problems of building codes in Kuwait. For the past 20 years, many researchers have high numbers of categories, components and rankings to explain different types of insufficiencies and infringements in building codes/regulations. However, these categories and rankings produce inconsistent and overlapping cause and impact factors. In addition, researchers and practitioners at this point tend to focus on the technical and administrative sides related to the issues of building codes development and implementation, and neglecting the importance of legal and social sides. Legal issues like finding a law to prepare and enforce building codes, cover of insurance companies, building materials testing system, weak regulations related issues, building specifications, and clarity of regulation texts; as well as social issues like community awareness, issuing and enforcing legal court rules, deterrent punishments for violators, violations or cheatings in related issues, all of these were deemed not that critical by most reviewers.

The research is specifically concerned with the insufficiencies and infringements in building codes/regulations which cause shortcomings of minimum requirements of public health, safety and general welfare, and how related cause and impact factors are selected and organized. Existing research highlights the need for further researches of how to relate between research and building regulations that are at present. There is evidence that construction industries around the world have little experience in this area (CIB TG37, 2001).

The proposal within this research is to address this aspect of the debate by seeking to clarify the role of the four functions of building code; legal, administrative, technical, and social function as a frame of reference that stakeholder parties (building officials, design and construction professionals) might agree with and which should act as the basis for the selection and formation of occurrences of cause factors, and their impact on public health, safety and general welfare. The focus on the four functions of building code as a fault (cause) frame of reference potentially leads to a common, practical view of the (multi) dimensionality setting of fault (cause) within which cause factors may be identified and which, we believe, could be grounded across a wide range of practices specifically in this research of building code development and implementation.

The research surveyed and examined the opinions of building officials, design and construction professionals. We assess which fault (cause) factors are most likely to occur in building and construction projects; evaluate fault (cause) impact by assessing which fault (cause) factors that building officials, design and construction professionals specifically think are likely to arise in the possibility of shortcomings of minimum requirements of public health, safety and general welfare.

The data obtained were processed, analyzed and ranked. By using the EXCEL and SPSS for factor analysis, all the fault (cause) factors were reduced and groups into clusters and components for further correlation analysis. The analysis was able to prove an opinion on fault (cause) likelihood, the impact of the fault (cause) on the objectives of building code.

The analysis indicates that it is possible to identify grouping of insufficiencies and infringements in building codes/regulations that is correspondent to the different parts of the framework of building code (legal, Administrative, technical, & social) these suggest three identified groups when viewing cause from the likelihood occurrence and four identified groups and their impact for each building code objective. The evidence related to the impact of building code objectives, view of cause, and provides a stronger view of which components of cause were important compared with cause likelihood. The research accounts for the difference by suggesting that a more selection and formation of cause and impact, offered by viewing cause within the context of a framework of building code, and viewing impact within the context of building code objectives (public health, safety and general welfare) allows those involved in building code development and implementation to have an understandable view of the relationships within cause factors, and between cause and impact factors. It also allows the various cause components and the associated emergent clusters to be more readily identified.

The contribution of the research relates to the assessment of cause within a construction that is defined in the context of a fairly broad accepted view of the framework of building code (legal, Administrative, technical, & social). The fault (cause) likelihood construction is based on the building code framework proposed in this research and could facilitates a focus on roles and responsibilities, and allows the coordination and integration of activities for regular development and implementation with the building code goals. This contribution would better enable building officials and code writers to identify and manage faults (causes) as they emerge with BC aspects/parts and more closely reflect building and construction activities and processes and facilitate the fault (cause) administration exercise.

Keywords: insufficiencies and infringements in building codes, shortcomings of minimum requirements of public health, safety and general welfare, building code development and implementation, framework of building code.

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DEFINITIONS

- **Act (Reform):** an act framed to amend the system of parliamentary representation, especially those introduced in Britain during the 19th century (Oxford University Press, 1999).
- **Administration:** The process or activity of running a business, organization, etc: the people responsible for this, regarded collectively. the management of public affairs; government. the government in power (Oxford University Press, 1999).
- **Building code**: Building Code is Model Building Regulation for Protection of Public Health, Safety and Welfare (BOCA, 1993). A building code is legal document that regulates the construction of new and exiting building and structures (BOCA, 1999). The term "Building Code" is frequently used to refer to a family of codes that are coordinated with each other to address specific scopes of technical application. This set of codes (Council of American Building officials, 1997) generally consists of four documents: a building code, a plumbing code, a mechanical code and an electrical code.
- **Building official:** The officer or other designated authority charged with the administration and enforcement of the building code (ICC, 2000).
- **Building permits**: is a license to build. A person who wishes to construct a new building or alter an existing building must obtain a permit from the building department. Typically, a permit is not required for ordinary repairs to structures (BOCA, 1999).
- **Certificate:** an official document attesting a certain fact, in particular: A document attesting a level of achievement in a course of study or training: *a university-accredited certificate.* A document attesting the fulfillment of certain legal requirements: *a certificate of motor insurance.* An official classification awarded to a cinema film by a board of censors indicating its suitability for a particular age group: *an 18 certificate* (Oxford University Press, 1999).
- **Civil Law:** the system of law concerned with private relations between members of a community rather than criminal, military, or religious affairs (Oxford University Press, 1999).
- **Code:** a system of words, letters, figures, or symbols used to represent others, especially for the purposes of secrecy. A series of letters, numbers, or symbols assigned to something for the purposes of classification or identification (Oxford University Press, 1999). **Code**: is a collection of requirements that pertain to a specific subject and regulate specific practices (BOCA, 1999
- **Codes Prevailing regulations**: ordinances or statutory requirements set forth by governmental agencies associated with building construction practices and owner occupancy, adopted and administered for the protection of public health, life safety, and welfare (CSI, 2003).

- **Coding:** the process of assigning a code to something for the purposes of classification or identification (Oxford University Press, 1999) .
- **Construction Documents:** A term used to represent all drawings, specifications, addenda, and other pertinent construction information associated with the construction of a specific project (CSI, 2003).
- **Decision:** A conclusion or resolution reached after consideration (Oxford University Press, 1999).
- **Enforce:** compel observance of or compliance with (a law, rule, or obligation) (Oxford University Press, 1999).
- **Enforcement Notice:** an official notification to remedy a breach of planning legislation (Oxford University Press, 1999).
- **Infringement:** violate (a law, agreement, etc.) (OUP, 2006).
- **Law:** The system of rules which a particular country or community recognizes as regulating the actions of its members and which it may enforce by the imposition of penalties (Oxford University Press, 1999).
- **Metrology:** It is the scientific study of measurement (Oxford University Press, 1999).
- **Model Code**: It is a written set of regulations that provides the means for exercising reasonable control over construction, and is available for adoption by cities, countries, with such changes as may be desirable or legal for local needs (BOCA, 1999).
- **Norm:** something that is usual, typical, or standard. A standard or pattern. A required standard; a level to be complied with or reached.
- **Penalty:** a punishment imposed for breaking a law, rule, or contract (OUP, 2006).
- **Performance Code**: states the purpose to be accomplished and allows design and engineering professionals to select alternative methods and materials, as long as they meet the minimum requirements for health, safety and welfare (BOCA, 1999).
- **Performance Specifications:** The written material containing the minimum acceptable standards and actions, as may be necessary to complete a project (CSI, 2003).
- **Practice**: the actual application or use of an idea, belief, or method as opposed to theories about such application or use, the customary, habitual, or expected procedure or way of doing of something, the carrying out or exercise of a profession, an established method of legal procedure. Repeated exercise in or performance of an activity or skill so as to acquire or maintain proficiency in it. In practice in reality (used to refer to what actually happens as opposed to what is meant or believed to happen): in theory this method is ideal—in practice it is unrealistic. Currently proficient in a particular activity or skill as a result of repeated exercise or performance of it (Oxford University Press, 1999).

- **Problem:** a matter or situation regarded as unwelcome or harmful and needing to be dealt with and overcome. A thing that is difficult to achieve or accomplish (Oxford University Press, 1999).
- **Public health**: is the state that public are in good health; not unwell or diseased. It is also promoting good health for public, in normal, natural, or desirable.
- **Public safety:** is the condition of public being safe. Safety is denoting something designed to prevent injury or damage.
- **Public welfare:** is the health, happiness, and fortunes of public, a person or group. It is also, an action or procedure designed to promote the basic physical and material well-being of people in need.
- **Purpose of codes**: the purpose of codes is to protect the public health, safety and welfare by regulating safe construction (BOCA, 1999).
- **Registration:** The action or process of registering or of being registered: the series of letters and figures identifying a motor vehicle, assigned on registration and displayed on a number plate (Oxford University Press, 1999).
- **Regulation:** A rule or directive made and maintained by an authority. The action or process of regulating or being regulated (Oxford University Press, 1999).
- **Resolution:** A formal expression of opinion or intention agreed on by a legislative body, committee, or other formal meeting, typically after taking a vote: *the conference passed two resolutions* (Oxford University Press, 1999).
- **Rule:** one of a set of explicit or understood regulations or principles governing a person's conduct within a particular activity or sphere. A code of practice and discipline for a religious order or community (Oxford University Press, 1999).
- **Specification Code**: describes exactly what methods and materials are to be used, as well as the size and location of components (BOCA, 1999).
- **Standards in Codes**: a standard is a published technical document that represents an industry consensus on how a material or assembly is to be designed, manufactured, tested or installed so that a specific level of performance is obtained (BOCA, 1999).
- **System:** A set of connected things or parts forming a complex whole, in particular: a set of things working together as parts of a mechanism or an interconnecting network: *the state railway system* (Oxford University Press, 1999).
- **Violation:** break or fail to comply with (a rule or formal agreement) (OUP, 2006).

ABBREVIATIONS

Abbreviations of Building Codes System:

- BC: Building Codes
- BCS: Building Codes System
- A&EBC: Administration and Enforcement of Building Codes

Abbreviations of Institutions and Organizations:

- ADR: Alternative Dispute Resolution
- ANSI: American National Standards Institute
- APRICF: Approved Plan Review and Inspection Consultant Offices
- ASTM: American Society for Testing and Materials
- BO: Building Officials
- BOCA: Building Officials Conference Association
- BSI: British standards Institute
- CABO: Council of American Building officials
- CIB: International Council for Research and Innovation in Building and Construction
- CMHC: Canada Mortgage and Housing Corporation
- DHHS: Department of Healthand Human Services
- EE: Engineering Experts
- FM: Factory Mutual Research
- GAFF: General Administration of Fire Fighting
- ICBO: International Conference of Building Official
- ICC: International Code Council
- KM: Kuwait Municipality
- KNA: Kuwait National Assembly
- KNPCP: Kuwait National Building Code Project
- LC: Legal Consultants
- MEW: Ministry of Electricity and Water
- MOED: Ministry of Economic Development
- NCSBCS: National Conference of States of Building Codes
- NFPA: The National Fire Protection Association
- SBCCI: Standard Building Code Conference International
- UL: Underwriters Laboratories Inc.

Abbreviations of Model Building Codes

- IBC: International Building Code
- IECC: International Energy Conservation Code
- IFC: International Fire Code
- IFGC: International Fuel Gas Code
- IMC: International Mechanical Code
- IPC: International Plumbing Code
- IPSDC: International Private Sewage Disposal Code
- IPMC: International Property Maintenance Code
- IRC: International Residential Code
- IZC: International Zoning Code
- ECAP: ICC Electrical Code Administrative Provisions
- PBC: ICC Performance Building Code for Building Facilities

Chapter One

Introduction

Chapter One

Introduction

1.1 Background

Despite the fact that Kuwait witnesses steady growth in construction movement throughout the last fifty years, **there are no proper defined and unified building regulations for construction practitioners in Kuwait** (Al-Azmi, 1997; MOP, 1997; MOP, 1995). According to the Central Bank of Kuwait, construction and real estate industry contributed 31.25% of the Gross Domestic Product of non-oil revenues (Kartam, 2001), and according to the Gulf Global Investment Firm, private housing projects claimed 94% of the total Construction and Real Estate industry in 2003 (GIH, 2003). The problem with current building regulations and codes is that there are partial regulations available in Kuwait Municipality, Kuwait Fire department, and Ministry of Electricity and Water, and there is a gross negligence in enforcing even the existing laws, such as non-enforced Safety Law, illegal construction, violation of heights and number of floors, etc.

Many building officials and professionals believe that there is a lot of confusion, misunderstanding and mismanagement in the administration of building regulations and enforcements in Kuwait (Al-Qabas, 2003; Al-Korafi, 2002; Khalifa, 2002; Abdul-Ghani, 2000). As a result of shortages in qualified personnel, tools, proper managerial systems, etc. many building officials believe that their technical authorities do not have full control over designs, construction documents, and construction inspection for every building and structure in the country (Mckinnon,1979). At this time, there is a procedure to handover all controlling activities to private sector.

Kartam, Flood and Koushki (2000) discuss the causes of safety problems, and agree that the current governmental safety inspection programs are ineffective because the inspectors are limited in both number and qualifications. Amin (2002) and, Hamed (2004) stated in their investigation which are based on official reports that the causes of some of building collapses were due to bad installation and inappropriate execution, inspection, and supervision procedures. Researchers at Ministry of Planning (1995-1997) declare that there are problems of using many outdated design codes for reinforcement, lack of reviewing structural designs for serviceability, and producing designs with excessive amount of materials. Al-Haider (2003) states that there are faults in the design, supervision and execution that caused weakening in many structural elements. Sadek (2001) agreed on neglected and improper and yet common concrete design practices that may threaten inhabitants and safety of the structure. An official accidents inspector stated that there are deaths and injuries happened for home occupants and users, because of poor electric and lighting works during alteration, movement, and repairing (M. Al-Bendari, personal communication, 15 September 2003).

Many researchers and government research bodies in other countries agreed on the problem of insufficient enforcement of building codes (BC). **In the UK**, Housing Association Property Mutual (1997) study confirmed that the majority of building construction defects occurred due to failures to achieve adequate standards. **In the USA**, there was waste, fraud and abuse of Building codes (BC) in New Jersey which had deficient and improper construction codes along with subversion of inspections and code enforcement, negligent government oversight and regulation, and inadequate consumer protection and remediation (Commission of Investigation, 2005). **In France**, Researchers suggested change in acoustical requirements for educational buildings in order to prevent noise (Vallet, Auzilleau, Lemonnier, 2003). **In Canada**, Melo and Chapnik (2001) approved the need for structure-borne sound transmission (SBST) as part of the Ontario Building Code (OBC). **In China**, China's Ministry of Construction reported that while 60% of buildings are complied on paper ,only half of that number is complied in actual construction (Building Research Establishment, 2008).

The particular nature of Kuwait construction industry led to difficulties in government control for construction works. Two thirds of people residing in Kuwait are expatriates. People from all parts of the world made Kuwait their second home and work place. In the construction industry people from Syria, Lebanon, India, Egypt, and Palestine are the majority in the consultancy sector, while technical labour force (for electrical, mechanical ,and aluminium works) are mostly from India and Pakistan, while other labours are mostly a comprise of people from Egypt, Iran, China, and Korea. It is highly essential for a country like Kuwait with such a diverse work force to have a common code of practice.

Furthermore, many Kuwaiti citizens travel during summer to various parts of the world, and this brings back a variety of construction ideas to Kuwait to implement in their projects. Another aspect which needs consideration is the education received by many citizens of Kuwait. Many construction professionals were educated in different universities around the world. In short, a combination of practice codes and methods were used in Kuwait in the construction industry and made it extremely fragmented.

This research is to investigate the impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait. The term "***Building Code (BC)***" has been defined as (ICC, 2009):

> "**Model code that provides minimum requirements to safeguard the public health, safety and general welfare of the occupants of new and existing buildings and structures".**

Public health is the state that public are in good health; not unwell or having diseases. It is the protection of the bodies and minds of people from illness resulting from the materials, processes or procedures used in the workplace (Hughes, Ferrett, 2007). **Public safety** is the condition of public being safe, and denotes something designed to prevent injury or damage. It is the protection of people from physical injury. The borderline between health and safety is ill-defined and the two words are normally used together to indicate concern for the physical and mental well-being of the individual at the place of work (Hughes, Ferrett, 2007). **Public welfare** means the health, happiness, and fortunes of public, a person or a group. It is also, an action or procedure designed to promote the basic physical and material well-being of people in need (Oxford University, 2006). It is the provision of facilities to maintain the health and well-being of individuals at the workplace. Welfare facilities include washing and sanitation arrangements, the provision of drinking water, heating, lighting, accommodation for clothing, seating (when required by the work activity), eating and rest rooms. First aid arrangements are also considered as welfare facilities (Hughes, Ferrett, 2007).

The background in this section gave details of the problems of insufficient building codes and its enforcement in Kuwait and in other countries. It is important at this stage to clarify the area of research and research justifications. ***The following section discusses the focus and scope of research with the respect of definition of BC, its enforcement, its technical requirements, and problems of BC.***

1.1.1 Classification of Shortcomings of Building Code

Many of the studies and researches till date try to define the framework of building code and to examine the insufficiencies and infringements in building codes/regulations from a broad aspect. Previous researches discussed the issues of insufficiencies and infringements in more common and generic rankings or groupings. Most research studies explored insufficiencies and infringements using particular structure techniques, and discussed the relationship between them according to research needs and methodology.

To understand the framework of building code, it was found that most of countries, cities, and towns around the world have a kind of building regulation system to organize their building construction activities. Laws and procedures state the broad philosophy of regulatory system of a country. Law is a system of rules which a particular country or community recognizes in regulating the actions of its members that might be enforced by imposition of penalties. Regulation is a rule or instructions made and maintained by an authority, or an action or process of regulating or being regulated, like planning regulations. System is a set of connected things or parts forming a complex whole, in particular like a set of things working together as parts of a mechanism or an interconnecting network (Oxford University, 1999).

A research group has an opinion about the framework of building code. According to CIB TG37 (2001) building regulations are legal requirements adopted by public policy makers to reflect as closely as possible society's minimum expectations from the built environment. Building regulations are a part of the Building regulatory system. Building regulatory system varies from one country to another due to the structure of governments, cultural differences, and other factors. In order to recognize the potential benefits of regulations, all parameters of regulatory system must be addressed. The Building regulatory system parameters include local government structure, public policy, education, technology, and general support framework. An example of support framework for Building regulations system would be national approval system for products (CIB TG37, 2001).

There is another set up for the framework of building code. According to The Productivity Commission, an institution of the Australian Government, building regulation has broad definition. The range of possible regulations that are associated is quite wide. The Building Code, prescriptive or performance, is a key element of building regulations, mainly connected to technical specifications. Building regulations may also be included or affected by building approval process, planning approval process, standard settings and accreditation of products, people and process, environmental regulations, some social regulations, some economic and financial regulations, occupational health and safety regulation (The Productivity Commission, 2004). The Commission conducted a comprehensive study for the reforming of building regulations in Australia. The Commission organized and categorized the causes of shortcomings of BC according to four main functions these are legal, administrative, technical, and social (The Productivity Commission, 2004).

Business companies could give details of construction systems in any country. Canada Mortgage and Housing Corporation (CMHC), for example, defines Canada's construction system (CMHC, 2002). This system deals with construction, and operation of buildings in Canada. System parts are owners, designers, general contractors, subcontractors, manufactures, standard development organizations, the national government, provinces and territories, and municipalities.

The Chairman of Canadian Commission of Building and Fire Codes states that, there are needs to recognize the importance of key elements in the construction other than building codes (Clemmensen1, 2003). These elements are well-functioning markets with knowledgeable, accountable and capable professionals, knowledgeable consumers who have access to the information, legal framework for the conduct of business, reliable standards, testing and design guides, warranties, insurance, education and training to enhance knowledge and skills of those involved in the building process.

Researchers have view regard organizing the causes of shortcoming of BC. Baiche, Walliman and Ogden (2006) conducted a questionnaire and organized and categorized the causes of shortcoming of BC (faults) according to technical elements of buildings such as Walls, floors, ceilings, doors or windows, pipes and other technical components. In addition, they conducted other elements to qualification aspects such as lack of skills and knowledge of required standards on the part of the operatives, shortcomings in site management and toleration of sub-standard workmanships.

Another government vision regards the organizing the causes of shortcoming of BC. A Commission in the USA conducted an investigation of construction and inspection activities in a town. The commission organized and categorized the causes of shortcomings of BC into four major areas : deficient and incomplete construction, subversion of inspections and code enforcement, careless government oversight and regulation, and inadequate consumer protection and remediation (Commission of Investigation, 2005).

A researcher has different observation regards the organizing the causes of shortcoming of BC. McCollum (2004) conducted a study to investigate building code violations in Florida, and organized and categorized the causes of shortcomings of BC (violations) according to (1) technical components of BC such as electric load calculations, HVAC load calculations, HVAC duct sizes, plumbing riser layout, and according to (2) technical requirements such as sound decibel test, Model Energy Code calculations Florida, and Accessibility Code, and according to (3) some administrative requirements such as Zoning compliance permit, approved site plan, permit-site work.

Ayininuola and Olalusi (2004) performed literature reviews and visual inspections of failed buildings questionnaires to indentify causes and possible solutions to common buildings failures in Nigeria. They organized and categorized the causes of shortcomings of BC (faults) according to a group of technical requirements, code enforcement and management of construction works. These categories are environmental changes, improper presentation and interpretation in the design, the use of materials prone to failure, poor or inadequate workmanship, inadequate supervision, inexistence of local codes, lack of maintenance culture, and inadequate fund.

The background in this section gave details of the problems of insufficient building codes and its enforcement in Kuwait and in other countries. It is important at this stage to clarify the areas of research and research justifications. ***The following section discusses the focus and scope of research with the respect of definition of BC, its enforcement, its technical requirements, and problems of BC.***

1.2 Research Focus

The focus of the research concerns with the development and implementation of building codes in Kuwait, which is involved in many insufficiencies and infringements that could contribute to the failures of the building codes in Kuwait. With the complexity of the building codes development and implementation and the failure factors involved, a further research in this area is deemed necessary as explained in later paragraphs.

The scope of **building code "BC"** has been defined as (ICC, 2009):

> **" The provisions of building code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures".**

The intent of **"BC"** has been defined as (ICC, 2009):

> **" The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighter".**

Building Codes generally **have 14 focuses** these are: structural safety/strength, fire safety, properties' safety, stability, sanitation, adequate light and ventilation, energy conservation, accessibility, mechanical, plumbing, electrical, property maintenance, zoning and occupancy (ICC, 2009). **Administration and enforcement of building codes (A&EBC)** is about how the organization of building regulations and codes can work to achieve effective and efficient levels of service. The **three major divisions *in A&EBC*** are general management, plan review, and site inspection (ICC, 2009).

The research investigates the effect of improper and/or absence of proper regulations and enforcements applicable to building construction industry in Kuwait. In particular, it addresses the inefficiencies and infringements in the contents and implementation of BC and regulations in terms of minimum requirements of public health, safety and general welfare. Many deficiencies of BC, and its administration and enforcement in Kuwait will be investigated.

1.2.1 Research Scope

The scope of this study is to identify the impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait. Organizations and institutions of building codes face enormous problems when they intend to perform their tasks, which are regular, administrative, technical, social, and other fields, that highlight the need to conduct a research, identify and resolve these problems. Four main functions have been investigated to identify insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait; such as (The Productivity Commission, 2004):

(1) **Regular/Legal function**: Building code is a regular document by which to specify and judge compliance. It is concerned with legal status of building codes and regulations.

(2) **Administrative function**: Building code is an administrative document which has a mechanism to describe compatibility achievement. It belongs to the building code organizations in the country, and its main functions such as issuing permits, reviewing plans, and conducting inspections.

(3) **Technical function:** Building code is a technical document that provides information to building practitioners about what should be done by experts. It consists of requirements for design and construction such as structural strength, fire safety (safety to life and properties from fire, and means of egress facilities), stability of structures, sanitation, adequate light and ventilation, life safety (safety to life and properties from other hazards attributed to the built environment), and requirements for energy conservation, accessibility, mechanical, plumbing, property maintenance, zoning, occupancy, and electrical.

(4) **Social function**: Building code is a social document that is specified for the society's minimum requirements of public health, safety and general welfare. It is associated with the effects of buildings and built environment on the human relationships. Examples of social norms are honesty, law-abidingness, and the work ethic (Productivity Commission, 2004).

The following sections explain the research problem, aim, objectives, and research hypothesis.

1.3 Research Problem

The research problem can be defined as the relationship between cause and effect, and it has two folds as follows:

(1) Cause: Insufficient and infringements of building regulations (codes)

(2) Effect: Not meeting the minimum requirements of public health, safety and general welfare

- **Insufficient Building Regulations (Codes)**

There are improper defined and unified building regulations for the use of construction practitioners in Kuwait. There are partial regulations available in Kuwait Municipality, Kuwait Fire department, and Ministry of Electricity and Water. However, there are considerable absences of **(i) Regulatory, (ii) Administrative, (iii) Technical, and (iv) Social** regulatory framework applicable for the building codes. This results in major problems in the construction industry in Kuwait.

- **Infringements of Exiting Building Regulations (Codes)**

There is a gross negligence in enforcing the existing laws, such as non-enforced safety law, illegal constructions, violations of heights and number of floors, etc.

1.4 Overall Research Aim and Individual Research Objectives

- ### Research Aim

The aim of this research is *to identify the impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait.*

- ### Research Objectives

The specific objectives of the research are:

1. Review of the previous work in the subject
2. Review of building codes/regulations in Kuwait
3. Review of how building codes/regulations are enforced and any penalties for non-compliance in Kuwait
4. Review of building codes and their enforcement in other countries

5. Indentify insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait
6. Identify the impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait

1.5 Research Hypothesis

Hypothesis is a logical conjecture (hunch or educated guess) about the nature of relationships between two or more variables expressed in the form of a testable statement (O'leary, 2004). The hypothesis of this research needs to verify whether the objectives of building code (minimum requirements of public health, safety and general welfare) are available for people or not in buildings in Kuwait, in the perspective of insufficiencies and infringements in building codes/regulations. The insufficiencies and infringements in building codes/regulations are investigated through the four functions of building codes, including legal, administrative, technical, and social function. The hypothesis is:

'Many of the problems encountered to meet the objectives of building codes in Kuwait (ensure minimum requirements of public health, safety and welfare for people and buildings) caused by insufficient building codes/regulations and infringement of those that currently exist'.

At this point, it is appropriate to discuss and explain research justifications by stating the value and importance of the research in the following section.

1.6 Research Value

This research subject is highly strategic, vital, unique, and first in its kind in the subject of building codes in the overall development of building industry in Kuwait. It is done to indentify the gaps of building code system in Kuwait, and determine the impact of these gaps which made the need for this research timely. The research work tends to investigate the insufficiencies and infringements in building codes/regulations and **(i)**to assure that people are in good health and not unwell or diseased, **(ii)** to assure that people and their properties are safe by preventing human injuries and damages of properties, and **(iii)** to assure that people are socially happy in cities. **Requirements of public health, safety and general welfare can be considered as a barometer to measure a country's performance in the building sector.**

Construction and building sector status affect the economic movement, civilization, social, political, and industrial aspects of any country. Therefore, it is necessary to study all aspects to achieve progress in this sector. In order to do so, it is a must to establish codes and standards to implement these projects (BOCA,1999; O'Bannon, 1989; Liebing, 1987; Scott, 1997; Stephenson, 2001; Polley, 1995).

This research has potentials to answer the question whether the current system of building codes, regulation, and government institutions is appropriate for Kuwait construction industry or not. These issues have great benefits for the country's economy since construction industry plays an important role in terms of the Gross Domestic Product of Kuwait.

The construction and building industry in Kuwait faces many problems. To assure that construction and buildings meet minimum requirements of public health, safety and general welfare, it is necessary to produce a building code to regulate materials, methods of construction, installation of fixtures, equipments, and accessories. In addition, there is also a need for administration and enforcement processes to activate the building code. The State of Kuwait should apply progress-building regulations as in USA, UK, Canada, New Zealand, and Australia, in order to enhance the development of buildings and real estate industry as well as protect peoples' lives.

The following section gives an overview of research methodology to explain the research road map.

1.7 Methodology Outline

The research methodology is generally outlined in this paragraph. However, the subsequent details of the research methodology approach with further argument and empirical support, is elaborated in the methodology chapter (Chapter 5).

The research reports an analysis of a survey of building officials and construction professionals with the objective of ascertaining their views concerning the identification, impact evaluation of the causes involved in supporting the development and implementation of Building Codes. The research methodology comprises a number of phases and tasks.

Phase One is a research initiation which involves a review literature to define research questions and identify problems. **Phase Two** involves the literature reviews on the subject area to gain more insight into the cause factors that may affect building codes. It involves reviewing current literature, performing personal interviews, small comparative study, focus group, field visits, and conducting professional activities.

Ayininuola and Olalusi (2004) and Chan A., Tam C. (2000) also performed questionnaires and used extensive literature reviews of buildings failures cause factors, and produced a cause list for their study. Even The Productivity Commission (2004), National Disability Authority (2009), Baiche and Walliman and Ogden (2006), McCollum (2004) and Olubodun and Mole (1999), used similar methods

Ayininuola and Olalusi (2004) performed literature reviews and visual inspections of failed buildings questionnaires to indentify causes and possible solutions to common buildings failures in Nigeria. Chan A., Tam C. (2000) performed site inspection for a group of projects to examine the underlying factors affecting the quality of building projects, and to identify factors that show a strong correlation to good quality performance. Olubodun and Mole (1999) asked the surveyors to rank their perception of failure on each component as being caused by an identifiable factors extracted from the repair database of a large local authority housing department whose stock is in excess of 80,000 dwellings. Visscher, Sheridan, and Meijer (2002) used extensive literature reviews of development and implementation of Building Code to identify, analyze, and explain the similarities and differences across other building regulations frameworks.

Previous reviews resulted in a list of overlapping cause factors, as other researchers also tend to use previous researchers' list for their own research, with the addition of some new cause factors. Apart from the literature reviews, other cause factors were also identified through the researcher's knowledge, understanding, informal discussions and brainstorming sessions with others. Figure 1.1 explains research design structure.

Phase Three involved defining research methodology, performing unstructured interviews, and surveys. **Phase Four** involved data analysis of surveys to understand practitioner's perceptions on likelihood occurrence of cause and impact factors. **Phase Five** involved conducting advance data analysis of surveys such Cronbach's Alpha to check the consistency of the research items, Kaiser-Meyer-Olkin to measure of reliability to test the probability of that a correlation exists between some of the variables, Bartlett's test of sphericity tests whether the correlation matrix is an identity matrix, Exploratory factor analysis to remove redundancy in data, clustering of likelihood occurrence of cause/impact factors (Factor Analysis), analysis within groups using Correlation Coefficient (Pearson Correlation), analysis among groups using T-test, and correlations between cause and impact using Cross Tabulation. **Phase Six** involves discussion and drawing conclusions.

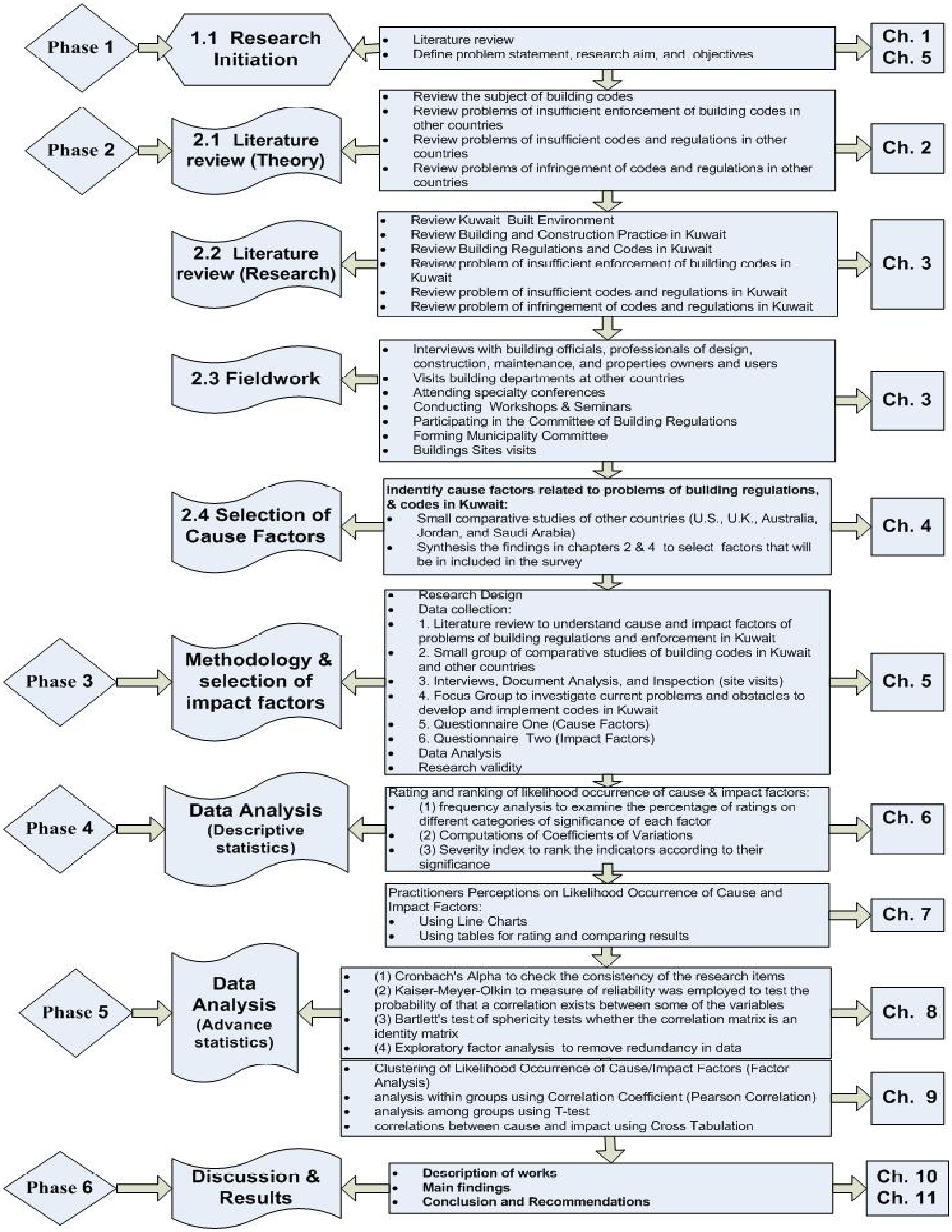

Fig. 1.1: Research Design Structure

1.8 Research Achievement

Indentifying the impact of shortcomings of minimum requirements of public health, safety and general welfare related to insufficient and infringements in the building codes/regulations have become an enduring challenge faced by the building officials and construction communities. In recent years, the incorporation of modern concept of building codes and its enforcement has emerged as an effective mechanism for addressing these problems. Since any initiation and implementation of the suggested frameworks should be started with the building officials' commitment, the influential role of construction community members (designers, contractors, manufactures, etc.) should be given an attention, particularly at the initial stages of building codes project.

The research establishes the facts that,

- There are improper defined building regulations for the use of construction practitioners in Kuwait
- There is a need for a unified single BC for Kuwait
- Many of the minimum requirements of the building construction in Kuwait are not compatible with standard building codes
- There are considerable absences of regular, administrative, technical, and social framework applicable for the building codes
- There are negative significant impacts of insufficient regular, administrative, technical, and social framework applicable for the building codes
- There are strong justifications for establishing minimum requirements of levels for building constructions and systems
- Adoption and enforcement of building codes will solve many shortcomings of minimum requirements of public health, safety and general welfare, and provide enormous benefits to citizens of the state.

1.9 Organization of the Thesis

Chapter 1 (Introduction): This chapter ***is an introductory chapter*** that details with the research background, research focus, scope, problem, overall research aim, individual research objectives, forming hypothesis, value of this research, overview of research methodology, research achievement, and organization of the thesis. It explains research importance and justification, such as the need for BC, and reforming BC and its enforcement.

Chapter 2 (Building Code: Overview and Problems): This chapter seeks ***to review the previous work on the subject, of BC, its enforcement, and problems***. Moreover, it seeks ***to review insufficient and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in other countries***. It has nineteen sections. It reviews definitions of BC, importance and benefits of BC, history of BC, aspects of BC, code structure and contents, uses of codes, administration and enforcement of building regulations/codes, building department operations, selection and adoption of codes, standards in codes, model code organizations in the world, BC types, performance and prescriptive BC, the relationship between problems of buildings and building regulations enforcement process, and problems of BC in other countries such as problems of insufficient enforcements of BC, problems of insufficient codes and regulations, and problems of infringements of codes and regulations. Built Environment, Construction Practice, & Building Regulations, Codes in Kuwait

Chapter 3 (Built Environment, Construction Practice, and Problems of Building Regulations, & Codes in Kuwait): this chapter seeks to review work done earlier on the subject, how building codes/regulations are enforced and penalties imposed thereon for non-compliance. Moreover, it seeks to *identify insufficient and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait*. This chapter also seeks to review the construction environment in Kuwait, and to introduce general and realistic picture about Kuwait's building traditions, history, and advancement. This chapter has four sections. Section 3.1 reviews the construction environment in Kuwait; Section 3.2 reviews building and construction practices in Kuwait; Section 3.3 building regulations and codes in Kuwait; Section 3.4 overviews problems of building codes and its enforcement in Kuwait; Section 3.5 reviews BC Legal Problems in Kuwait; Section 3.6 reviews BC Administrative Problems in Kuwait, Section 3.7 reviews BC Technical Problems in Kuwait, Section 3.8 reviews BC Social Problems in Kuwait and Section 3.9 is the Summary.

Chapter 4 (Cause and Impact Factors Related to Problems of Building Regulations, and Codes in Kuwait): In this chapter, the focus is on extracting the generic factors of insufficiencies and infringements from the literature reviews of building codes/regulations which are common in most building projects in Kuwait. The factors of insufficiencies and infringements extracted were organized into relevant categories of framework of building code (legal, Administrative, technical, & social framework) to make them more useful and meaningful for the building officials and researchers.

Chapter 5 (Research Methodology): This chapter ***gives an outline of the plan of action and the research methods followed in the study***. This chapter has eight sections. Section 5.1 is an introduction, which sets the structure of this chapter. Section 5.2 is research design which explains research initiation, aim, scope, objectives, novelty, and process. Section 5.3 discusses research style and approaches such as objective, subjective, quantitative, qualitative, and action research. Section 5.4 descries data collection for the different methods used in research. Section 5.5 describes data analysis for the different methods used in the research. Section 5.6 discusses and confirms the research validity. Section 5.7 explains the limitations of the research data. Section 5.8 is a summary.

Chapter 6 (Preliminary Analysis of Survey One and Two: Descriptive Statistics and Data Presentation): Data collection was conducted and the descriptive analysis of the responses was performed using the Microsoft Excel and SPSS. The data obtained were grouped and organized in order to be analyzed and discussed further in later chapters. The general and overall findings of the survey were presented in this chapter, but the detailed discussions of the findings were presented in later chapters. The statistical techniques include ranking, weighted mean, standard deviation, coefficient of variation and severity index.

Chapter 7 (Practitioners Perceptions on Likelihood Occurrence of Cause and Impact Factors): The results of the descriptive analysis from the previous chapter were elaborated and the perceptions of the building officials and professionals were discussed in details. The main areas of agreements and disagreements of the perceptions among the practitioners were discussed.

Chapter 8 (Factors Analysis and Correlations of cause factors and their impact on Public Health, Safety and General Welfare in Kuwait**):** Factor analysis process of the responses was conducted. Using the principal component analysis (PCA) techniques with the SPSS, components of the cause and impact factors were identified based on the factor loading scores. Clustering of the components was established in finding common themes based on the proposed cause and impact construct of framework of BC in Kuwait.

Chapter 9 (Advance Analysis of Survey One & Two: Hypothesis Testing and Correlations): This chapter is elaborated in greater details of interactions and correlation of the factors. Exploratory Factor Analysis for data reduction was used to reduce the number of questionnaire questions to a lower number of variables. Based on the factors' relationship and correlations, the outcome of data reduction is presented in a few components that consist of the most important cause and impact factors of the original large group of cause and impact factors. A Pearson correlation coefficient was computed to assess the relationship within cause and impact factors. Independent sample T-test is used to compare the mean score of two different groups of respondents with one continuous factor. Cross Tabulation is used to compare responses and to show the relationship between cause and impact factors.

Chapter 10 (Discussion): Discussion of the results of the whole analysis and research conclusion. This chapter discusses the significance and the relevancy of the research within the overall perspective of the framework of BC in Kuwait. Relationships and correlations of cause occurrences, and their impact on public health, safety and general welfare in Kuwait were identified and explained.

Chapter 11 (Research Summary and Contribution): Summary, Research contribution and recommendations for further research. The whole perspective of the research and the research contribution towards the practical and applicable perspectives were highlighted. The limitations of the research and the recommendations for further researches were also explained.

Chapter Two

Building Code: Overview and Problems

Chapter Two

Problems

In accordance with research objectives no. 1, and 4, this chapter seeks ***to review the previous work on the subject, of BC, their enforcement, and problems***. Moreover, it seeks ***to review insufficient and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in other countries***. It has nineteen sections. It reviews the definitions of BC, the importance and benefits of BC, the history of BC, the aspects of BC ,the code structure and contents ,the uses of codes, administration and enforcement of building regulations/codes, building department operations, selection and adoption of codes, standards in codes, model code organizations in the world, BC types, performance and prescriptive of BC, the relationship between the problems of buildings and the building regulations enforcement process, and the problem of BC in other countries such as the problem of insufficient enforcement of BC, problem of insufficient codes and regulations, and the problem of infringement of codes and regulations.

2.1 What is a Building Code?

Most of Building Codes in many counties deal with safety of life (Kreimer , Arnold, Carlin, 2003), (BOCA, 1993), (ICC, 2009), (Tricker, Algar, 2006), (Foulger, 2004), (Polley, 2001), (Australian Building Codes Board, 2008) ,(Jordanian Building Codes Board, 2008).

The Building Code in the US has more detailed requirements (BOCA, 1993), (ICC, 2009), while in the UK the focus is on energy efficiency (Tricker, Algar, 2006), (Foulger, 2004), (Polley, 2001). In Australia they focus on sustainability (Australian Building Codes Board, 2008), and in Jordan its objectives are not well defined (Jordanian Building Codes Board, 2008). The US and Australian codes are similar in their objectives.

Even though some cities are in the same country but they may have different building codes' requirements. For example, a town that lies in the path of hurricanes may require special storm protection standards. Cities like Houston has large oil refineries that create certain hazards, and cities like Chicago and New York require special codes and standards that relate to high-rise buildings and population density (Kubba, 2008).

2.1.1 Definitions of Building Code

A group of government appointed, professionals, and academic research institutions define the building codes [(BOCA, 1993), (ICC, 2009), (Kubba, 2008), (Tricker, Algar, 2006), (Foulger, 2004), (Polley, 2001), (The Australian Building Codes Board, 2008), (Liebing, 1987), (Jordanian Building Codes Board, 2008)]. Most of these reviews agree with similar objectives. These reviews are:

The term **"BC"** has been defined in BOCA National Building Code as ***"the model building regulation for protection of public health, safety and welfare"*** (BOCA, 1993)

While the definition of BC as in the International Building Code is more detailed in its requirements such as (ICC, 2009): ***"the code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations."***

According to Kubba (2008): ***"Building codes are designed to govern the construction of all types of buildings—public, commercial, retail, residential, etc. Building codes are a set of rules designed with two main objectives in mind: 1. Save lives, protect public health, safety and general welfare as they relate to the construction and occupancy of buildings, and 2. Protect property in all its shapes and forms. To do this, building codes generally stipulate minimum standards for safety and comfort that must be met in new construction and major renovations".***

The BC in England and Wales is Building Regulations is defined as (Tricker, Algar, 2006), (Foulger, 2004), (Polley, 2001): ***"to ensure the health and safety of people in and around buildings, and the energy efficiency of buildings".***

The BC in Australia defines it in The Australian Building Codes Board, (2008) as: "***to enable the achievement efficiently of nationally consistent, minimum necessary standards of relevant, health, safety, including structural safety, safety from fire, amenity, and sustainability."***

The BC in Jordan defines it as (Jordanian Building Codes Board, 2008): ***"Set of rules, conditions and technical requirements related to the realization of planned reconstruction of the Board and approved by the Council of Ministers".***

Liebing (1987) gave a comprehensive definition of the subject of Building Code, ***that it is a series of rules, regulations, or statutory requirements, adopted by local government jurisdictions, enacted as law, which sets minimum acceptable safety standards for all types of construction and occupancies; addresses aspects of construction design, practices, uses, materials, systems, and owner occupancy; adopted and administered for the protection of public health, safety, and welfare; encompasses general construction and structural requirements, in both remodeling and new construction, by using numerous reference standards. Other associated codes generally encompass electrical, plumbing, and mechanical systems.***

2.2The Importance and Benefits of Building Codes

Various benefits accrue from building codes (Meijer, Visscher, 2008), (Listokin, Hattis, 2004), (BOCA, 1999), (Disaster Management Planning Hyogo Office, Osaka, 2007), (Clemmensen1, 2003), (Legislative Audit Division of Montana, 1997), (Ministry of Economic Development in New Zealand, 2003), (Feld, Carper, 1997).

According to Meijer and Visscher (2008) building regulations are one of the most important instruments to guarantee an adequate quality of the European built environment. Some of the benefits include "protecting the consumers from the consequences of their own ignorance. For example, a homebuyer purchasing a hazardous dwelling, as well as external benefits, such as protecting surrounding properties, or the community at large, from a dwelling that could collapse, catch fire, and otherwise be hazardous (Listokin, Hattis, 2004). Building codes are obviously vital foundation for promoting good quality buildings that meet society's stated and un-stated goals (Clemmensen1, 2003).

Scientific evidence is growing that the new structures erected with updated building codes are performing better than older structures with old building codes. This fact was underscored in Japan, which regularly update its BC that during the 1995 Kobe Earthquake, buildings built under old codes performed poorly while those built under new codes performed well (Disaster Management Planning Hyogo Office, Osaka, 2007).

According to Legislative Audit Division of Montana (1997) various construction industry groups, such as insurance industry representatives, fire officials, and model code groups, agree that a number of benefits are gained by enforcing building codes in Montana. These benefits include ensuring the integrity of the structure and adjacent structures; saving lives and property; mitigating natural hazards; ensuring installed products are safe; confirming qualified installers are on the job; independent review of contractors' work; consumer comfort knowing independent review was done; lowering insurance premiums; alleviating pressure on local fire services; and increasing property values.

According to the Ministry of Economic Development in New Zealand (2003)**,** it is not possible to quantify many of the economic and social benefits arising from the proposed changes to the regulatory regime. However, many officials, experts, and researchers agree on:

- **BC Provide a Definition to the Concept of Acceptable Minimum Requirements**

BC provides definition to the concept of acceptable minimum requirements for the society in general, and the building industry in particular, through the concept of what is '***acceptable***'. For example, when discussing a particular objective of the building code, such as safety, BC provides a very important support to the building industry by specifying particular minimum solutions. BC helps stakeholders with questions such as: ***How safe is 'safe'?*** Without some guidance from the building code, builders would need to start from the beginning every time something different is built in order to answer these questions (Clemmensen1, 2003).

- **BC Provide Minimum Consistent Standard**

Governments benefit from BC to regulate building and construction activities, in order to ensure a minimum standard of building. ***BC provides consistent standards in construction***, which provide quality and durability for construction methods and materials, these are ultimately beneficial to the consumers (BOCA, 1999).

- **BC Provide Technology and Information for Professionals**

Governments need to get the benefit of the technology that codes have. BC offers valuable assets of providing technical information for professional of construction. In **materials selection,** codes address product quality characteristics, such as composition, dimensions and uniformity. In **engineering design,** codes addresses design procedures, engineering formulas, and methods of testing to determine the physical, functional, or performance characteristics of specific materials or products. In **installation**, codes govern installation of specific products or systems. In **testing**, codes identify methods and procedures for evaluating structural strength, fire resistance and other performance criteria (BOCA, 1999).

- **BC Safe Guard the Interest of Construction Industry**

BC protects the country's construction industry economy, by bringing uniformity, lowering the construction costs, and saving buildings from costly defects. According to Central Bank of Kuwait, construction and real estate industry account for 31.25 percent of the Gross Domestic Product of non-oil revenues (Kartam, 2001). Construction industry plays an important role in terms of the Gross Domestic Product.

- **BC offers uniformity**

Uniformity lower construction and material costs. Codes offer an environment of uniformity and compatibility between the entities of a political geographic territory. It eliminates unjustifiable restrictive requirements. It offers uniform, and timely appropriate acceptance of new products, methods, and technology. It establishes basis for education and certification of building officials (BOCA, 1999).

- **BC will lower the construction costs**

BC lowers construction costs by providing uniformity for construction industry, which allows builders and material manufactures to do business on large scales, and allows cost savings, which are ultimately passed onto and benefit consumers (BOCA, 1999).

- **BC saves buildings from costly defects.**

Homeowners lose a lot of money in Kuwait. Inexperienced owners acting as general contractors supervise major works of alteration cause major or minor defects that appear during or after the construction process. These defects are costly, because building a private house in Kuwait costs a minimum of KD 70,000 (=£140,000), and takes nearly a year. Therefore, there is a great need for BC and its enforcement for housing projects. Feld and Carper (1997) recommend solutions to reduce building faults, defects and failures by having better code enforcement, and strengthening the building departments in many jurisdictions in order to carry out the necessary regulatory functions.

- **BC Protect Lives and Buildings**

BC reduces potential hazards by protecting building inhabitants, owners, and users from harms caused by fire, structural collapse, and general deterioration of structures. BC contribute to community well-being by preserving life and safety as well as the maintenance of property values over time. The case study of Cost-Benefit related to smoke alarms in private houses and apartments in Kuwait proved that many lives could be saved with the enforcement of smoke alarms in private houses (Meijer, Visscher, 2008), (BOCA, 1999).

- **BC Protect Owners from Litigations and Differences**

Construction works have the highest percentage (39.62%) of litigations in Kuwaiti courts (Ministry of Justice, 2000). BC can shelter and protect owners from many litigations and differences. BC offers valuable guidelines by setting high standards for construction professionals. Feld and Carper (1997) state the potential for honest misunderstanding which is enormous, and construction industry has gained a reputation for being contentious and prone to litigation. Also, they state that in order to function professionally on today’s construction project; one must be able to recognize and diagnose problems as they evolve and apply the appropriate principles in order to avoid or resolve the problems.

2.3 History of Building Codes

Building codes are not a product or an invention of modern civilization but have evolved from the past; and the purpose of codes has remained the same for more than 4,000-year of history (Kubba, 2008), (BOCA, 1999), (Liebing, 1987).

Historically, communities developed building regulations to address specific needs. The tradition originated as far back as 1700 B.C. when the Code of Hammurabi dictated that builders who were deemed responsible for structural collapse that resulted in the loss of life would lose their own lives (CIB TG37, 2001; BOCA, 1999; O'Bannon., 1989; Liebing, 1987), (Fig. 2.1). It is for the governmental authorities and assemblies to set rules which organize the relation among the owners, design offices, contractors, building departments, and others.

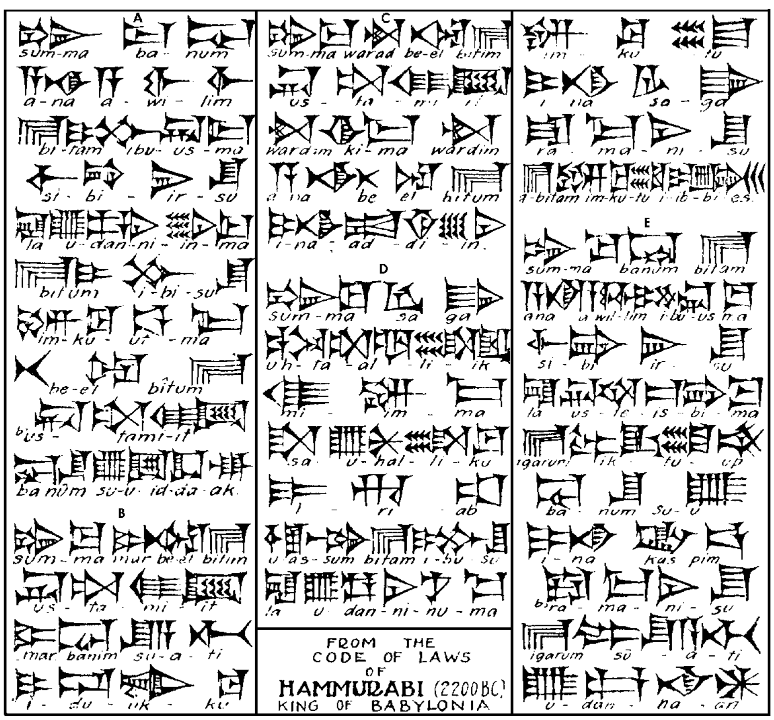

Fig. 2.1 Hammurabi's Building Code - 2200 BC

2.3.1 Milestones in Building Code Development

Historically, building code development occurred in response to tragedy rather than prevention. Some milestones in the history of codes include (BOCA, 1999; Liebing, 1987):

- 5000 B.C.: Development of Egypt began
- 3373-3700 B.C.: The Sphinx built; Pyramids built at Giza and Cheps
- Greek & Roman Times 1630: Laws enacted to restrict construction types, roofing materials, size of buildings and density of land use, and lot coverage. Similar regulations were enacted in the Middle Ages especially in England. Building regulation records show that Plymouth, Massachusetts, required thatched roofs to be changed into wood.
- 450 B.C.: Roman code and zoning regulations.
- Revolutionary Times: George Washington recommended that height and area limitations be restricted for wood frame buildings when planning the District of Columbia.
- Latter Part of 19th Century: The United States enacted the first set of building regulations because of widespread loss of property by fire.
- 1905: The first model code laid the foundation for testing methodology, specifications and the formats of today's codes use. The specific purpose was to reduce fire hazards, but it had a more general and humanitarian purpose: to protect public health, safety and welfare. The National Board of Fire Underwriters (now the American Insurance Association) published the first National Building Code.
- 1915: Building Officials Conference of America (BOCA) was established to provide a forum for the exchange of knowledge and ideas concerning building safety and construction regulations.
- 1927: Adoption of the Uniform Building Code by the Pacific Coast Building Officials Conference, now the International Conference of Building Officials (ICBO).
- 1945: Publication of the Standard Building Code by Southern Building Code Congress International, Inc. (SBCCI).
- 1950: Publication of the Basic Building Code (now called the BOCA National Building Code) by Building Officials Conference of America (BOCA), now Building Officials and Code Administrators International, Inc.

The advent of model building codes has made it possible to regulate construction in many communities that had previously found it physically impossible or financially impractical to produce codes of their own. It also made it possible for those communities utilizing archaic codes to replace them with well written and technical model codes.

2.4 Aspects of Building Codes

Building codes deal with four aspects: (i) legislative, (ii) social, (iii) administrative, and (iv) technical (The Productivity Commission, 2004). **The legislative aspect** is concerned with the legal status of building codes and regulations. **The social aspect** is related to human relationships and the effects of buildings and built environment. **The administrative aspect** relates to the building code organizations in the country, and its main functions, which constitutes of issuing permits, performing plan review, and inspection (ICC, 2009). **The technical aspect** identifies shortcomings in minimum requirements for public health, safety and general welfare needs by looking into 13 different technical categories such as (ICC, 2009):

1. Structural: Structural strength
2. Fire: Safety to life and properties from fire, and means of egress facilities
3. Stability
4. Sanitation
5. Adequate light and ventilation
6. Safety to life and properties from other hazards attributed to a built-up environment
7. Energy conservation requirements
8. Accessibility
9. Mechanical requirements
10. Plumbing requirements
11. Property Maintenance requirements
12. Zoning and Occupancy requirements
13. Electrical requirements

2.5 Code Structure and Contents

The term "Building Code" is frequently used to refer to a family set of documents, which coordinate with each other to address specific scopes of technical application. This set of codes generally consists of four documents: a building code, a plumbing code, a mechanical code and an electrical code (Council of American Building officials, 1997). The following items are typical contents of building codes: Building Code, Zoning Code, Plumbing Code, Mechanical Code, Electrical Code, Property Maintenance Code, Fire Code, Private Sewage Disposal Code, Energy Conservation Code, Fuel Gas Code, Residential Code (ICC, 2009, BOCA,1999).

The building codes should be arranged and grouped in a logical format, which makes the codes "user friendly" (BOCA, 1999). The first few pages of the codes should provide introductory information such as **Preface**, **Note to code users**, **Adoption information**, **Guide to use the code**, and all which make the code easier to use. Some codes have ready-made designed forms for building application, plan review, and inspection. The last pages of the code consist of **Appendices**, and **Index**. Appendixes are used for extra information, and many times, technical requirement are added for non-mandatory use. Index includes an alphabetical list of topics and code sections.

A model code structure of the technical section is BOCA National Building Code (1999). The **Table of Contents** of the code shows how related subjects are grouped together. The following lists 35 chapters of the code, and major sections with each chapter (Fig. 2.2)

Administration and Terms Administration Definitions ***Building Planning*** Use or occupancy Special use and occupancy General building limitations Types of construction ***Fire Protection*** Fire resistant materials and construction Interior finishes Fire protection systems ***Occupant Needs*** Means of egress Accessibility Interior environment ***Building Envelop*** Energy conservation Exterior wall covering Roof and roofs structures ***Structural Systems*** Structural loads Structure tests and inspections Foundation and retaining walls	***Structural Materials*** Concrete Light weight metals Masonry Steel Wood ***Non structural Materials*** Glass and glazing Gypsum board and plaster Plastic ***Building Services*** Electric wiring, equipment and systems Mechanical systems Plumbing systems Elevators and conveying systems ***Special Devices and Conditions*** Special construction Construction in the public right-of-way Site work, demolition and construction Existing structures ***Standards*** Referenced standards

Fig. 2.2: Contents of Building Codes

The 35 chapters are divided into sections, which are further divided into sub-sections, which address a topic more specifically.

2.6 Uses of Codes

Building codes are generally applied by the architectural and engineering professionals, as well as by many other professionals including safety inspectors, contractors and subcontractors, real estate developers, manufacturers, insurance companies, and others (Kubba, 2008).

There are several uses for Building codes. The building code once adopted as a law by a government institution in a country, requires that all construction activities in governorate, county, or city must conform to building codes as per law. The administrative section of the building code regulates the permit and inspection process. Building code provides standards for design, construction, and maintenance for all types of building uses (BOCA, 1999).

2.7 Administration and Enforcement of Building Regulations (Codes)

Building codes are administrated in two parts. The organization of Building Codes varies geographically, however in general, they consist of two parts (BOCA, 1999) (Fig. 2.3).

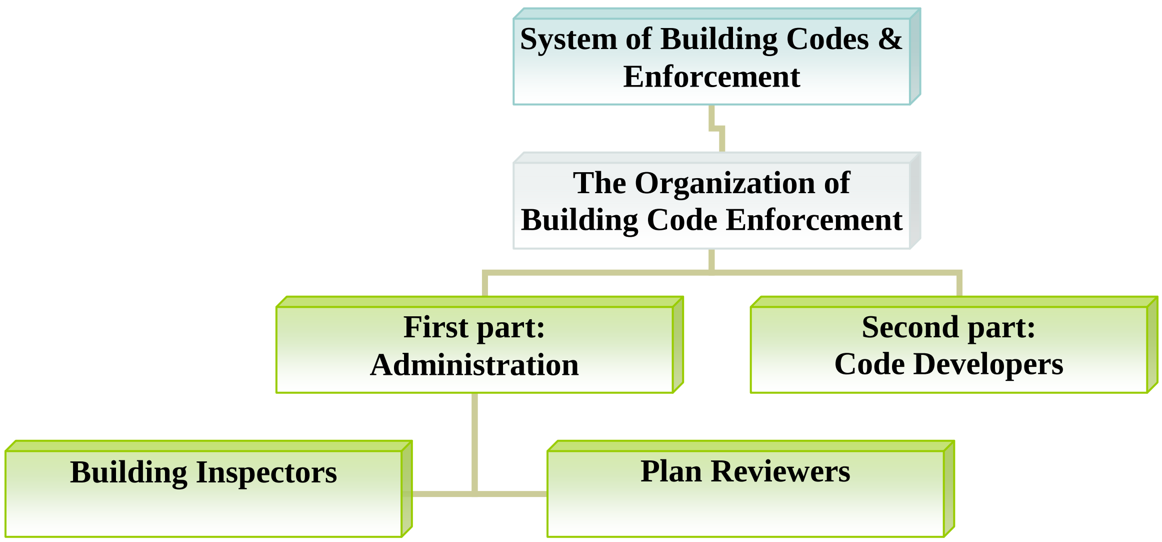

Fig. 2.3: Building Codes and the Organization of Building Code Enforcement

The first part usually covers administration and enforcement issues such as licenses, permits, fees, inspections, certificates of occupancy, safety, projections beyond street lines, alterations, maintenance, applications, approval of drawings, stop work orders, and posting of building to indicate permissible live loads and occupant load.

The second part enforces requirements for design and construction such as structural component, lighting, HVAC, plumbing, gas piping and fixtures, elevators and escalators, electrical distribution, stairs, corridors, walls, doors and windows. This part also defines and sets limits on the occupancy and construction type classifications. In addition, the second part contains provisions for safety to public and property during construction and provisions for fire protection and means of egress after the building is occupied.

Building codes are typically updated every few years taking into account advancements in technology and construction techniques as well as knowledge gained from natural hazards, terrorist attacks, etc (Kubba, 2008).

2.7.1 Permit Issue Process

The building permit process involves various stages from application, through plans review, to the issuance of a permit, to building inspection (Residential and Civil Construction Alliance of Ontario, 2008). Prior to obtaining a building permit to construct a commercial property, a developer is required to produce design plans that, among other things, must conform to the building codes in effect within the jurisdiction of the proposed development (Kubba, 2008).

In many countries there are standard forms for building permits. In Canada, Bill 124 introduced a standard building application form for all municipalities (Residential and Civil Construction Alliance of Ontario, 2008).

The most important forms scrutinized by the building inspection department are the permit forms which authorize construction or installation of specified work. In addition to authorization, they may serve a number of other functions, including: (1) a public record, (2) a public notice, (3) an application, (4) a plan check list, (5) a statistical record, (6) a routing slip, (7) authorization for activities in addition to construction, (8) an inspection record, (9) a receipt, and (10) general information of importance to the permittee and public. The pattern or arrangement of information on the form should follow a logical order (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987).

A building permit is a license that grants legal permission to a construct or alter a structure. The building permit process starts before submitting an application, by first consulting with municipal building officials. After, submitting the application with supporting documentation and fees stipulated to local building officials, the officials review the application for compliance with zoning laws, and building code and other legislatives. The application may be approved or refused. Once approved, the building inspector checks the phases of construction through to final completion. The building official issues Certificate of Occupancy, when construction is completed and approved (BOCA,1999), (O'Bannon, 1989), (Liebing, 1987).

If the construction documents are not in compliance with BC, the application is rejected. The applicant may correct the problems by providing relevant documentation, or may file an appeal (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987).

The building permit usually has six copies. These are department file copy, applicant copy, field copy, job weather card, assessor's copy, and Certificate of Occupancy (BOCA,1999), (O'Bannon, 1989), (Liebing, 1987).

2.7.2 Plan Review

The first step in the plan review process is to perform a zoning review. After, zoning review is completed; construction documents are examined for compliance with code requirements. If the plan reviewer finds any violations or needed corrections, it is noted by them stating the specific code reference. Once all discrepancies are corrected, the plans can be approved (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987), (ICBO, 1982).

- **Forms for Plans Exam**

While building officials create forms for plans examiners, two goals must be kept in mind. Forms should provide a systematic method of reviewing plans and help the plans examiner avoid overlooking code requirements. In addition to these forms, a plan check correction list saves countless hours of writing detailed corrections. The plans examiner may merely circle or check off corrections on a standard correction sheet. However, the misuse of such correction lists often occurs when the plans examiner fails to properly associate a correction with the plan. For example, if certain exit doors do not conform to the code, the plans examiner should indicate specifically which doors are involved. The same holds true for other details. It is a simple matter to refer to the plans by sheet and detailed number. This procedure also saves time when the plans are to be re-checked by the plans examiner. Plan correction sheets should be prepared in duplicate so the plans examiner may make a copy of the correction sheet for his or her own records. If the original given to the applicant is lost or destroyed, the office copy may be used to verify corrections (ICBO, 1982).

2.7.3 Site Inspection

Inspections are necessary to ensure that the permit holder does not deviate from the approved construction documents and drawings during the course of construction. There are three types of inspections handled by building departments. These are called inspections, complaint inspections, and survey periodic inspections.

At least, there are five called inspection carried out during the course of construction. These include footing, foundations, concrete slab on grade, framing, and final safety. Called inspection requires a number of forms which must be completed. These include inspection record, field correction notice, job weather card, general inspection report, and notice violation (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987).

2.8 Building Department (BD) Operations

The building department is a law enforcement agency within a local jurisdiction. Its main function is to enforce building codes. The size of BD varies from country to country and from city to a city (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987).

2.8.1 Key Personnel of Building Department

The key personnel of building department usually are director of code enforcement, plan examiners or reviewers, and building inspectors (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987), (Residential and Civil Construction Alliance of Ontario, 2008).

Usually local governments charge a director of code enforcement with the responsibility to enforce building codes. His prime mission is to protect public health, safety and welfare through the prevention or correction of code violations.

The plan examiners or reviewers studies proposed construction documents for code compliance. The plans are often reviewed for some or all of the aspects of construction depending on the scope, complexity of the projects, and code requirements.

Building inspectors enforce regulations related to the design, construction, and use of buildings. They inspect methods and materials used in the construction of new and existing structures (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987).

2.8.2 Duties and Authorities of the Code Officials

The code officials reviews building applications and conduct a preliminary inspection of new construction and equipment installation. They issue permits, perform plan review, perform periodic inspections, and enforce compliance with the code and related ordinance. Also, they evaluate the services needed, and calculate the cost of building plan review and inspection. They establish a budget for the department (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987).

Code officials have the authority of right of entry for building or construction site by law. They have the authority to stop construction works until code violations or other threats to public safety have been resolved. In addition, they are authorized to suspend or revoke building permit (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987).

2.9 Selection and Adoption of Codes

Some researchers set a number of principles that should frame the formulation of building codes and regulations. These principles are (Building Research Establishment, 2008):

- Be easy to apply
- Be applicable to all types of buildings and systems
- Be sufficiently adaptable/flexible to accept new technologies and design approaches
- Be easy and reliable to police
- Produce reliable outcomes
- Be consistent in application
- Discriminate between better and less good buildings
- Not having adverse side effects (e.g. on health or safety).

Codes are adopted through model code organizations. Codes offer an environment of uniformity and compatibility between the entities of a political geographic territory. It eliminates unjustifiable restrictive requirements. It offers uniform, timely, and appropriate acceptance of new products, methods, and technology. It establishes bases for education and certification of building officials. It offers valuable assets of providing technical information for construction professionals (BOCA,1999), (O'Bannon, 1989), (Liebing, 1987).

2.10 Standards in Codes

Standard is a published technical document that represents an industry consensus on how a material or assembly is to be designed, manufactured, tested or installed so that a specific level of performance is obtained (BOCA, 1999).

Standards are different than codes. Standards are not enforced by laws as codes. Usually, codes once adopted by a jurisdiction, become primary authorities of references, while standards are secondary authorities references, and depend on the extant to this referenced on the codes. Standards give details about construction materials, design and engineering requirements, installation methods, or testing practices (BOCA, 1999).

Many of the proceeding requirements are adopted by reference in the code from nationally and internationally recognized standards or codes of practice. These may be promulgated by organization such as British Standards Institute, Kuwaiti Standards Department, the American National Standard Institute, American Society for Testing and Materials (ASTM), American Institute of Steel construction, American Concrete Institute; American Institute of Timber construction, and other well known organizations. Some building codes and insurance rating organizations also rely on test information from Factory Mutual Research (FM) and Underwriters Laboratories Inc. (UL) (BOCA, 1999).

2.11 Model Code Organizations in the World

They are many codes organizations in the world. These organizations usually produce building codes for their countries and some organizations provide model codes and support for other countries to adopt their code technologies. The most famous organization, which offers extensive services for other countries, is International Code Council (ICC). The Building Officials and Code Administrators International (BOCA) a member of ICC offers services for code users. These services include certification for code officials, training and professional development, interpretation services, plan review services, professional journals, national representation on standards writing agencies, research report etc (BOCA,1999), (O'Bannon, 1989), (Liebing, 1987).

Usually members of model code organization are building officials, fire officials, design and construction professionals, trade associations, building materials manufactures, and distributors.

It is highly recommended that codes are regulated and enforced at the country or state level otherwise every town or governorate in a country would have a different code system resulting in:

- Increase of construction costs, that may be caused by expensive materials
- Cause inconsistent and conflicting application of codes from one jurisdiction to another
- Threat to the uniformity of the entire code
- Lack of technical support, due to lack of resources

In the U.S. "International Code Council" (ICC) is the major organization for codes which has been formed through the unification of three organizations:

- The Building Officials and Code Administrators International (BOCA)
- The International Conference of Building Officials (ICBO)
- The Southern Building Code Conference International (SBCCI)

There are other international organizations for codes such as (IRCC, 2005):

- Department of Transport, Local Government and Regions, UK (DTLGR)
- Building Control, England, Wales and North Ireland, UK
- The National Research Council, Canada (NRCC)
- The National Office of Building Technology and Administration, Norway (NBTA)
- The Ministry of Land, Infrastructure and Transport, Japan (MLIT)
- The National Institute for Land and Infrastructure Management, Japan (NILIM)
- The Building Industry Authority of New Zealand (BIA)
- The Australian Building Codes Board, Australia (ABCB)
- National Fire Protection Association, USA (NFPA)
- Ministry of Public Works (Minsterio De Fomento), Spain

2.12 Building Codes Types

There are three kinds of building codes each with a different objective. These are prescriptive or descriptive building codes, performance based building codes, and a third type which is a combination of the previous two. The two major types are prescriptive and performance building codes. Prescriptive code describes exactly the methods, and materials to be used, as well as other specific details like size and components. Performance building code states the purpose to be accomplished, and allow for design and engineering professionals to select alternative methods and materials, as long as they meets the code objectives (BOCA,1999), (O'Bannon, 1989), (Liebing, 1987).

2.13 Performance and Prescriptive Building Codes

The International Code Council defined that the intent of the International Performance Building Code is to provide a reasonable level of health, safety, and welfare, to protect the public from the risk of death or energy and to limit **damage** to property from unintentional and natural events which are expected to impact buildings and structures (Bukowski, 1997).

The intent and purpose of ICC Performance Code is similar to the corresponding prescriptive codes (ICC, 2009, 2000). The code provides for "structural strength, stability, sanitation, means of access and egress, light and ventilation, safety to life and protection of property from fire and, in general, to secure life and property from other hazards affecting the built environment" (Fig. 2.4).

The most advanced countries in terms of building regulations have adopted this approach based on performance or objectives. Noteworthy among them are the following (CSIC, 2004):

- United Kingdom (1984)
- New Zealand (1992)
- Sweden (1994)
- The Netherlands (1996)
- Norway (1998)
- Australia (1998)
- Canada (1995-2003)
- USA (2001): Southern Building Code Congress International (SBCCI), International Code Council (ICC), Building Officials Code Administrators (BOCA), International Conference of Building Officials (ICBO)

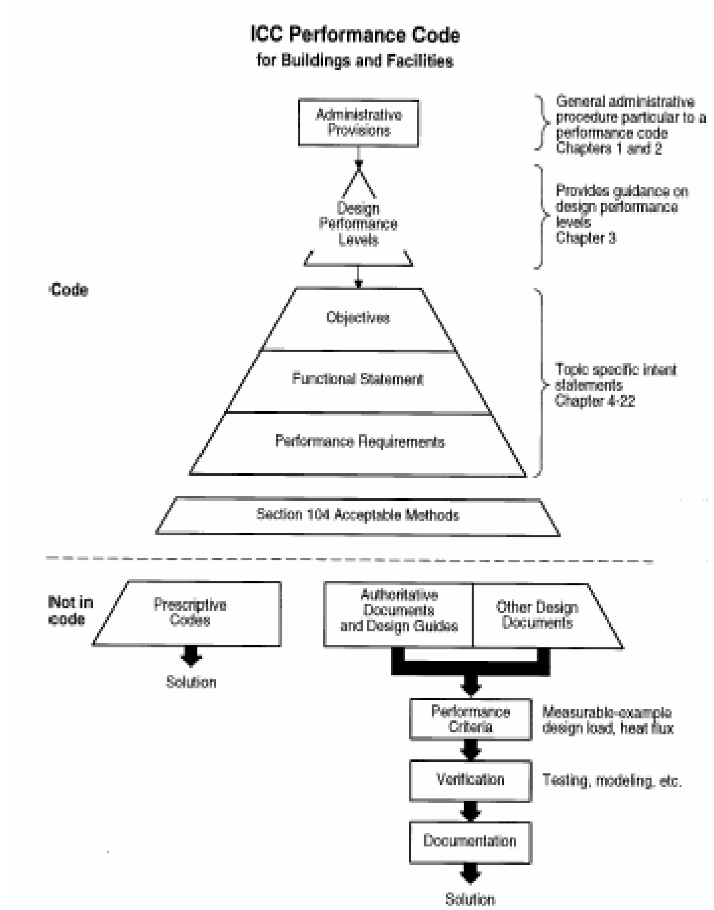

Fig. 2.4 Flow Chart for the step to apply ICC Performance Code for Building and Constructed Facilities (ICC , 2000)

The IBC performance committee examined other performance codes before drafting the U.S. code. They found the New Zealand code as the primary model, although Canada, Australia, and the United Kingdom codes influenced some elements. Fig. 2.5 shows the parallel approaches for the development of performance and prescriptive building codes for the U.S.

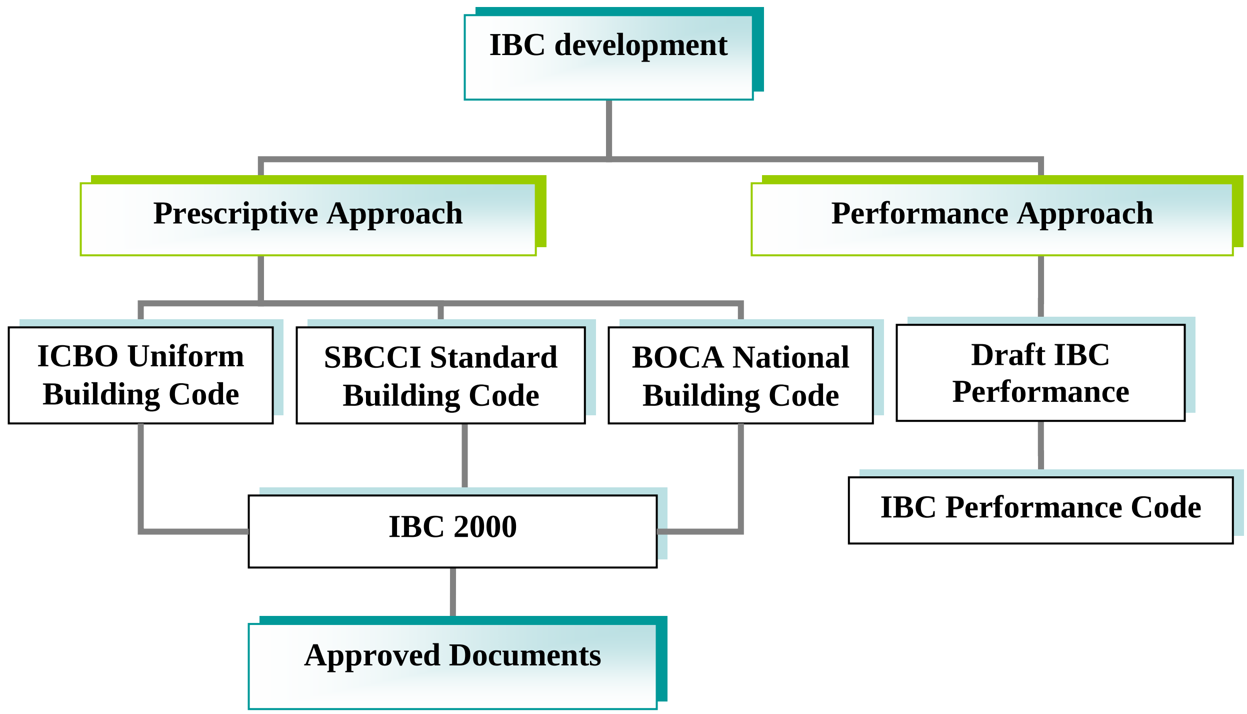

Fig. 2.5: Parallel approaches for IBC development

According to Gross (1996), the performance approach is a way of thinking and communicating about building problems and solutions from the viewpoint of the end result rather that the ways and means of building. CIB coordinator defines the concept of performance approach as, first and foremost, the practice of thinking of working terms on end rather than means (Meacham, 2002).

Foliente (2000) discusses the development of performance based building codes. He concluded that most performance based building regulatory frameworks consist of goal, functional requirement, performance requirements, and verification methods, as shown in Fig. 2.6. Goal addresses the essential interests of the community at large with respect to the built environment, and/or needs of the user and consumer. Functional requirement addresses one specific aspect of the building or a building element to achieve the stated goal. Performance requirement specifies the actual requirement to be satisfied. Verification methods and examples of acceptable solutions deal with specifics of meeting the goal.

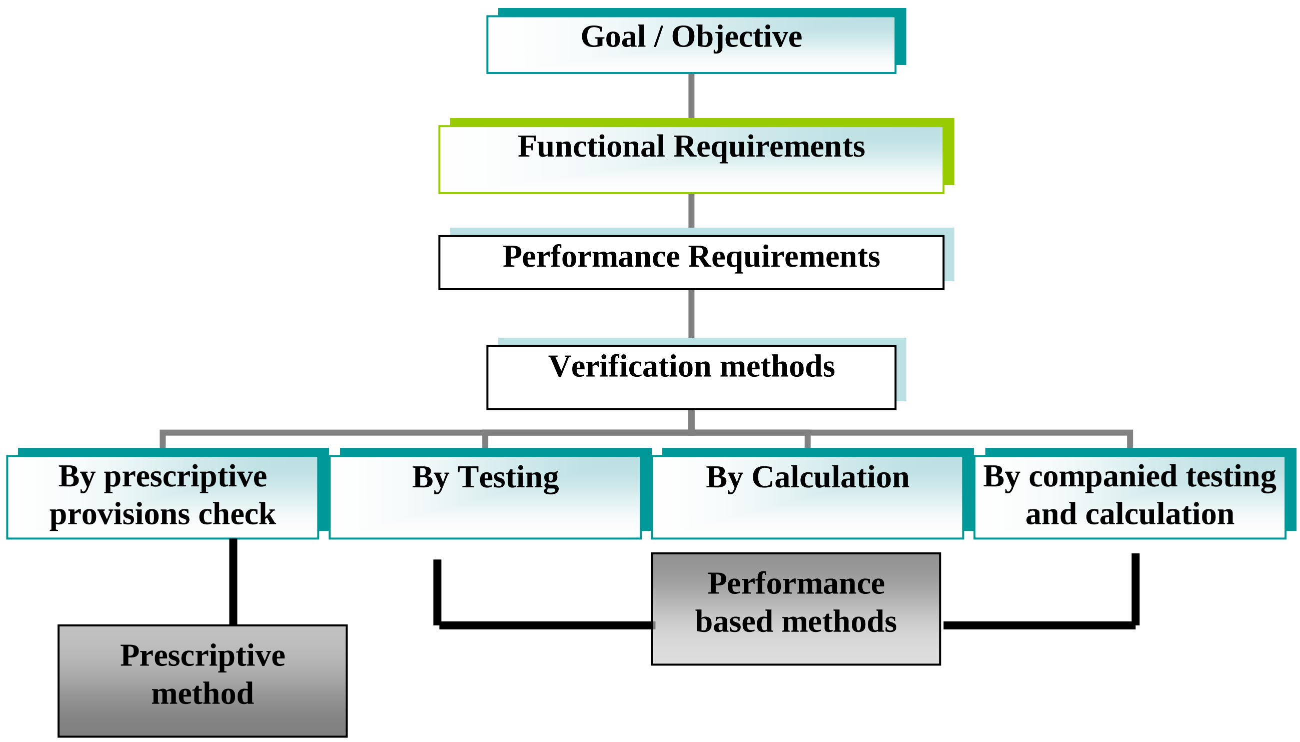

Fig 2.6: Performance based building regulatory frameworks

2.13.1 Applications of Performance Based Building Regulations

The application of performance based building regulations can encourage the use of alternative construction methods and materials (Benge, 1999). It can facilitate the use of local materials, traditional construction methods, or new technology result in enhanced performance, considering cost, quality, and time saving. The prescriptive building regulations are subordinate to the performance based building regulations (Gross, 1996).

The Performance Based Building Network (PeBBu) work plan concludes that the prescriptive building specifications and codes that are currently enforced in most countries inhibit both organizational and technological innovation in the construction industry. They suggest performance based building requirement to solve the previous problem (Bakens, 2001).

A group of researchers in Italy applied a performance based building regulations in the city of Cadoneghe to avoid the most unusual failures of Italian mass housing projects (Gottfried, 1999). They designed new rules and control tools. Most of performance requirements are successful, like floor plan arrangement, safety and security, indoor comfort, heat loss, and building envelope durability. Noise defect from footsteps is the only requirement that could not be fulfilled, but they identified the cause which can be avoided in the future (Gottfried, 1999).

2.13.2 Prescriptive Building Codes

The purpose of building code is to establish the minimum requirements for safeguarding the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and properties from fire and other hazards attributed to the built environment (ICC, 2009).

Building codes regulate materials, methods of construction, and instillation of fixtures, equipments and accessories, and promote alternative or new materials (Liebing, 1987), (Fig. 2.7). In **materials selection,** codes address product quality characteristics such as composition, dimensions and uniformity. In **engineering design,** codes addresses design procedures, engineering formulas, and methods of testing to determine the physical, functional, or performance characteristics of specific materials or products. In **installation**, codes govern installation of specific products or systems. In **testing**, codes identify methods and procedures for evaluating structural strength, fire resistance and other performance criteria (ICC, 2000, BOCA, 1999).

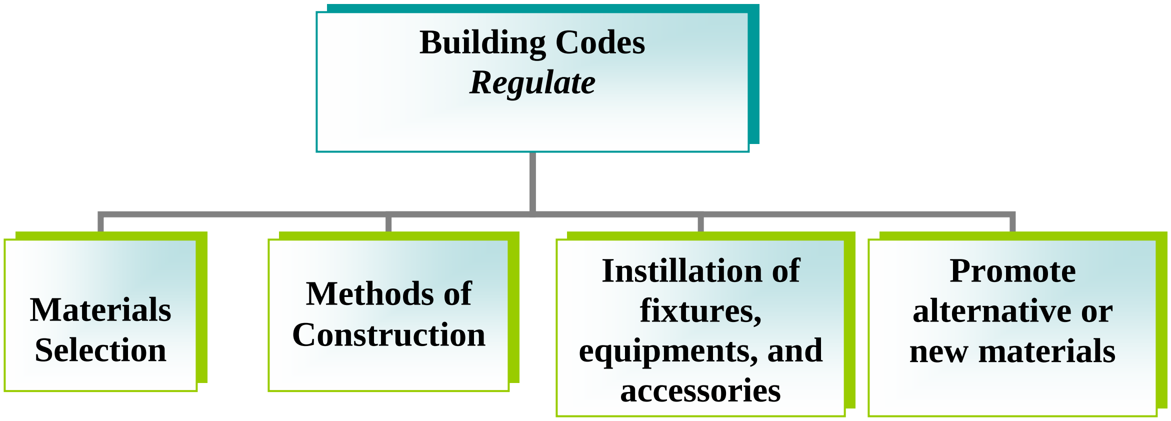

Fig. 2.7: Building Codes Purposes

Fig. 2.8 shows the relation between building codes and design. Fig. 2.9 shows the relation between building codes and construction. Fig. 2.10, 2.11, 2.12, and 2.13 show examples of design and construction requirements.

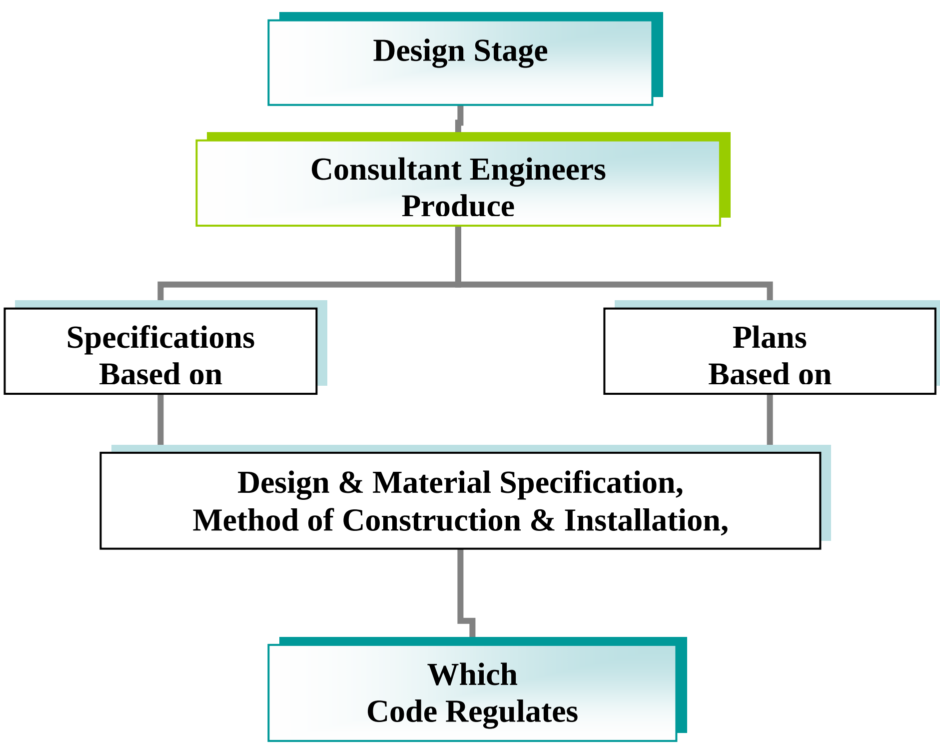

Fig 2.8: The Relation between Building Codes and Design

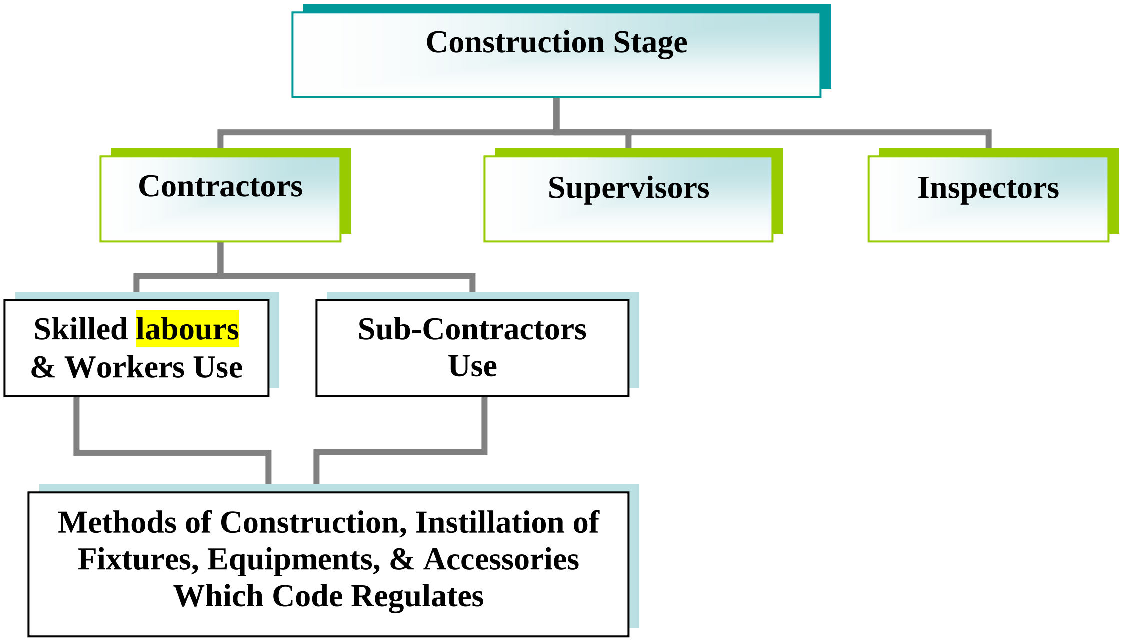

Fig 2.9:The Relation between Building Codes and Construction

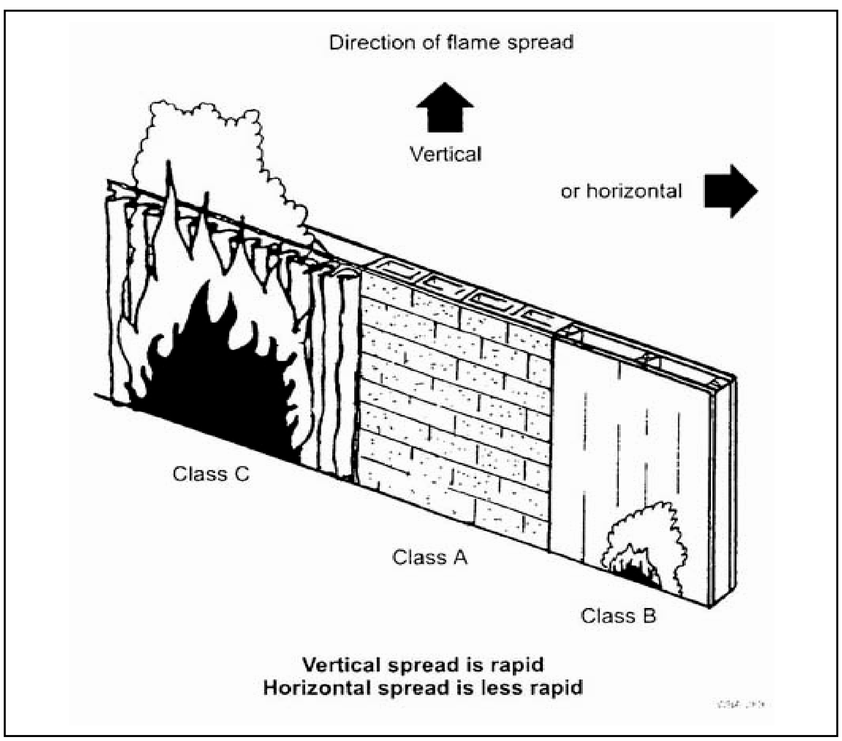

Fig 2.10: An example of design requirements

The classification of interior wall and sling finishes is based primarily on their flame spread index. Class A has an index of 0 to 27. Class B of 26 to 75, and Class C of 76 to 200. The smoke-developed index for all three classifications is limited to 450 (ICC, IBC 801, 807.1, 2000).

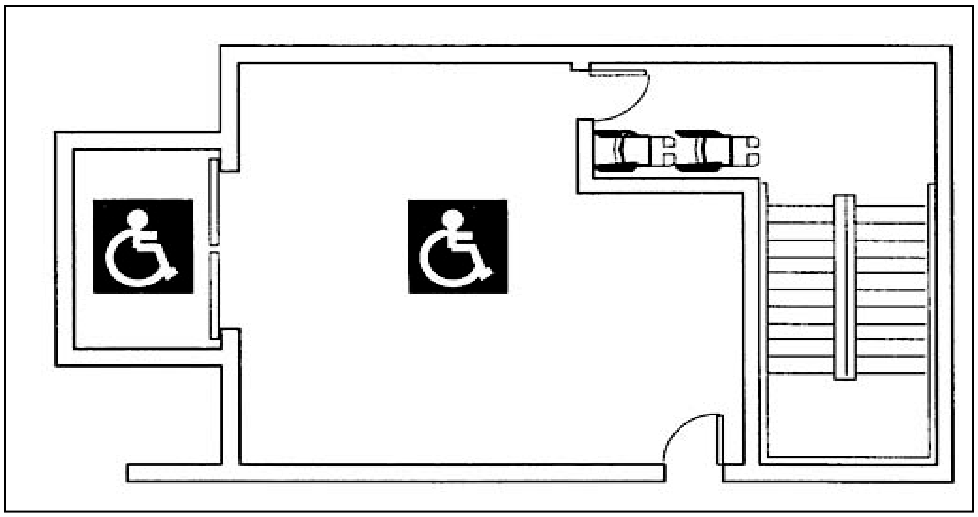

Fig. 2.11: An example of design requirements

Although three or more means of egress from an accessible space may be required, only two of the exit ways must be accessible. However, where an area of refuge is used as part of the egress system, the maximum travel distance set forth in Section 1004.3.2 must be maintained (ICC, IBC 1004.3.2, 2000).

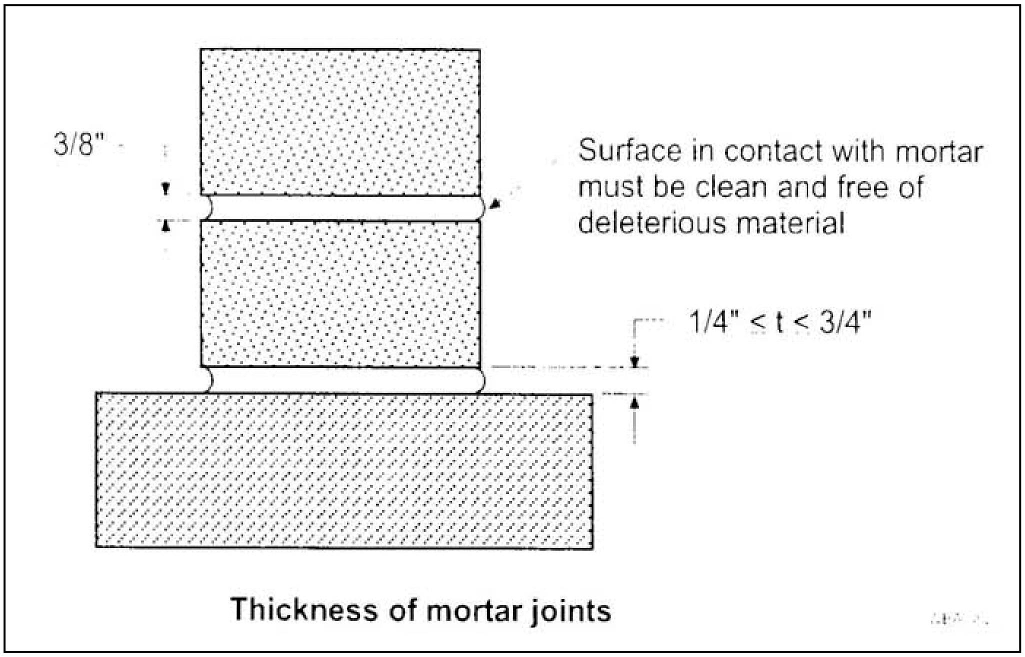

Fig 2.12: An example of construction requirements

Masonry placed during periods of cold weather is regulated under Section 2104.3 of IBC. In addition to general requirements for the protection of materials and partially completed masonry walls, provisions address procedures for construction spanning various temperature ranges (ICC, IBC 2104.3, 2000).

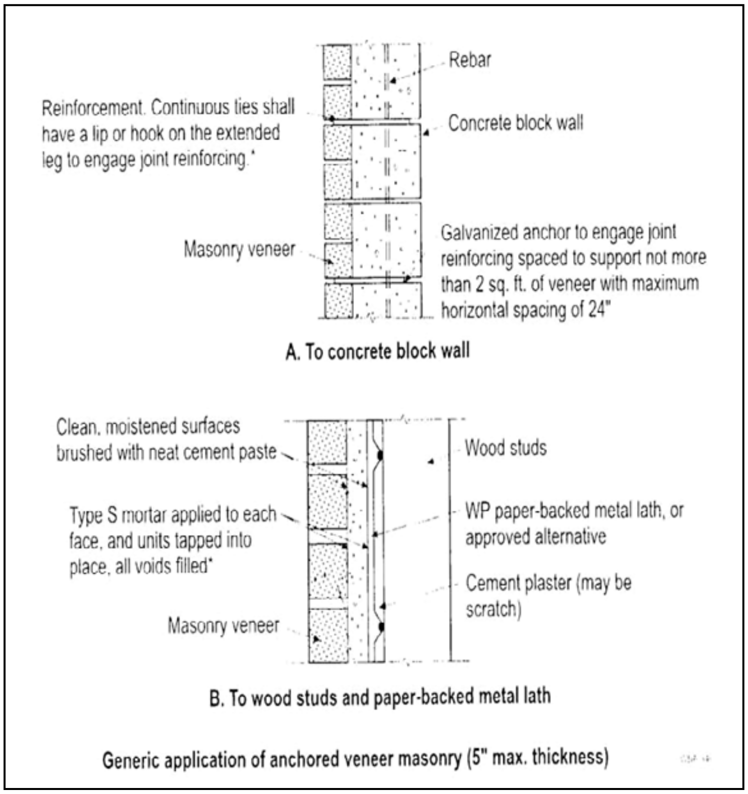

Fig 2.13: An example of construction requirements

As they are constantly subjected to alternate cycles of wetting and drying, the anchors, ties or supports used in the attachment of veneer shall be corrosion resistant. These materials, when used on the exterior of a building, must support the veneer properly for the life of the building (ICC, IBC 1402, 2000).

2.14 The Relationship between Problems of Buildings and Building Regulations Enforcement Process

2.14.1 Building Codes and Project Stages

There are multiple layers of checking a building before and during the construction (BOCA, 1999). First, architects and consulting engineers check the design against available codes and standards and submit the checked designs to local jurisdictions to obtain the permit for construction. Then the governmental code officials verify the design against the codes and standards. If there are comments, design teams shall revise the drawings accordingly and submit for a permit again. After the permit is obtained, construction starts. During the construction, local jurisdictions should inspect and enforce codes periodically. Items missed during the approval process are caught during this time. After construction is substantially completed, architects and consulting engineers check the building again and request an occupancy permit. The local jurisdiction then should check the building for the final permit, and the building can be placed in use and occupied (Fig. 2.14).

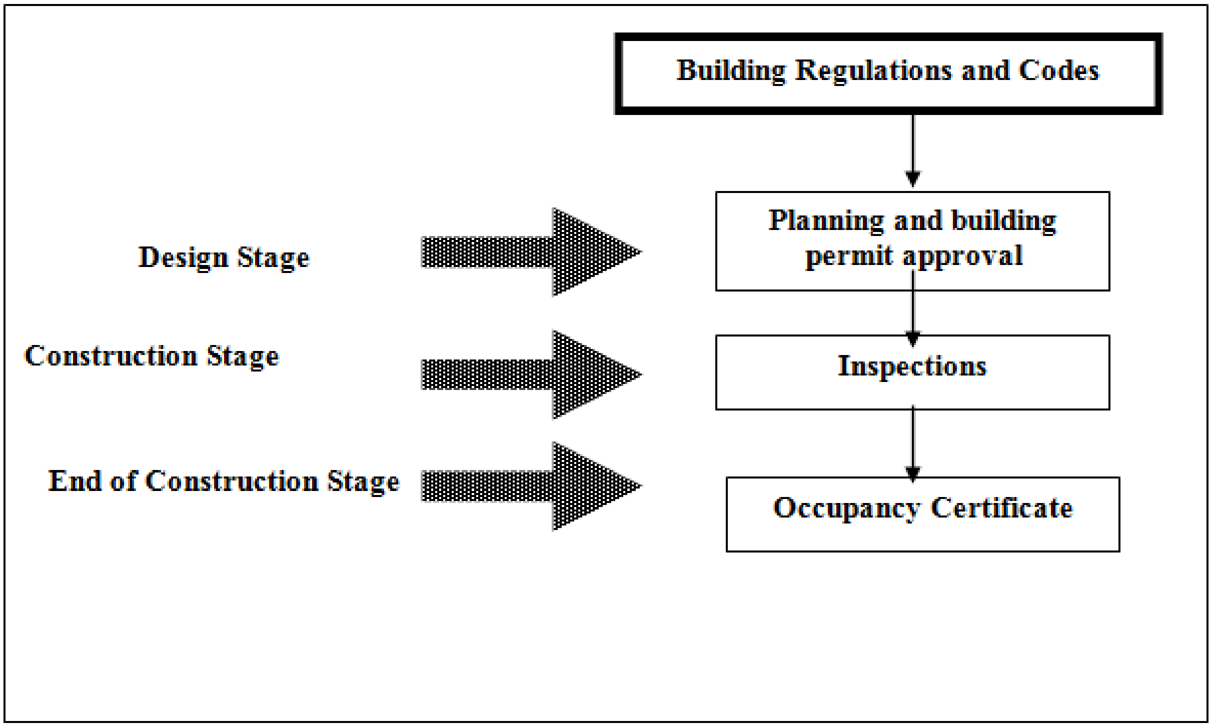

Fig. 2.14: Codes and Building Project Stages

2.14.2 The Enforcement Process and Problems of Buildings and Its Inhabitants

Many possible building and construction problems arise during the following stages of projects (Feld, Carper, 1997, Richardson, 2003):

1. Concept and feasibility studies (Fundamental errors in concept)
2. Engineering and design (Site selection/development, and Design errors)
3. Procurement
4. Construction (Construction errors, and Material deficiencies)
5. Start-up, Implementation, and Maintenance (Material deficiencies)

6. Operation and Utilization (Operational errors, and Material deficiencies)
7. Deconstruction, Demolition, and Disposal

The following table (Table: 2.1) define the relation between project construction problems and building regulation system, by defining the location and level of responsibility (P: Primary or S: Secondary) for the various activities (Liebing, 1987). It is intended to show preliminary approach or methodology to determine the current and potential problems, due to lack of proper building regulations and enforcements within the various stages of a project.

No.	Project Stage	Possible Error	Task & Responsibility	Owner or CM	Design Professionals (Architect & Engineer)	Contractors & Skilled labours	Building Regulation & Code Officials
1	Concept and Feasibility Studies	1-Fundamental Errors in Concept 2-Site Selection and Site Development Errors	Needs and concept	**P**	**S**	**-**	**-**
			Finance	**P**	**S**	**-**	**-**
			Selection of the design professionals	**P**	**S**	**-**	**-**
			Site Selection	**P**	**S**	**-**	**-**
2	Architecture and Structural Engineering Design	3-Design Errors	Programming, including code search	**S**	**P**	**-**	**-**
			Site planning studies	**S**	**P**	**-**	**-**
			Plans & specifications	**S**	**P**	**-**	**-**
			Design quality	**S**	**P**	**-**	**-**
3	Procurement	-	Pre-bid conference	**S**	**P**	**S**	**-**
			Bid evaluation & award	**P**	**S**	**-**	**-**
			Contract preparation	**S**	**P**	**S**	**-**
4	Construction	4-Construction Errors	Code review for compliance	**P**	**S**	**-**	**P**
			Permit issuance	**-**	**-**	**-**	**P**
			Construction schedule	**-**	**-**	**P**	**-**
			Construction safety	**S**	**S**	**P**	**S**
			Change order preparation	**-**	**P**	**S**	**-**
			Quality programme	**P**	**S**	**-**	**-**
			Shop drawing preparation	**S**	**-**	**P**	**-**
			Shop drawing review	**-**	**P**	**S**	**-**
			Quality control	**-**	**S**	**P**	**S**
			Quality control monitoring -on & off-site	**-**	**P**	**-**	**-**

No.	Project Stage	Possible Error	Task & Responsibility	Owner or CM	Design Professionals (Architect & Engineer)	Contractors & Skilled labours	Building Regulation & Code Officials
			Periodic inspections for compliance	-	S	-	P
			Required special & third-party inspection	S	S	-	P
5	Start-up, Implementation, and Maintenance	-	Occupancy permit application	P	S	S	-
			Occupancy permit issue	-	-	-	P
			As-built drawings	-	P	S	-
6	Operation and Utilization	5-Material Deficiencies 6-Oporational Errors	Periodic inspections for compliance	-	-	-	S
			Periodic Maintenance	P	-	P	S
			Adding Buildings	-	S	P	P
7	Deconstruction, Demolition, and Disposal	-	Needs and concept	P	S	-	-
			Finance	P	S	-	-

Table 2.1: Life Cycle of Construction Project, adopted from Liebing (1987) with amendments (P - stands for primary, S - stands for Secondary)

2.15 The Problem of Building Codes in Other Countries

The Concern about construction industry in many countries has resulted in many reviews of the industry which led to a series of reports to identify the need to change current building regulations and its enforcement to solve and accommodate these countries construction problems and needs.

The following three sections will illustrate the problems of insufficient building codes and its enforcement in other countries. These sections are:

(i) The Problem of Insufficient Enforcement of Building Codes in Other Countries

(ii) The Problem of Insufficient Codes and Regulations in Other Countries

(iii) The Problem of Infringement of Codes and Regulations in Other Countries

2.16 The Problem of Insufficient Enforcement of Building Codes in Other Countries

A number of publications were reviewed ***to understand the problem of insufficient enforcement of building codes in other countries*** [(Black, 2004), (Building Research Establishment, 2008), (McDonald., Smith, Mehta, 1996), (Kubba, 2008), (Lyubashevskii, Martenson, 1990), (Udoeyo,1995), (Compliance Task Force, 2008), (Fang, Okada, 1999), (Burby, Peter ,1999), (McPherson, 2008), (Thiruppugazh, 2008), (Rousseau, 2000), (JSCQB, 2002), (Residential and Civil Construction Alliance of Ontario, 2008)].

Many researchers and government research bodies in other countries agree on the problem of insufficient enforcement of building code (Black, 2004), (McDonald., Smith, Mehta, 1996). (Building Research Establishment, 2008). Black (2004) stated that sometimes building and fire officials and inspectors are unable to perform their tasks due to limited resources and technology available. According to McDonald, Smith, and Mehta (1996) there are obstacles for the enforcement of code or regulation for residential construction that frequently does not receive the engineering attention needed to comply with the wind load provisions of building codes. Building regulations were perceived to be too complex for many parts of the building industry, which struggles to understand the need for energy regulations (Building Research Establishment, 2008).

According to Kubba (2008), in the case of failures, it is important to determine whether a building code violation was the main cause. Lyubashevskii, and Martenson (1990) agree with Kubba, and they found cases that presented failures and damages to the mechanical equipment of various hydro stations, when the building codes are not observed during construction of hydraulic structures.

In Nigeria, Udoeyo (1995) found that poor inspection enforcement during construction, among other factors, was identified as being responsible for the geometrical imperfections caused by variations in geometrical quantities of reinforced-concrete members on three large project sites in Nigeria.

In the US, the Code Compliance Task Force (2008) investigated the most significant lapse of code enforcement implemented over the last 12 years. The force addressed the problem of an extremely high rate of inspection failure rate, which increased both the cost of inspections and inspection response time to customers. Fang and Okada (1999) researchers who investigated the process of managing natural disaster risk through enforcement of development standards, estimated that better building code compliance and enforcement could have prevented 25% of the insured losses from Hurricane Andrew, which hit Southern Florida just south of Miami in August, 1992. Furthermore, Burby and Peter (1999) found that building codes had not provided the degree of protection against damage that many expected. Researchers concluded that these are due to the problems of poor code enforcement.

In Turkey, there is a great negligence on the part of building officials to control construction. McPherson (2008) generally found across Turkey building regulation and planning system based on permits and local authorities, with day-to-day supervision largely left to the site professionals.

In India, the problem of the system is of self regulation, though it did not fail completely, it resulted in large scale noncompliance of building codes by the private developers and builders. The failure of buildings in Ahmedabad is attributed to inadequacy for seismic safety and non-compliance of building codes, substandard construction and callous contractors and builders, and lack of regulation and enforcement of building codes, poor quality of construction and poor quality of material (Thiruppugazh, 2008).

In England and Wales, it was found that energy regulation was one of the weakest areas with respect to compliance. In particular, there was a feeling that officers will not refuse certificates or prosecute for failures in this area. This leads to a lack of respect for the regulations by builders (Building Research Establishment, 2008).

In Canada, A study proved poor building codes enforcement is a major cause for low quality buildings products. It was found that many high-rise residential buildings require extensive costly repairs while still relatively new (less than 2 years old, in some cases), (Rousseau, 2000).

In Australia, the Joint Select Committee on the Quality of Buildings (JSCQB) found that the major cause of poor quality buildings was due to building codes violations where principal certifiers were not properly performing their functions; dwellings that meet building codes but are not consistent with approved design. Inadequate building codes are seen to be a contributing factor to poor quality of dwellings, such as sound proofing, thermal and waterproofing standards (JSCQB, 2002).

According to Building Research Establishment (2008) many countries have problems with quality of enforcement of building regulation. **In China**, China's Ministry of Construction reported that while 60% of buildings complied on paper only half of that number complied in actual construction. **In the Netherlands** it was found that between 2003 and 2005 only 12 to 16% of municipalities carried out control of building permit applications (generally – not just for energy issues) and only 7 to 11% carried out control of construction work adequately, and mainly due to the problem of understaffing. Understaffing has also been cited as a shortcoming **in Australia**. **In Denmark**, energy performance certification is mandatory for dwellings, but in practice only about 50% of houses and 25% of flats had certificates five years after implementation. The same results have been reported for **Sweden**, after site checks became non-mandatory, and for **New York**.

The following sections give further details caused due to the problem of insufficient enforcement of building code.

2.16.1 The Lack of Enforcement due to Limited Resources and Technology

Fire code is part of Building codes (ICC, 2009). Sometimes building and fire officials and inspectors are unable to perform their tasks due to limited resources and technology available (Black, 2004). For example, In Northern Ireland, fire protection systems were traditionally quite simple to inspect. Development of addressable systems, the technology, and hence the design codes, became much more complex, making the inspecting of systems more difficult. Therefore, Northern Ireland Fire Safety Panel developed a system to help enforcement authorities to inspect fire detection and alarm systems.

2.16.2 Insufficient Building Codes, Plan Review, and Site Inspection Cause Buildings Failures

A research sponsored by UNESCO investigated common buildings failures in Nigeria which revealed that owners, designers, and contractors blamed building officials for construction failures for not following specified principals before and after building permit approval. The research found that the non existence and lack of enforcement of building regulations, by laws and construction health and safety regulations are major cause of building failures (Ayininuola, Olalusi, 2004).

2.16.3 Poor BC and lax Enforcement Causes Construction Defects

In Australia, the Joint Select Committee on the Quality of Buildings (JSCQB) published a Report on the Quality of Buildings in July 2002 (JSCQB, 2002). The Committee found that the major cause of poor quality buildings was due to building codes; violations where principal certifiers were not properly performing their functions; dwellings that meet building codes but are not consistent with approved design. Inadequate building codes are seen to be a contributing factor to poor quality of dwellings, such as sound proofing, thermal and waterproofing standards. The major problem is due to the fragmentation of the regulatory regime. The enforcement of the Building Codes occurs without a unified system to regulate the process.

The Committee has also identified several issues concerning the Building Code of Australia which requires modifications. These include raising the current minimum standards for noise transmission, revising the Code for waterproofing standards and examining the alternative solutions provisions. In order to improve general knowledge of the Building Codes, the Committee has recommended that consumer access should be improved and that a consumer information booklet be prepared indicating acceptable standards and tolerances for building work capturing both interpretations of Building Codes and quality benchmarks. The Committee recommends that a performance audit to be undertaken for the Compliance Commission (JSCQB, 2002).

2.16.4 Unqualified Building Inspector to Enforce Incorrect Wind Load Provisions

Sometimes there are obstacles for the enforcement of code or regulation. In the case of residential construction, it frequently does not receive the engineering attention needed to comply with the wind load provisions of building codes (McDonald., Smith, Mehta, 1996). Code's standards provide prescriptive requirements for residential design. Unfortunately, these requirements are often difficult for the non-engineer designer to apply and interpret, and even harder for the building inspector to enforce.

2.16.5 Failures in Detecting Damages in Mechanical Equipment Installations due to Poor Inspection Procedures

Cases are presented of failures and damages of the mechanical equipment of various hydro stations, as a result when the building codes are not observed during construction of hydraulic structures

(Lyubashevskii, Martenson, 1990). It was concluded that all requirements of the building codes and standards affecting the technological designing of hydro stations should be adhered to by all participants during the installations of mechanical equipment, as well as by the designers, builder and operators of hydraulic and hydropower structures.

2.16.6 Failure in Detecting Imperfections in Reinforced-Concrete Members Due to Inadequate Inspection Procedures

Poor inspection enforcement during construction, among other factors, was identified as being responsible for the geometrical imperfections of the variations in geometrical quantities of reinforced-concrete members on three large project sites in Nigeria (Udoeyo, 1995).

2.16.7 Poor Enforcement of BC Causes Extra Losses during Hurricanes

It is important to ensure that infrastructure and residential development projects meet the prescribed building codes, standards, and are properly enforced. Fang and Okada (1999) researchers investigating the process of managing natural disaster risk through enforcement of development standards, estimated that better building code compliance and enforcement could have prevented 25% of the insured losses from Hurricane Andrew, which hit Southern Florida just south of Miami in August, 1992.

Investigators picking through the debris left by the Northridge earthquake in 1994 and Hurricane Andrew in 1992 found that building codes had not provided the degree of protection against damage that many expected. Researchers concluded that these are due to the problems of poor code enforcement (Burby, Peter, 1999).

2.16.8 Undetected Buildings Defects Due to Poor Design Review

A study proved poor enforcement of building codes enforcement is a major cause for low quality constructions. Insufficient standards and poor enforcement in preparing building plans cause major structural faults and defects. A study found many high-rise residential buildings require extensive costly repairs while still relatively new (less than 2 years old, in some cases). In 1991, for example, the

Ontario New Home Warranty Program (ONHWP) paid out $20 million for repairs to high-rise condominium buildings (Rousseau, 2000).

The common complaints were of moisture, efflorescence, cracking, drafts, interior staining and corrosion. Many of the problems reported appeared to be the result of poor or inadequate building plans which did not provide enough details to guide the builder. Inspections by designers seemed inadequate as means of quality control. The weak enforcement of building codes is mainly due to the insufficient budgets of local building officials which limit their focus to **structural and fire safety only**. In addition, since in many cases the plans are not complete, it is difficult, if not impossible, for inspectors to determine compliance. Another factor affecting the quality of construction is the lack of expertise and attention to details of the contractor. Successful single-family home builders do not necessarily have the skills required for high-rise construction. It may be worth considering different warranty rates depending on the experience and track record of the contractor, or a third-party inspection system (Rousseau, 2000).

2.16.9 Poor Enforcement of Building Code due to Inadequate Application Form of Building Permit Process

The building permit process involves various stages from application, through plans review, to the issuance of a permit, to building inspection. An important part of the process is the Application Forms. In Canada, Bill 124 introduced a standard application form for all municipalities. It was found that the form was inadequate. It should be updated regularly to reflect the ongoing changes to the Building Code. The form was too complicated, which led a number of municipalities to move plans review staff to front counter inquiry desks to assist builders with their application. This in turn reduced the amount of time reviewers had been available to review plans. The form did not account for the individual characteristics of a municipality. For example, in Richmond Hill, where poor soils are an issue, the municipality has for many years requested information about soil conditions on a site. This is not provided on the standard form. To counter such shortcomings, many municipalities supplement the standard form with a form of their own; in effect making applicants complete two forms (Residential and Civil Construction Alliance of Ontario, 2008).

2.17 The Problem of Insufficient Codes and Regulations in Other Countries

A number of publications were reviewed ***to understand the problem of insufficient codes and regulations in other countries*** [(Frosch, 1999), (Housing Association Property Mutual, 1997), (Olubodun, Mole, 1999), (Geoff,1999), (Building Research Establishment, 1983), (Prevatt, 2002), (Block, 2002), (Vallet, Auzilleau, Lemonnier, 2003), (Melo, Chapnik, 2001), (Ramos, De Carvalho, Dos Santos, Roman, 2003), (Ayininuola, Olalusi, 2004)].

Many researchers and government research bodies in other countries agree on the problem of insufficient codes and regulations. **In the UK**, Housing Association Property Mutual (1997) study confirmed that the majority of building construction defects occurred due to failures to achieve adequate standards. Olubodun and Mole (1999) performed a survey and concluded factors such as age, design, construction, standards, and vandalism pertaining to building defects. UK buildings face an absence of explicit safety criteria (Geoff, 1999). Researchers at Building Research Establishment point out that around half of faults where attributed to design were infringements of building regulations, codes and standards cited in building regulations, and codes and standards not cited in building regulations (BRE, 1983).

In the US, there are some recent changes to the wind load design provisions of the American Society of Civil Engineers Standard, due to costly losses which happened to buildings once the components of the exterior walls and claddings failed (Prevatt, 2002)**.** According to Block (2002) requirements and standards of glazing, skylights, handrails, and glass strength are under development to improve building codes which are concerned with safety performance and quality of buildings. **In France**, Researchers suggest change acoustical requirements for educational buildings in order to prevent noise (Vallet, Auzilleau, Lemonnier, 2003). **In Canada**, Melo and Chapnik (2001) approved the need for structure-borne sound transmission (SBST) as part of the Ontario Building Code (OBC)**. In Brazil,** Ramos, De Carvalho, Dos Santos, Roman (2003) state that the intensive use of masonry as structural material, the parameters and requirements consideration of architectural design suffer from a lack of specification of conceptual design criteria, and technical codes. **In Nigeria,** a research sponsored by UNESCO investigated common buildings failures in Nigeria. The survey conducted revealed that owners, designers, and contractors blamed building officials for the construction failures for not following specified principals before and after building permit approval. The research found that the non existence and lack of enforcement of building regulations, bylaw and construction health and safety regulations are major cause of building failures (Ayininuola, Olalusi, 2004).

The improvement of Building codes to improve concrete durability to minimize flexural cracking in reinforced concrete structures by using thicker concrete covers are rapidly increasing (Frosch, 1999).

The following sections give further details for the problem of insufficient codes and regulations.

2.17.1 Inadequate Building Standards Cause Building Defects

Housing Association Property Mutual (HAPM) investigated data from audit of 31,000 dwellings in U.K. and identified common potential defects for six elements of building construction. These elements are foundations, ground floor, external masonry walls, pitched roofs, separating walls, and intermediate floors. The study confirmed that the majority of defects occur due to failures to ***achieve adequate standards*** through using traditional methods of construction, rather than innovative methods (HAPM, 1997).

Olubodun and Mole (1999) performed a survey and concluded the factors pertaining to building defects. These factors are age, design, construction, standards, and vandalism. They conducted their study to investigate which building components are most vulnerable to these defects factors. They constructed their questionnaire based on these factors as primary causes of 28 defects previously identified from repair data base of a large local authority housing department. Then, they asked 100 surveyors to rank their perception of failure associated to each factor, and they got 45 responses.

2.17.2 Insufficient Fire Safety Standards

Accurate development of the documents of building codes is very vital. UK buildings face absence of explicit safety criteria (Geoff,1999). A researcher suggests that a framework for future standardization activity is needed in order to arrive at a wholly compatible package of national fire safety standards, which will be a help to all and a hindrance to none.

2.17.3 Insufficient Code for Wind Load Design Cause Costly Losses

There are some recent changes to the wind load design provisions of the American Society of Civil Engineers (ASCE) Standard, ASCE 7-98, that apply to exterior building walls structural systems of fully engineered buildings perform adequately during extreme wind events, however costly losses happen to buildings once the components of the exterior walls and claddings fail (Prevatt, 2002)**.**

2.17.4 Insufficient Code for Reinforced Concrete Cause Flexural Cracking

Building codes hinder building defects (Frosch, 1999). In the case of flexural cracking in reinforced concrete structures, the ACI Building Code requires control of this potential defect. Therefore, the uses of thicker concrete covers are rapidly increasing, because of durability concerns.

2.17.5 Insufficient Code for Glasses Causes Problems for Glazing and Skylights

Building codes are concerned with safety performance and quality of buildings and building's components (Block, 2002). For example, glasses in buildings in the United States are under development due to the adoption process of building code requirements and standards related to safety of glazing, skylights, handrails, and glass strength.

2.17.6 Insufficient Code for Acoustical Problems in Educational Buildings

Development and upgrading of Building Codes is a continuous process to fulfil the codes' objectives. An example is the acoustical requirements for educational buildings in France (Vallet, Auzilleau, Lemonnier, 2003). These requirements are indoor insulation from room to room, shock noise insulation, noise from indoor and outdoor equipments, acoustical control for the large rooms and for corridors, and insulation from outdoor. Researchers agreed that these new regulations apply to new built schools or new parts of the old buildings, and do not apply to existing old buildings.

2.17.7 Insufficient Code for Structural Masonry Increases Construction Costs and Cause Potential Failures

The Code of practice or approved design and construction methods are essential in any building and construction industry. In the case of intensive use of masonry as structural material, the parameters and requirements consideration of architectural design suffer from a lack of specification of conceptual design criteria, and technical codes (Ramos, De Carvalho, Dos Santos, Roman rvalho, 2003).

Researchers from Brazil demonstrate that technical codes ensure that the architectural design is adequate for the structural masonry in terms of design modulation, rationalization, simplicity of construction, reduction of construction costs and avoiding potential failures.

2.18 The Problem of Infringement of Codes and Regulations in Other Countries

A number of publications were reviewed ***to understand the problem of*** **infringement** ***codes and regulations in other countries*** [(The Standard, 2009)**,** (Commission of Investigation, 2005)**,** (Legislative Audit Division, 1997)**,** (BRE, 1983), (Ilozor, 2003)].

In Canada, the law punishes buildings owners for violations of codes and an owner of an apartment building was fined $18,750 in court for sprinkler system violations (The Standard, 2009). **In the US,** there was waste, fraud and abuse of Building Codes in New Jersey which had deficient and improper construction codes along with, subversion of inspections and code enforcement, negligent government oversight and regulation, and inadequate consumer protection and remediation (Commission of Investigation, 2005). Another study in the US found infringements of building code related to Minimum Roof Weight-Bearing Standards could cause hazardous incidences, and significantly decreases the life of buildings (Legislative Audit Division, 1997). **In the UK**, the Building Research Establishment carried out a survey under construction houses which identified hundreds of faults, around half of which faults were attributed to improper design, infringements of building regulations, codes and standards (BRE, 1983).

The following sections give further details of the problems caused by of infringement of codes and regulations.

2.18.1 Waste, Fraud and Abuse of Building Codes in New Jersey

The Commission of Investigation in New Jersey opened an investigation into new-home construction and inspection issues in July 2002 after receipt of a referral from the Office of the United States Attorney in Newark involving complaints filed by new-home buyers. Rigorous investigation and analysis confirmed an astonishing state-wide panorama of waste, fraud and abuse. Casting a broad net that reached into every corner of New Jersey, the Commission found a system in which the public trust has been thoroughly shaken by graft, by greed and incompetence and by the failure of government to fulfil its fundamental duty to protect the safety and welfare of citizens. This is a system mired in the past, a system utterly incompatible with 21st century standards and expectations, a system that, in many respects, is as fractured and as imperilled by structural flaws as the problem-plagued homes it has produced (Commission of Investigation, 2005).

The research project was based upon a thorough investigative record developed over the course of more than two years, including (1) interviews and sworn testimony from scores of witnesses, (2) field surveillances, (3) accounting analyses, and (4) examination of thousands of pages of documentary evidence obtained from builders, homeowners, local construction code officials and regulatory personnel. Overall, 234 subpoenas were issued, more than half calling for the production of records and documents. Sixty-four individuals provided sworn testimony before the Commission in private executive session. In addition, Commission staff conducted nearly 400 field interviews (Commission of Investigation, 2005).

The Commission's key findings fall broadly into four major areas such as deficient and incomplete construction, subversion of inspections and code enforcement, careless government oversight and regulation, and inadequate consumer protection and remediation. Deficiencies in new-home construction in New Jersey are enabled and exacerbated by an inspection and code enforcement system whose ability to function properly has been weakened by insufficient resources, by inspectors unskilled and unschooled in changing technology and by the sheer volume of construction across the state. In extreme instances, the integrity and credibility of this system have been eroded by incompetence, conflicts of interest and outright corruption (Commission of Investigation, 2005).

2.18.2 Infringements of Regulations the main Cause of Building Faults

The Building Research Establishment carried out a survey of housing under construction which identified hundreds of faults. Around **half** of which were attributed to design because of ***infringements of building regulations, codes and standards cited in building regulations, and codes and standards not cited in building regulations*** (BRE, 1983). Most failures ***or performance shortfalls*** can be traced back to ***contravention of requirements*** (e.g. contained in Building Regulations) or authoritative advice (e.g. contained in BSI Standards and Codes) or in the publications of well-recognized professional, or commercial or research bodies. It is assumed that the performance requirements defined in these authoritative documents are both necessary and reasonable. Contraventions of these requirements have been defined as ***fault*** (BRE, 1983).

Another study conducted by BRE (1988) on technical quality of design and construction of new housing revealed 955 different kinds of faults in low-rise, mainly two-storey housing. Significant factors that led to these defects were inadequate design information and poor site practice. Half of these faults were caused by site conditions, while slightly fewer due to design, and others related to materials and components (Ilozor, 2003).

2.18.3 Infringements of Minimum Roof Weight-Bearing Standards main Causes of Collapsed Buildings

Inappropriately constructed buildings can result in hazardous incidences, or significantly decrease the life of buildings. During the winter of 1996-97, at least 37 buildings collapsed in the Lincoln county area resulting in estimated damages of $3 to $4 million. According to insurance representatives and building officials, many of these structures collapsed because they did not meet the minimum roof weight-bearing standards. During the same year, a riding arena collapsed under the weight of snow due to a design which did not comply with codes. Building officials indicated the footings and foundation which support the building were not reinforced and the entire building subsequently collapsed (Legislative Audit Division, 1997).

2.19 Summary

This chapter is a review chapter for the subject of building codes. This section summarizes the main findings of the literature review of basic elements of building codes, its enforcement, and problems relating to research objectives.

Parts of the objectives no. 1, 2, 4, and 7 are fulfilled through the review of literature of previous work in the subject, and building codes and their enforcement. This chapter reviews definitions of building code, importance and benefits of building codes, history of building codes, aspects of building codes, code structure and contents, uses of codes, administration and enforcement of building regulations/codes, building department operations, selection and adoption of codes, standards in codes, model code organizations in the world, building codes types, performance and prescriptive building codes, the relationship between the problems of buildings and building regulations enforcement process, and the problem of building codes in other countries such as the problem of insufficient enforcement of building codes, the problem of insufficient codes and regulations, and the problem of infringement of codes and regulations. The key points are the following:

- Historically, building code development ***occurred in response to tragedy rather than prevention***.
- The advent of model building codes has made possible the control of construction in many communities that had previously found it physically impossible or financially impractical to produce codes of their own. It also made it possible for those communities utilizing archaic codes to replace them with well written and maintained model codes.
- The area of building codes is dived to four aspects, legislative, social, administrative, and technical.
- The building codes should be arranged and grouped in a logical format, which makes the codes "user friendly".
- Various benefits accrue from building regulations.
- Building codes are administrated in two parts .The first part usually covers administration and enforcement, and the second part covers requirements for design and construction.
- The most important forms used by the building inspection department are the permit forms which authorize construction or installation of specified work.
- Site inspections are necessary to ensure that the permit holder does not deviate from the approved construction documents and drawings during the course of construction.
- The building department is a law enforcement agency within a local jurisdiction. Its main function is to enforce building codes.
- The key personnel of building department usually are director of code enforcement, plan examiners or reviewers, and building inspectors.
- Codes are adopted through model code organizations.
- Standards are different than codes. Standards are not enforced by laws as codes.
- There are many codes organizations in the world. These organizations usually produce building codes for its countries and other organizations provide model codes and support for other countries to adopt their codes technologies.

- There are three kinds of building codes each with different objective. These are prescriptive or descriptive building codes, performance based building codes, and a third type which is a combination of the previous two.
- Performance Building Code is to provide a reasonable level of health, safety, and welfare, to protect the public from the risk of death or energy and to limit damage to property from unintentional and natural events which are expected to impact buildings and structures.
- The application of performance based building regulations can encourage the use of alternative construction methods and materials.
- The purpose of prescriptive building code is to establish the minimum requirements for safeguarding the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and properties from fire and other hazards attributed to the built up environment.
- The reviews identify the need to change building regulations and its enforcement in many countries due the problems of insufficient building codes and its enforcement.

The next chapter presents the summery of Insufficiencies Factors Related to Problems of Building Regulations, and Codes in Kuwait.

Chapter Three

Built Environment, Construction Practice, and Problems of Building Regulations, & Codes in Kuwait

Chapter Three:

Built Environment, Construction Practice, and Problems of Building Regulations, & Codes in Kuwait

In accordance with the research objectives, this chapter seeks to review work done earlier on the subject, how building codes/regulations are enforced and penalties imposed thereon for non-compliance. Moreover, it seeks to ***identify insufficient and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait***. This chapter also seeks to review the construction environment in Kuwait, and to introduce general and realistic picture about Kuwait's building traditions, history, and advancement.

This chapter has four sections. Section 3.1 reviews the construction environment in Kuwait; Section 3.2 building and construction practices in Kuwait; Section 3.3 building regulations and codes in Kuwait; Section 3.4 overviews problems of building codes and its enforcement in Kuwait; Section 3.5 reviews BC Legal Problems in Kuwait; Section 3.6 reviews BC Administrative Problems in Kuwait, Section 3.7 reviews BC Technical Problems in Kuwait, Section 3.8 reviews BC Social Problems in Kuwait and Section 3.9 is the Summary.

3.1 Kuwait and the Built Environment

3.1.1 Introduction

This section describes the site and climate in Kuwait, The Nature of Surface, Civil Construction after the discovery of oil, Modern Kuwait, City Planning, Parts of Civil Construction, Down Build (Utilities), Network of Roads and Rain Drainage, Health Drainage Network, Services, Residential Areas, Housing Units, Residential Care, and the Sort of Buildings in all regions. It gives a clear picture of the building environment in Kuwait.

It is essential to study the building and housing environment in Kuwait. Many countries around the world have similar building regulations system. The development of building codes in a particular country or city should consider the environment factors such as the climate, topography, natural building material, and soil conditions along with the economic and housing ideology of the country and its people.

3.1.2 Location of Kuwait

Kuwait is situated to the North West corner of the Arabian Gulf between latitude 30 and 28 North and between longitude 46 and 49 east, Iraq lies to the North and North West and the Kingdom of Saudi Arabia lies to the South and South West. The area of Kuwait is 818.17 km (Fig. 3.1) (Al-Saned, 1994).

Fig. 3.1: Kuwait Map and Boundaries

3.1.3 The Climate of Kuwait

The months of June and July bring in more winds compared to other months. During this time the north-westerly winds increase in velocity and bring more dust resulting in decreased visibility. The main features of Kuwait's climate are high temperatures from April to October with the average temperature in May 40^{o}C which then gradually increases to 50^{o} C in August (Al-Ajmi, 1987).

3.1.4 Nature of Kuwait's Surface

The topography and environmental factors are highly important in choosing the construction sites. Kuwait is distinguished by a levelled surface with few high grounds and low levelled areas. The high ground height is about 300 meters to the north from the sea surface in the south west. Kuwait's surface is composed of some sandy plains embedded by dry valleys such as Al-Batten valley {the land between Kuwait and Iraq}, and also the Ababa plain in the west. It is apparent that Kuwait's land surface is almost levelled so the topographic factor has no much value in choosing housing sites.

3.1.5 Civil Built Before Oil

Much of Kuwait's old view has disappeared following the discovery of oil and the resultant wealth which has greatly reflected upon the life in Kuwait, particularly the construction industry which has seen more changes due to modern construction planning.

Kuwait has been opened to the sea for three centuries; the distance is increasing to 300 KM (EPA, 2002), (Fig. 3.2). The old Kuwait was surrounded by a wall from sea to sea to protect the life and property of people. The fence had many openings. These openings linked Kuwait City with the desert, the cities and neighbouring countries.

Fig. 3.2: Map of old Kuwait

The old Kuwait was divided into many quarters. These quarters contained a group of houses. People knew each other. They met in mosques and majlis (guest room) , while their sons met in schools and on playgrounds (Figure 3.3).

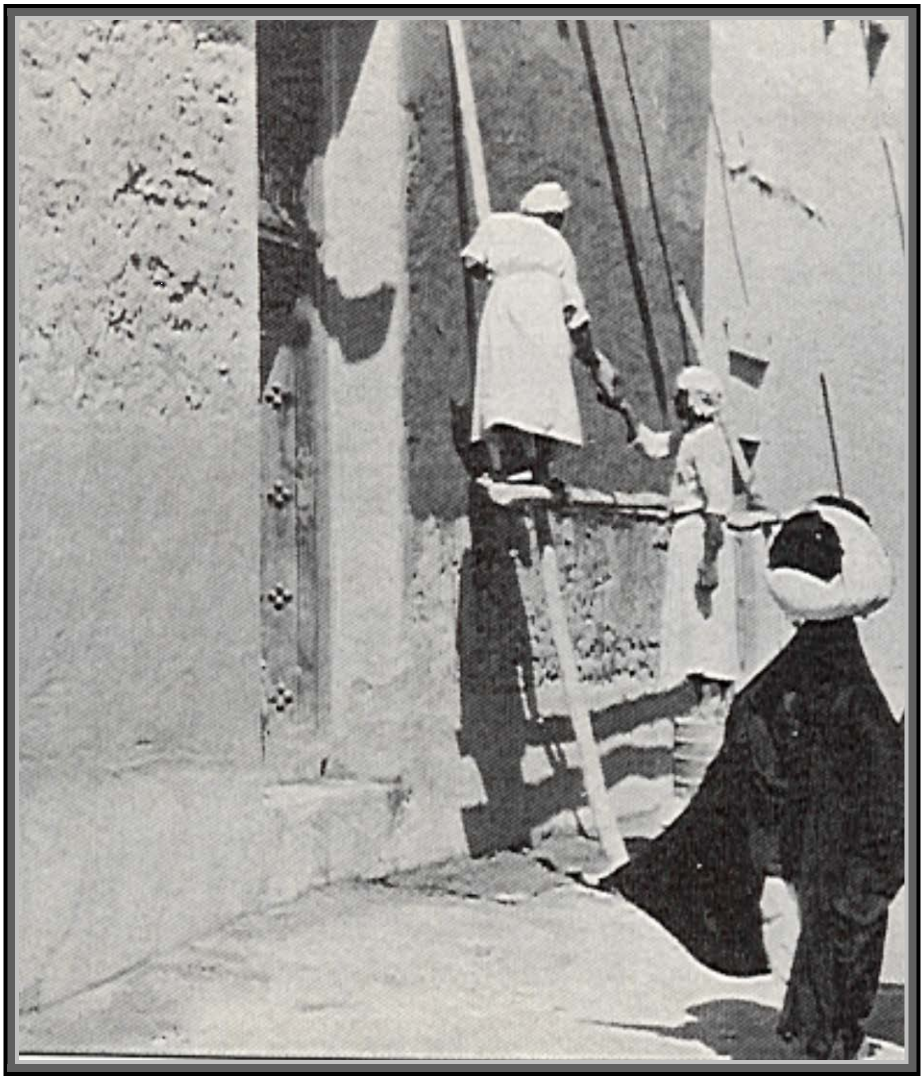

Fig. 3.3: Picture shows one of the old Kuwait streets; one of the boys in the quarter and the builder (Al-Hijji, 1997)

The areas of these houses were very small, but they provided enough services to the people. The roads were narrow and unpaved. The building materials which were used were simple ; mud from the sea and clay or raw brick made from mud and water (Figure 3.4, and Figure 3.5).

Kuwait began building its first cities on the south side to accommodate the increasing population over the years. The houses were built as and when the need arises. The shape of the houses was according to the builder's vision and as merited by the skill of the labourers' merits that suited life's demands.

Fig. 3.4: Typical quarter in The Old City (Al-Hijji, 1997)

Fig. 3.5:An Aerial View of Old Kuwait City (Al-Hijji, 1997)

3.1.6 Civil Construction after the Discovery of Oil

Generally, life changed rapidly in the Arabian Gulf, especially, in Kuwait after the Discovery of Oil. In the past, life depended on work In land and in the sea, while for those dwelling in the desert it became easier and more comfortable after the Discovery of Oil (Al-Hajji, 1997).

Fig.3.6: The New Kuwait City

This dynamic growth in construction was accompanied by change in building styles and types (Fig. 3.6, and Fig. 3.7). The old mud houses gave way to progressive buildings of all shapes. The oil economy and foreign investments generated more revenue and this gave a rise to the construction of more buildings, roads, and factories and useful civil buildings (Table 3.1). Kuwait relied on the expatriate workforce to perform various tasks on various projects particularly in the construction sector.

Fig.3.7:The New Kuwait City (Kuwait pictures, 2003)

New Construction Works	Households (Families)	Private Business Sector	Government	Total	No. of Establishments
Grand total	102,430	90,490	290,561	483,481	1,287
Residential buildings	58,746	35,304	40,573	134,623	347
Non-residential buildings	2,196	26,216	70,139	98,551	101
Roads, streets, and bridges	0	213	27,288	27,501	18
Water mains and sewage systems	0	0	32,470	32,470	15
Electricity networks, telephone, and telegraph	0	0	3,392	3,392	6
Power projects	736	356	46,468	47,560	23
Harbour	0	0	5,113	5,113	6
Natural gas and oil pipe lines	0	0	15,935	15,935	9
Natural gas and oil well drilling	70	354	6,759	7,183	8
Other public utilities	5	3,787	8,643	12,435	18
Cement brick laying	0	0	0	0	1
Stone brick laying and stone setting	885	98	0	983	9
Floor laying and tile setting	74	3	0	77	5
Lathing and painting	912	47	85	1,044	47
Metal ceiling and decoration	5,452	2,277	1,139	8,868	166
Marble setting	168	36	0	204	5
Ceramic and porcelain setting	223	0	0	223	1
Foundation concrete works	784	28	154	966	13
Other special contractors	0	0	5	5	1
Sanitation systems	5,486	1,152	25	6,663	245
Electrical insulation and repair	7,453	4,152	10,836	22,441	173
Heating and air-conditioning systems	17,933	10,675	9,962	38,570	87
Elevator insulation	518	2,967	3,826	7,311	7
Glass and mirror	80	40	0	120	2
Insulation work	27	73	39	139	5
Insulation of fire protection	79	2,598	7,566	10,243	11
Others	603	114	144	861	-

Table 3.1: New construction works recreated by main contractors classified by the type of investor (Ministry of Planning, 1997) *Values are in 1000 Kuwaiti Dinar (1 KD = £2)

3.1.6.1 Modern Kuwait City Planning

Kuwait was surrounded by a fence from sea to sea that linked it with the desert through openings and sites in the Arabian island. The city sectors were in the main regions. The city was an Islamic city with these main components ; A palace for the governor and administrator, a big mosque, adjacent residential quarters, the relevant markets ,fences and openings (Al-Awadi, 2002).

It had 3 sectors: The sea sector was composed of the seaside; the commercial sector facing the beach; and the residential sector in the inside.

Three types of societies appeared in the city these are:

- The civilized type that lived inside the fence ; people who worked in the sea or were traders/merchants.
- The rural type was the tourist village outside the fence such as: Abu-Halifa, Fintas ; these people worked as farmers or as fishermen.
- The Bedouin type lived in tents surrounded by the fence either on the outside or inside ; they worked in the desert in the field of transportation or animal rearing.

This stage continued till the beginning of the 1950s until the discovery of oil, which led to the appearance of civilized planning and civilized spreading. The Kuwait City can now be distinguished by its outlook before the discovery of oil , features of this stage disappeared very fast by many factors:

First:

Initially, the government gave money to people to move from the city centre to the suburbs.

Second:

The civil plans appeared in the entire country:

- First, the Master Plan extended to the Second Ring Road.
- The Master Plan of the Municipality in 1967 extended to the Fourth Ring Road and the beginning of the Fifth Ring Road and in the south along the beach.
- The Master Plan of 1977 till the Seventh Ring Road
- The Master Plan of 1983 extended increasingly to the interior.
- The Third new Master Plan extends to year 2015 and is spread over to far limits.

Third:

The Kuwaiti households was affected by the inside fence during the civil discipline.

3.1.7 Parts of Civil Construction

3.1.7.1 The Underground Services and Utilities

It is the essential services that should take care of the residential units such as electricity, water, telephone and drainage networks, paved streets and general roads (Table 3.2).

Residential Construction	Industrial Construction	Heavy Engineering Construction	Building Construction
▪ Single-family homes ▪ Town houses ▪ Condominiums ▪ High-rise apartments	▪ Petroleum refineries ▪ Petrochemical plants ▪ Synthetic fuel plants ▪ Nuclear power plants ▪ Steel mills ▪ Heavy mfg. plants	▪ Urban transit systems ▪ Communication networks ▪ Water treatment plants ▪ Highways ▪ Airports ▪ Dams ▪ Ports ▪ Pipelines ▪ Bridges ▪ subways	▪ Light manufacture's plants ▪ Government buildings ▪ Hospitals ▪ Recreation centres ▪ Office towers ▪ stores ▪ Schools ▪ Theatres ▪ Universities ▪ Commercial centres

Table 3.2: Examples of parts of civil construction and facilities classified by sector – U.S. 1992 (UDC, 1992)

3.1.7.2 Network of roads and rain drainage

The roads network in Kuwait has a good planning and high efficiency. It applies the world's specifications and achieves easiness of movement among regions. This network contains rain water drainage network to control the increasing water when necessary. These networks require maintenance for smooth running.

3.1.7.3 Health Drainage Network

The network extend to all residential units and all service units to carry drain water into the sea. The state of Kuwait decided that there will be no draining into the sea. Any un-purring water will be handled forth and reused to increase the green lands.

Kuwait had a great interest to provide the necessary services to all residential units for the comfort of all inhabitants whether they are religious, educational, health, public, 0r commercial facilities. The state looks forward to increase the efficiency of these services in the Master Plan according to the growth of population over the years.

Fig. 3.8: The Entertainment City north of Kuwait City (Kuwait pictures, 2003)

The services

- Religious facilities: comprise of mosques, religious institutes and good assemblies.
- Educational facilities: comprise of schools, institutes, faculties, universities and general libraries to ensure the rights of citizens in education.
- Health services: comprise of health centres; hospitals, clinics etc., that introduce good healthcare for citizens.
- Social services: comprise of youth centres, childhood and motherhood care centres to emphasize the role of women and youth and to prepare 'them to be good future citizens.

- General facilities: comprise of police stations, general assemblies, co-operative societies, establishments and government ministries to provide services for all people (Fig. 3.10).
- Recreational facilities: comprise of gardens, sports' clubs, beaches and coastal regions (Fig. 3.9).
- Commercial facilities: comprise of shopping malls, commercial markets, etc.

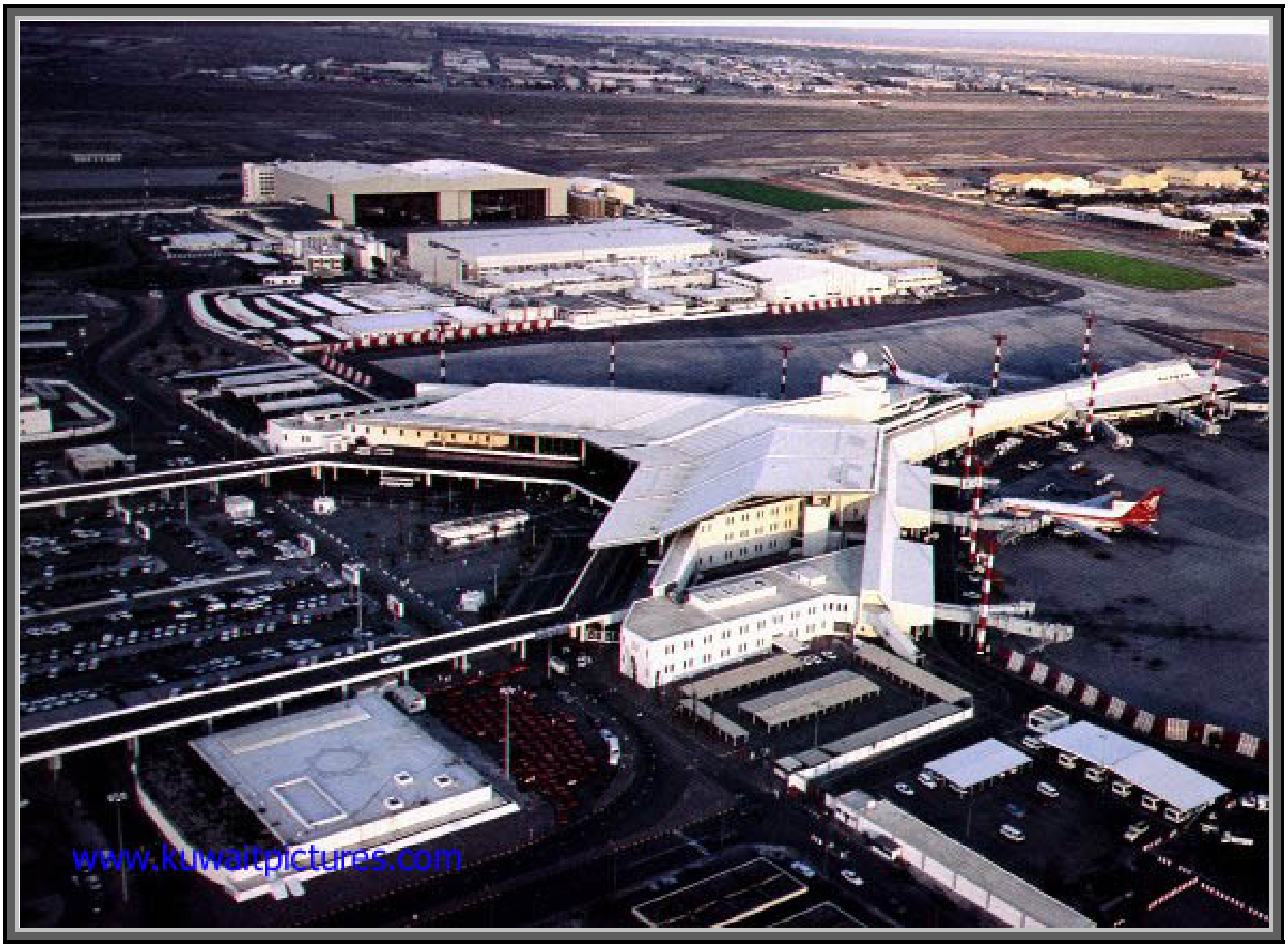

Fig. 3.9: Kuwait International Airport (Kuwait pictures, 2003)

3.1.7.5 Residential Area

The residential area consists of housing units as designated in the Master Plan prepared by the Kuwait Municipality (EPA, 2002; Kuwait Municipality, 1997). The residential regions in Kuwait vary from region to region whereas some of them contain model-housing units. Some regions contain commercial centres along with housing units.

3.2 Building and Construction Practice in Kuwait

3.2.1 Introduction

This section describes statistics, construction process, problems of practice , the cost of projects, and the cost of average housing project. It gives a clear picture of the type and practice of building projects in Kuwait.

3.2.2 The Importance of Building and Construction in Kuwait

Kuwait has been witnessing a prosperous construction boom over the past forty years (Al-Azmi, 1997; MOP, 1997; MOP, 1995). According to the Central Bank of Kuwait, the construction and real estate industry occupied 33.25 percent of the Gross Domestic Product of non-oil revenues (Kartam, 2001), and according to the Gulf Global Investment, the private housing projects claimed 94 percent of the total construction and real estate industry in 2003 (GIH, 2003). At the end of 1998 the total number of housing units in Kuwait was 298,401; the private housing accounted for 75%, and the governmental share was 25% (Khatab, 2000).

3.2.3 Strategic Plan for Administration and Organizing Building Industry

Building regulations are legal requirements adopted by the public policy makers to reflect as closely as possible the society's minimum expectation from the construction environment (CIB TG37, 2001). The countries and governments develop visions, directions and strategic plans to organize their building and construction industry.

The Institute for Research in Construction (IRC) is the leader in research, technology and innovation for the Canadian construction industry. The IRC has developed a comprehensive set of five objectives to realize its vision (IRC, 2004). The first objective is to excel in research and development areas critical to Canadian construction needs; the second is to be a gateway for construction technology nationally and internationally; the third is to provide an objective and efficient link between technology development and its implementation and commercialization; the fourth is to support the development of a nationally accepted codes system, which encourages innovation and the fifth is to create a fulfilling workplace conducive to creativity and innovation.

According to a senior official in Council of Ministers there is a lack of strategic planning for administration and organizing the building industry (A. AL-Jowder, personal communication, 2005).

Statistics and indicators for the Kuwait construction volume and legal cases are not available either from the Ministry of Justice or from the Kuwait Municipality (A. ALJaser, personal communication, 2003). Therefore, the status of performance, technology development and its implementation in building industry of Kuwait are ambiguous.

3.2.4 Different Causes of Professional Practice and Workmanship Standards

The Productivity Commission investigated the building codes and regulations to look at issues that affect the efficiency (The Productivity Commission, 2004). These causes are technical, regulatory, administrative and social, which imbues professional practice and workmanship standards in building projects. In the case of Kuwait, political reasons may have played an important role in the Kuwait Municipality and the Municipal Council (AL-Qabas, 2003; ALKorafi, 2002; Khalifa, 2002; Abdul-Ghani, 2000).

3.2.5 Kuwait Construction and Inhabitant's Statistics

The Total number of inhabitants in Kuwait was 2753656 on 31/12/2003. The total population of Kuwaiti families is 1365121. The total population of private homes is 122343. The total workforce is 183337 and the total workforce in the construction sector is 115163. Table 3.3 shows the number of buildings in Kuwait. Table 3.4 shows the number of inhabitants per governorate (Public Authority for Civil Information, 2004).

Governorate	House	Building	Part of Building	Traditional	Under Construction	Other	Total
Kuwait City	20291	703	356	3610	361	21	25342
Hawally	19670	5726	29	1680	830	12	27947
Ahmadi	22472	1953	3010	4468	515	3	32421
Jahra	19206	229	150	7043	723	3	27354
Farwaniya	21666	2334	70	2649	748	4	27471
Mubarak Al-Kabir	19039	72	53	1644	402	0	21210
Total	122344	11017	3668	21094	3579	43	161745

Table 3.3: Building type in every governorate as on 31/21/2004

Governorate	No. of inhabitants
Kuwait City	203165
Hawally	163884
Ahmadi	195872
Jahra	100869
Farwaniya	179498
Mubarak Al-Kabir	111983
Total	963

Table 3.4: Number of inhabitants per governorate as on 31/11/2004

3.2.6 Limitations of Construction Practice and the Cost of Private Housing Projects

It is very common in Kuwait that the owners supervise the construction of their villas (Haque, 2003). Since there is no active building codes and enforcement, the majority of owners in Kuwait act as general contractors when they decide to build their homes or when they intend to embark on renovation works (Al-Fahad, 1998). Most of them are inexperienced; therefore, major and minor defects appear during and after the construction process. The major defects and consequences surface clearly during the operation stage. This, undoubtedly, will result in an enormous number of additional maintenance repairs; loss of huge financial resources, and other hazards. The minimum cost of building a private home in Kuwait is approximately KD 70,000 (=£140,000). Fig. 3.10 shows the construction of a typical villa in Kuwait.

The process of building private homes usually begin by the allocation and purchase of a plot of land, preparation of architectural and structural designs, assigning the work to a contractor and/or subcontractor and ends by the owner occupying the house.

Usually, articles of agreement (Owner/contractor) are not effective, in particular for the private housing projects. Municipality and other organizations could not develop criteria for this issue. Furthermore, insurance companies in Kuwait have no effective role in insuring and preserving quality of building construction works (Al-Fahad, 1998).

A typical housing project begins with the preparation of plans which take from (one month to 45 days), receiving documentation about boundaries from the Municipality and signing a contract with the engineering supervising office (14 days maximum), followed by a check on the soil (7 days). The owner then chooses the frame contractor (it takes 20 days for an experienced owner to lay down his needs and up to 3 months for inexperienced person). This stage includes choosing contractors and companies to carry out plumbing, electricity, and A/C works. The preparation of project contracts for frame, plumbing, electricity, and A/C, and revising them with the lawyers and contractors' offices will take 7 to 10 days. The construction of the frame and brick work will take nearly 107 days. Completion of work will take about 150 days (Interview. 22 May 2002).

A typical project will pass through many consequent stages within a specified duration and budget. This applies for all construction projects whether big, special residential, private or government.

Fig 3.10: Construction of a typical villa in Kuwait

Unfortunately, most owners who are engaged in building their homes, do not have the required knowledge or the experience to supervise the design and construction process and to follow up securely the sequence of works and the cash-flow status requirements.

In addition, there isn’t an assistance from government plan review and inspection bodies, because of the absence of compulsory building or construction codes, and the duties of revision of plans, specifications, contracts, and inspection or following construction works are mostly not part of their responsibilities.

Based on the Municipality requirements, the owners have to assign a supervisor from an engineering office to follow reinforced concrete frame works. Unfortunately, most engineering supervisors are not professionals. There aren't any principles, standards, or procedures to conduct proper supervision. Guarantees related to design and supervision that are offered by engineering offices to Municipality are ineffective to control/prevent violations or cheatings. Testing of building materials and concrete by certified testing centres get neglected, and many violations during periods after finishing construction usage.

Moreover, many owners deal with unlicensed contractors and those who deal with such people usually find out that they are not qualified (Al-Ali, 1997). Government regulations require certification of contractors and tradesmen based on their technical qualifications. However, certification is not enforced.

The owners tend to act like general contractors, who supervise the construction process from the beginning till the end. This situation will usually end up with projects that are over budgeted by increasing the cost from [10% to 30%], and behind schedule along with a series of disputes between the owner and his contractor (Al-Fahad, 1998).

This matter forces the owner to go through the process of the project management until the end, starting from the planning and scheduling phases and then pass through the budget and the cost control phase and hopefully end with the maintenance period supervision phase. Bearing in mind, he has to assign powerful forms of contracts with his design office, structural concrete contractor, finishing, and electro-mechanical sub-contractor etc .. as well as his materials suppliers.

Usually common procedures for private housing projects are done by preparing temporary inapplicable electricity plans by the engineering office to get building permit from the Kuwait Municipality. After that, the electricity contractor prepares the electricity plan to be implemented and endorsed by the Ministry of Electricity. Preparation of temporary inapplicable electricity plan is added to the cost of the project.

The air-conditioning plan is not prepared by the engineering office, but by the air-conditioning contractor who tries to save money that causes poor low quality air-conditioning, and improper architectural view.

3.2.7 Estimated Cost of an Average Housing Project

The following is an example of cost details for an average typical private house project which shows that the reinforced concrete works have the highest percentage cost from the total cost of the project. Table 3.5 shows further details. The following is the project description:

- **Type of Building:** Private housing project
- **Description:** Two floors and a basement
- **Year:** 2004
- **Location:** Confidential
- **Lot Area** = 400 m2
- **Building Area =** 800 m**2**

Div. No.	Division Title	Cost (K.D)(1 K.D. = 2 £)	%
1	Design (plans, specifications & permits)	750	3.07
2	Soil tests	100	0.14
	General Requirements		0.00
3	Site work	500	0.71
4	Reinforce concrete	**22850**	**32.64**
5	Masonry (brick works)	4000	5.71
6	Metals	1500	2.14
7	Thermal & moisture protection	3000	3.29
8	Doors & windows (aluminium)	4000	5.71
9	Carpentry	1500	2.14
10	Decoration	1500	2.14
11	Paints	800	3.14
12	Facade	6500	8.29
13	Grounds	4000	5.71
14	Plastering	1500	2.14
	Total Design and Civil Works	**52500**	75.00
	Mechanical	3500	5.00
15	Fire Fighting	0	0.00
16	Plumbing	4000	5.71
17	HVAC	7000	10.00
	Electrical		0.00
18	Electric and Communications Work	3000	3.29
	Total Project Cost	**70000**	100.00

Table 3.5: Estimated cost of an average housing project

3.2.8 Typical House Project Process (Procedures):

The following description is for project stages in the local market for building private homes in Kuwait and their associated time for every stage (Interview. 22 May 2002):

1. Preparation of plans (one month to 45 days).
2. Receiving lot boundaries from Municipality and contract with engineering supervising office (14 days maximum).
3. Performing soil investigation (one week due to routine).
4. Choosing of structural contractor (20 days for knowledgeable owner to 3 months for inexperienced owner). This stage includes choosing contractors and companies to carry out plumbing, electricity, and air-conditioning works.
5. Preparation of project contracts (frame, plumbing, electricity, and A/C), and revising them with lawyers and contractors' offices (7-10 days).

- **Procurement of Building Materials:**

  When the owner wants to benefit from government support for subsidy in building materials, he should file an application to get the material and receive it from the lending bank. To receive reinforced steel, it requires a maximum of two months and receives the cement requires two weeks. The owner should have a place to store the materials.

6. Implementing and excavating works for 400 m^2, 3m deep (max. 1 week)
7. Implementing of normal concrete cleaning layer for land service (one day).
8. Implementing of water proofing for cleaning layer in case of existence of basement (two days).
9. Pouring of normal concrete layer for the protection of land surface in case of existence of basement (one day).
10. Putting of site fence (wooden fence).
11. Implementing the nets to determine columns centres (one day).
12. Making wooden formworks for ground footings and beams, and extending of plumbing pipes draining by the plumbing contractor (two days to 3 days)
13. Installing steel reinforcing for ground footings and beams (one day).
14. Straightening up wooden formworks for ground footings and beams (1 day).
15. Pouring concrete on ground footings and beams concrete (one day)
16. Comfort period (two days). Wooden formworks don't dissemble before 48 hours of pouring concrete. Many times, this requirement is ignored by dissembling wooden formworks after 24 hrs.
17. Dismantling of wooden formworks, painting the ground footings and beams with insulation for humidity, for example (primer) (one day).
18. Filling up ground footings and beams with soil (one day).
19. Implementing of cleaning layer of normal concrete (one day).
20. Sheltering of wooden formworks for columns and basement walls (3 days).
21. Installing steel reinforcement for columns and basement walls (1-2 days).
22. Straighten up and closing of wooden formworks for columns and basement walls.
23. Concrete pouring for columns and basement walls (one day)
24. Comfort period (two days).
25. Dismantling of wooden formworks for columns and basement walls (one day).

26. Insulating of basement walls with humidity insulation (one day).
27. Filling up of external basement walls (one day).
28. Pulling of wooden formworks for roofs (slabs and higher beams) for basement (4 days)
29. Installing of steel reinforcing for basement roofs (slabs and higher beams). Also, extending of electricity points, and plumbing drainage (2 days).
30. Pouring of basement roofs concrete (one day).
31. Slabs and higher beams wooden formworks are not removed except after 14 days.
32. Pulling of wooden formwork for ground floor columns (2 days).
33. Installing of steel reinforcing for ground columns (one day).

- **Following of Methods Contrary to Engineering Standards:**

  The Syrian Formwork method is by carrying (loading) structure loads of building on walls. Building of all first floor walls and thresholds of doors and windows are before performing the roofs of slabs and higher beams. It leads to collapse in case of removing or maintaining or restoring walls. It saves time and cost. The Egyptian Formwork carrying (loading) method is safer and stronger. It is bearing structure loads of building on columns, roof slabs, and higher beams. In all cases, it is a must to follow available contract specifications and the Kuwaiti Standard Specifications.

34. Closing and binding of wooden formwork for first floor columns and checking supports (one day).
35. Pouring of concrete for ground floor columns (one day).
36. Dismantling of wooden formwork for ground floor columns except after 48 hours (2 days).
37. Dismantling of ground floor columns (one day).
38. Binding of wooden formwork for ground floor roof (slabs and higher beams) (4 days).
39. Installation of ground floor roof steel reinforcement, extending of electricity drainage, plumbing and A/c pipes (2 days)
40. Closing and binding of wooden formworks for ground floor roof (1 day).
41. Pouring of concrete ground floor roof slab (one day).
42. Installation of wooden formworks for first floor columns (two days).
43. Making of steel reinforcement for first floor columns (one day).
44. Closing and binding of first floor columns (one day).

45. Pouring of concrete for first floor columns (one day).
46. Wooden formworks are not removed for first floor roofs (14 days).
47. Binding of wooden formworks for first floor roofs (4 days)
48. Making of steel reinforcing for first floor roofs (2 days).
49. Closing and binding of first floor roofs (one day).
50. Pouring of concrete and binding of first floor roofs (one day).
51. Binding of wooden formworks for stairs columns, and surface fences.
52. Closing and binding stairs columns and surface fence (1 day).
53. Pouring of stairs columns, and surface fences concrete (1 day)
54. Extending of drains pipes for the house as the American method and extending of water line and the main electricity line (1 day)
55. Filling up of the enclosure (one day).
56. Installing of the steel reinforcing for enclosure ground (1 day)
57. Pouring of concrete for the enclosure ground (1 day)

- **Precautions should be taken in frame-implementing works that are many times neglected in private building projects:**
  a. It is a must to make certain about steel reinforcing numbers, diameters and lengths, plumbing and electricity works, and procedures of concrete tests (compression and slump tests) from taking the necessary concrete cubic moulds specimens.
  b. It is considered that concrete should not be poured more than 2 meters high to segregation of concrete components.
  c. It is necessary to cover the concrete surfaces with wet clothes and curing these surfaces with water for 7 days. Many times, works of coverage with wet clothes are neglected in private housing projects.

58. Laying of bricks for half height from ground floor walls, height for over windows, door opening (3 days). Laying of ground walls bricks, making of internal walls for basement. Sand, cement, and bricks lift for the first floor.
59. Binding of wooden formworks for windows, doors, fence, and thresholds (1day)
60. Installing of steel reinforcement for windows, doors and fence thresholds (1day)
61. Pouring of concrete for windows, doors and fence thresholds.

62. Comfort day.
63. Laying of bricks for the higher half for ground floor walls (1day)
64. Repeating works of laying bricks for first floor, stairs and fence of surface.

In case of neglecting basement works, the works of laying all bricks for basement walls, ground, stairs, fences with implementing all thresholds take 16 days. The total time to implement the structural framework and laying of bricks will take nearly (107 days).

3.3 Building Regulations and Codes in Kuwait

3.3.1 Introduction

Kuwait as well as many other countries has a kind of components and structures of Building Codes System (BCS). The following sections describe the structure, components and different parameters of Kuwaiti BCS in details.

3.3.2 Historical background

In the beginning, the administrative organization was very simple. In 1950, the Kuwait Municipality and the Parliament decided on the building permit approval, engineering professional work license. Zoning and building administrations was set up1963. In 1972 the first major law of Kuwait Municipality was produced. Article 19 of Building law 1972 states that the Municipality is responsible to safeguard people and properties by promoting, developing, planning, establishing, building and cities, and safeguarding the public health, safety, general welfare, and hygiene (Kuwait National Assembly,1972). In 1976, the building licenses section, and the inspection section were set up. In 1985, the first set of building regulations were produced, and in 2005 some amendments were made to these building regulations.

- **Kuwait Experience in BC Projects**

The initiation and implementation of BC in Kuwait has a history. KISR had attempted to initiate the BC project in late eighties. In 2000, I initiated a National Building Code Project at Kuwait Municipality through workshops conducted to Municipality managers on the subject of building problems and in particular the problems faced by disabled people due to the absence of proper building facilities for such people. The workshop concluded the opinion that there is an omission by Municipality by not preparing an accessibility code for public buildings in Kuwait (N. Bouresli, personal communication, 08 October 2000). The Municipality had a draft regulation for accessibility in 1982 and still there was no approval for implementing the regulations. Later, I observed that the issue needed more detailed and sophisticated studies. In 2001, I started a PhD research at Loughborough University, and in 2006, I formed a Municipality Development Committee for the development and implementation of Building Codes, and in Jan 2008, I organized the BC Project at Kuwait Municipality to develop the new code with new proper framework setup. In 2009, I prepared and conducted two BC workshop, which led the Municipality Minister to initiate the first National Building Code Committee of Kuwait.

3.3.3 The BC Legal Issues

3.3.3.1 Law for the Enforcement of BC in the Country

The Kuwait System of Building Regulation draws most of its authority from articles No. 20 and 15 of the Kuwait Municipality Law 1972 that sought to establish one system for Kuwait and make the Kuwait Municipality Law the dominant Law in the control of building (Kuwait National Assembly, 1972). The Law applies articles of the Constitution to daily life. It is a strategy that establishes intentions to respond to needs affecting the society in general (Fig.3.11).

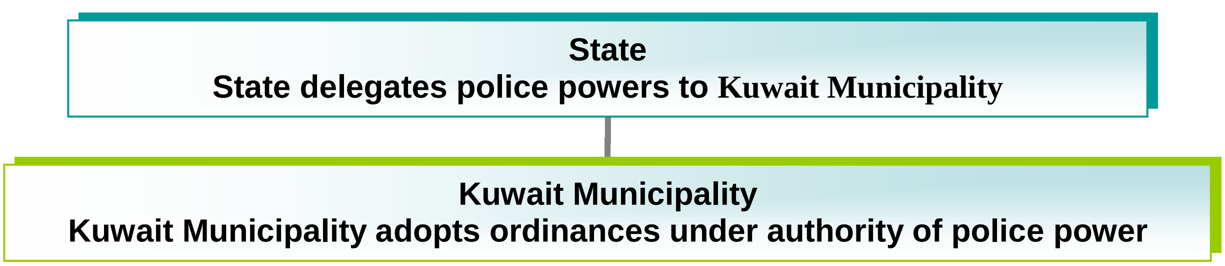

Fig.3.11: Building Control Police Powers

Article No. 19 of the Kuwait Municipality Law shows the Municipality responsibilities with regard to work for the growth and advancement of building construction and public health, Article No. 20 organizes building permit and Article No. 34 organizes the development of rules and principles of building construction.

Al-Deen (1998) said the Egyptian Building law 106 – 1976 is the current applicable law, it had some amendments in law 136 – 1981, 2-1982, 30 –1983, 54 – 1984, 25 – 1992, 101 – 1996. ***These amendments completely changed the main law, except its name and number. Kuwait building law and regulations are more similar to the Egyptian law***. This study assures the importance of building laws and regulations.

3.3.3.2 Building Bye-law

The Kuwait Municipality president issued decision No. 30 of 1985 to organize building works by the Law No. 15 of 1972 to organize construction in Kuwait, and preserve the buildings and protect citizens from dangers concerning public safety inside the country (Kuwait Municipality, 1985). The Municipal Council issued decisions to divide the land for construction of buildings in 1966, and adjusted in 1972, preceded by law No. 33 of 64 concerning property ownership and the general beneficiary.

Kuwait Municipality enforces fines and penalties for non-compliance of proper construction. The lawmaker, in the two articles 34, 35, - No.15 – 1972 concerning Kuwait Municipality, gave the right to the Municipality President to make special decisions, and codes in some topics, related to the building special rules, property rights, digs, wells and residential. Any one contradicts these rules is punished by a fine of 500 KD (= 1000 £) and contradiction removing closing some punishments to the fine punishment.

3.3.4 The BC Technical Issues

3.3.3.1 BC Name

The name of BC in Kuwait is the Building Regulations (Kuwait Municipality, 1985). Under the Kuwait Municipality Law 1972, the Kuwait Municipality Board issued the Building Regulations in 1985, and some other decisions related to administration and enforcement of building regulations.

The Building Regulation of 1985 is limited to administration of work and simple general technical requirements (Kuwait Municipality, 1985). Regulation articles are general provisions to building use, building permits, design insurance, stop work order, construction supervision, work order and simple regulation of small contractors, and design/supervision offices. It has more zoning requirements and aspects than building or construction regulations.

At present, a modern building code is under development in Kuwait, through the Building Code Project initiated at Kuwait Municipality (Al-Fahad, 2001; Kuwait Municipality, 2001). At this time, there isn't a complete Building Code, similar to the current building system that exists in the US, Canada, UK., Australia, and some other countries. There are only simple and introductory building regulations as described earlier.

3.3.3.2 BC Volumes Titles

The following are the main components of current Building Regulations and Codes at Kuwait (General Administration of Fire Fighting, 1996; Ministry of Electricity and Water, 1983, 1999):

1. Building Regulation 1985 (Kuwait Municipality decision)
2. Protecting Building from Fire Regulations (The General Administration of Fire Fighting)
3. Electrical and Energy Conservation Regulations (Ministry of Electricity and Water), the following is a list of Publications for Regulations and Codes of Practice:

- Regulations for Electrical Installations (Fourth Edition 1983)
- Procedures for Approval of Electrical and A/C Drawings and connection of power supply for construction and buildings projects. (1st Edition 1983)
- Electrical load form and explanatory memo (2nd Edition 1983)
- Regulations for testing of Electrical installations before connection of power supply (1st Edition 1983)
- General Guidelines for Energy Conservation in building (2nd Edition 1983)
- Practice codes for Energy Conservation in Kuwait buildings and Appendices (1st Edition 1983)
- Rules and Regulations of design of A/C System and Equipment. (3rd Edition 1983)
- Rules and Regulations for handing over Engineering Services (Electrical and Mechanical) to the Maintenance Authority. 2nd Edition 1983
- General specifications for electrical installations 3rd edition 1983

3.3.3.2 Guide Books for BC

There are summaries and guides to assist the use of Kuwait's BC (Building Regulations). The Kuwait Municipality, the Ministry of Electricity and Water, and the General Fire Departments have issued guidelines for regulations users such as design offices, contractors, and owners how to implant the regulation. These guidelines give description of the process of permitting, plan review, and inspection.

3.3.3.3 BC Objectives

The BC objectives are to organize construction work in Kuwait, preserve the buildings and to protect citizens from dangers concerning public safety inside the country (Kuwait Municipality, 1985). These objectives are mentioned in the Kuwait Municipality Law, and not in the BC document.

3.3.3.4 BC Technical Requirements

The Kuwait BC (Building Regulations) contains some of the technical provisions for design and construction of buildings and other structures, covering such matters as:

- Architecture requirements to check the building use (educational, commercial, health, etc.), classification, building areas, height, space allocation, stairs, balconies, basement, elevators, and applications for the disabled.
- Fire resistance (access and egress, services and equipments).
- Electrical requirements (installations, load, A/C systems and equipments)
- Energy efficiency (building peak load requirements, and application of insulation materials)

3.3.5 The BC Administrative Issues

The administration and enforcement of building codes (A&EBC) is about how the organization of building regulations and codes can work to achieve effective and efficient levels of service. The major divisions in A&EBC are general management, updating and development of BC, plan review, and site inspection.

3.3.5.1 General Management

3.3.5.1.1 Main Administration Organization

The Municipality is the authority that is responsible for local building industry by planning cities, setting recreational, maintaining streets (sweeping – spray – bins), maintaining water networks, electricity and drainage (Citizen Service Department,2001).

- **Municipality Departments**

The Legal administration, Administration of taking the property, Citizen service administration, General relations administration, Developing, training administration, Information systems centre, Statistics, Researches administration, Zoning administration, Building administration, Construction administration, Surveying administration, Safety administration, Following and monitoring administration, Environment affairs administration, Developing of constructing projects administration, Food administration, General cleanliness administration, Public roads administration, Preparing and burying the dead people administration, Licenses, shops and advertisements administration, Public markets administration, Workers affairs administration, Administrative affairs administration, Maintaining and Transport administration, Public stores administration, and Financial affairs Administration (Citizen Service Department, 2001).

The Municipality Parliament (local council) is a privileged organization with its own independent budget. It imposes local taxes on the state citizens. It had administrative independence that represents two authorities (Citizen Service Department, 2001).

3.3.5.1.2 Name of technical advisory body of Main Administration Organization

The main departments of the Municipality related to the building regulations are:

The Building Administration, Following and Monitoring Administration, Safety Administration, and Zoning Administration (Fig 3.12).

The secondary Departments of the Municipality related to the building regulations are:

Surveying Administration, Environment affairs administration, Developing of constructing projects administration, Licenses and shops and advertisements administration, and Statistics and researches administration.

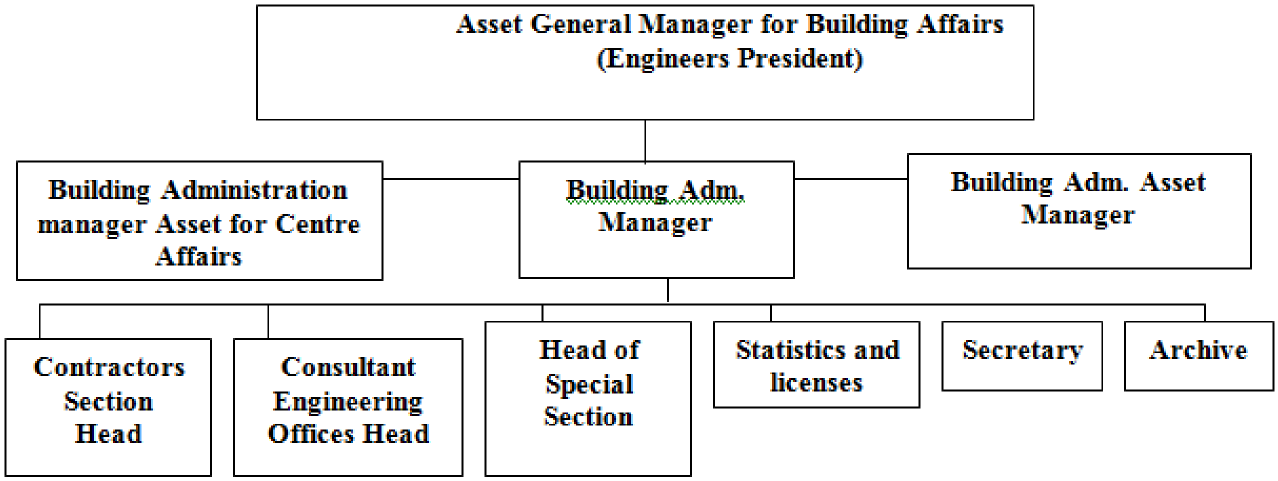

Fig 3.12: Building Administration (Administrative Skeleton)

3.3.5.1.3 Services of Main Administration Organization

The process of administering Building Regulations is organized by building officials at Kuwait Municipality (KM), the General Administration of Fire Fighting (GAFF), and the ministry of Electricity and Water (MEW), who are enforcing, controlling and applying building regulations through their administrative system, at their institutions and authorities.

Usually, KM, GAFF, and MEW have Building and Inspection Department as part of their organization system to execute these regulations and works. The administrative characteristics of Building and Inspection Department consist of the following (ICC, 2000): Department Organization, Department Officials, Development and Upgrading of Building Codes, Building Plan Review and Permits, Building Inspection, Violations, Certificate of Occupancy, Board of Appeal and Other related characteristics.

The administrative structure of building regulations in Kuwait consists of permit issues, plans review, and site inspection.

3.3.5.1.4 Second Administration Organizations

There are many government and private organizations involved in construction and building regulations. **The General Institution for Housing Care** is the organization responsible for providing subsidized governmental houses for citizens. It is the largest organization that produces houses in the country. **The Ministry of Public Works** builds all state buildings and hospitals, schools, in addition to the roads network and general services. **The Governmental Centre for Investigation and Laboratories** is specialized in testing of building and construction materials. **The Ministry of Electricity and Water** provides electric and water services. **The Ministry of Transport** is concerned with providing telephone services. **The Department of Standards and Specifications at Public Authority for Industry** has an important role in the preparation, control and implementation of specifications and standards for construction and other fields. **The Department of Quality Laboratories at Public Authority for Industry** plays an important role to maintain guidelines and national references of measurement and issue certificates of approved standardization. Further, the Department follows up testing and analysis operations of local and imported industrial products, and materials**. The Kuwait Institute for Scientific Researches** provides consultation about the best means for finding coordinated buildings with the environment. For example, the Institute is coordinating with the Ministry of Electricity and Water while preparing energy codes. **The National Council for Culture, Arts and Letters** cares, maintains, protects national heritage of old architectural buildings heritage and monuments.

The Public Authority of Environment prepares and applies public policy for the protection of environment and prepares strategies and action plans to achieve sustainable development.**The Department of Planning and Environmental Impact Assessment** is evaluating the projects and giving an opinion regarding the environmental suitability of these projects. **The Ministry of Planning** is studying proposed structural projects from government authorities and public institutions and organizations, and assists them according to the general plans of the State and contributes to budget development of the projects in addition to preparing central statistics of the State. **The Ministry of Social Affairs and Labour** is supervising and organizing manpower in the private sector as well as in the oil industry.

3.3.5.2 Updating and Development of BC

3.3.5.2.1 Model Code

The selection of a model code for Kuwait has been decided through the document titled "Terms of Reference for National Building Code Project", (KM, 2001). This document is produced in May 2001 by Kuwait Municipality Building Code Committee. Kuwait Institute for Scientific Research has been selected as the consultant to produce the code. It was decided to study The ICC codes as major model codes. These codes can be supported by other codes recommended by the consultant, Kuwait Institute of Scientific Research, by taking account of approval of Kuwait Municipality.

The required model codes are: Building Code, Zoning Code, Plumbing Code, Mechanical Code, Electrical Code, Property Maintenance Code, Fire Code, Private Sewage Disposal Code, Energy Conservation Code, Fuel Gas Code, Residential Code, and Performance Building Code.

3.3.5.2.2 BC Production Schedule

No defined production schedule for current building regulations and codes.

3.3.5.2.3 Publishing Format

Some of the current building regulations and codes have two publishing formats: web based version, and hard bound book.

3.3.5.2.4 BC Translation to English

The current codes are in Arabic language and almost there is no translation to English.

3.3.5.2.5 BC Updating

The current updating criteria for current regulations to consider technical proposals to change are not clear.

3.3.5.2.6 BC Change Impact Studies

The criteria to perform Change Impact Studies to assess the impact of any proposal for regulatory change are not clear and sometimes omitted.

3.3.5.3 Permit issues

The construction documents and drawings for a proposed building should be submitted to the building code administrator before construction begins. If the building meets the code requirements, the administrator issues a building permit. During construction, the administrator sends inspectors periodically to inspect the work. If they discover a violation, they may issue an order to remove it or they may halt the construction, depending on the seriousness of the violation, the administrator issues to the owner a certificate of occupancy, once the construction is found acceptable (Fig. 3.13).

Getting out the file

↓

Registering the deal

↓

The Draftsmen

↓

Inspection Department

↓

Permit printing

↓

Payment of fees

↓

Endorsing the license from the Department manager

↓

Receiving the license

Fig. 3.13: Procedures of obtaining building permit

Name and address of the person applying for the license is mentioned in the building license, a given permission to the owner and contractor to execute building works (Table 3.6, & 3.7).

Month	Total License	Nature of License			Building Use				Areas m2			
		New	Extra	Rem.	Inv.	Comm.	Industrial	Housing	Inv.	Comm.	Industrial	Housing
Jan	304	744	324	116	8	3	4	289	18393	9246	3915	315161
Feb	1198	393	636	169	9	7	5	372	26520	9828	8562	485289
Mar	1140	367	613	160	16	4	8	339	18747	3016	44055	415534
Apr	1330	414	696	220	8	4	5	397	73670	8992	5633	471580
May	1414	349	782	283	12	4	7	327	43123	13638	27966	447853
Jun	1115	294	608	213	11	1	8	274	18543	1374	9184	354112
Jul	1194	346	617	231	4	5	4	333	7334	11423	9025	461389
Aug	1001	330	481	190	5	2	12	311	8074	6840	18196	409412
Sep	962	266	476	220	14	4	1	247	44583	21618	4909	322743
Oct	1165	391	581	193	16	26	7	342	16273	50035	7342	371099
Nov	913	292	415	206	5	1	6	280	9580	514	5946	392304
Dec	274	87	130	57	2	1	4	80	7590	169	2537	145427
Total	12450	3833	6359	2258	110	62	71	3590	292430	136693	147270	4591903

Table 3.6: Activities of Building Department 1999 - Private Sector Licenses,

(Research and Statistical Department, 1999)

Month	Total License	Nature of License			Building Use				Areas m2			
		New	Extra	Rem.	Inv.	Comm.	Industrial	Housing	Inv.	Comm.	Industrial	Housing
Jan	10	6	2	2	0	1	0	5	0	3320	0	6499
Feb	24	11	8	5	0	0	0	11	0	0	0	26506
Mar	38	20	11	7	0	0	0	20	0	0	0	30526
Apr	18	5	7	6	0	0	0	5	0	0	0	6675
May	24	12	8	4	0	0	0	12	0	0	0	16020
Jun	31	18	12	1	0	2	1	15	0	27770	8804	34706
Jul	28	10	9	9	0	1	1	8	0	1282	49012	21786
Aug	47	15	28	4	0	0	0	15	0	0	0	190323
Sep	24	11	6	7	0	0	0	10	1323	0	0	43787
Oct	24	7	15	2	0	0	0	7	0	0	0	5631
Nov	20	3	3	14	0	0	0	3	0	0	0	86430
Dec	3	1	1	1	0	0	0	1	0	0	0	2013
Total	291	119	110	62	1	4	2	112	1323	32372	58716	470910

Table 3.7: Activities of Building Department 1999 - Facilities Licenses

(Research and Statistical Department, 1999)

3.3.5.4 Plans Review

If plans are not approved by government agencies because of non-conformity of building regulations and codes, the plan examiner/reviewer makes comments on an attached correction list or makes corrections or notes down deficiencies in red ink. The correction list typically lists the changes that must be made to achieve code compliance and should cite applicable code sections. The plans must then be revised to conform the building regulations and codes before a permit is issued.

The purpose of plan review is to verify that the proposed design of a building or structure complies with building regulations, codes and related ordinances. There are methods used to review plans signed by a licensed architect or engineer.

The plan examiner/reviewer should study and verify the proposed construction documents for building regulations and codes compliance in new buildings as well as additions and alterations to existing buildings.

According to building officials, plans are often reviewed for some or all of the following aspects of construction, depending on the scope and complexity of the project (Interviews, 18 March 2002, 09 July, 2003, 07 November 2002):

- Air pollution control (by Environment Department, not applicable for private housing projects)
- Building construction (by Consultant Offices and Contractors -- No Government agency involvement)
- Electrical (by Ministry of Electricity and Water)
- Fire prevention (by Fire Department, does not include private housing projects)
- Planning (by Department of Zoning)
- Flood zone (by Department of Zoning)
- Mechanical (some by Fire Department, not applicable for private housing projects)
- Plumbing (by Consultant Offices and Contractors)
- General Safety (by Consultant Offices and Contractors)
- Sanitation (by Consultant Offices and Contractors)
- Structural (by Consultant Offices and Contractors)
- Traffic (by Department of Zoning, not include private housing projects)
- Engineering (by Consultant Offices and Contractors)

- Zoning (by Department of Zoning)

3.3.5.5 Site Inspection

Building inspectors from government agencies and consulting offices enforce regulations related to the design, construction and use of buildings.

They are supposed to inspect methods and materials used in the construction of new as well as existing structures to ensure that building regulations, codes, health and safety regulations, construction standards, and zoning ordinances are met.

Building inspectors from consulting offices study construction documents for planned repairs of existing buildings, construction of new building projects and building sites being considered for development. Before work begins, they should investigate the construction site, checking drainage, elevation and the placement of buildings on the plot, but some of them are ignoring these tasks (Al-Teho, 2003).

The number and types of inspections conducted during the remodelling or construction of the buildings depend on government agencies, owners and consulting offices, and construction agreements between the owner and consulting office.

As each building phase is completed, inspections are required before work can progress. Plumbing, ventilation, heating, air-conditioning and electrical installations are usually not checked by inspectors from government agencies or consultant offices, only minor checks for electrical works are carried out by inspectors from the Ministry of Electricity and Water at the end of the project. Inspectors trained in these specializations should check these works.

Inspectors should keep detailed records and copies of reports pertaining to all of their inspections. When construction meets established standards, the inspectors report satisfactory job progress. If inspections disclose unsatisfactory work, they notify the job superintendent or contractor and conduct another inspection once the corrections have been carried out.

Building inspectors from the Kuwait Municipality and consulting offices that discover deliberate nonconformity with established building regulations and codes are responsible to put pressure on Municipality officials to issue 'stop work' orders on the construction activity. legal proceedings should evolve as a result of nonconformity to building standards, the building inspectors must produce inspection data as evidence and they may be required to testify in court about their findings.

3.3.6 Other Issues: System of Violations and Penalties for Building and Construction Works in Kuwait

The objective of this section is to review system of violations and penalties for building and construction works in Kuwait. This section also reviews penalty articles in Building Regulations 1985, for reasons and obstacles that have led to the spread of penalties.

3.3.6.1 Introduction

This section discusses the administrative procedures used against parties or agents responsible for regulations and code violations in new or existing building construction. These procedures are part of a continuous process which begins with the permit application for new construction, repairs, or alterations.

The builder of a new structure has placed himself under the jurisdiction of the building department, which presumably has at its disposal a substantial record of the work being done. The administrative action discussed in this section is against the owner, or his or her agent, directly.

To assure compliance with building or related codes, competent field inspectors must be able to discover violations when they occur. Just as important, however, is the effectiveness of departmental procedures to obtain corrections of these violations.

3.3.6.2 General Procedures for permitting building works in Kuwait

Inspectors should issue a written notice to the builder for all field violations, no matter how minor. This provides a record at the department’s disposal in case any of the violations are carried through the entire administrative enforcement procedure and eventually into the court.

The building inspector may inform the violator verbally and make a note of it on the inspection record. If, upon re-inspection, the violation has not been corrected, the building department confirms the notice of violation either by mail or personal service.

All violators shall be issued a notice in writing. However, the building department may prefer to telephone the violator and ask him to visit the department to explain in person why the code is being violated, before the written order is issued. Such a system helps maintain good relations between builders and the department.

It is important that code officials have methods for bringing reluctant builders or installers into compliance with the code, while avoiding litigation whenever possible. Generally, such enforcement is obtained through a combination of formal and informal means. The method most commonly followed consists of a series of warnings of court action, usually through such communications as telephone calls, letters, or served notices to appear before either the code official or a public prosecutor. Very few local building departments like to use the Courts if such action is avoidable.

3.3.6.3 The Penalties for Building Regulations Articles No. 30 /1985

Article (1): Constructing a building without license – extending the building – increasing height of the building – demolishing the building without license, digging and changing the building without a license.

Article (8): Demands of buildings safety are not considered in designing and implementing.

Article (11): Non-implementation of building is based on good technical practice, plans, and approved documents that the license is permitted for it.

Failing to keep copies of the license and drawings at the construction site.

Article (6.3): Making necessary adjustments on the licensed construction plans during implementation without revised license.

Failing to inform the Municipality in writing that the engineering office has given up the supervising in implementing

No other engineering office follows the supervision through the determined period by Municipality.

The Use of unspecified building materials

Article (14): Contracting construction works with unregistered contractor

Article (15): Not informing the Municipality about cancellation of the contract with the contractor.

Article (17): Not taking necessary precautions for nearby buildings peace for protection of fire.

Not setting up a fence around the work site as per the specifications by the Municipality.

Not taking the necessary precautions for the safety of workers and security of pedestrians.

Article (18): Permitting workers to reside at the work site

Permitting workers to enter the building after working hours

Article (19): The conditions and specifications are not complete as in schedule (14) with this system.

The conditions and specifications that are determined at the Municipality agreeing with the specialist governmental sides and the General Administration of Fire Fighting are not complete.

Article (20): Not setting up obstacles for the window for protection from falling objects according to Municipality conditions.

Not setting of obstacles for stairs for protecting of falling according to Municipality conditions.

Not setting of obstacles for window for protecting of falling according to Municipality conditions

Not setting of obstacles for roofs for protecting of falling according to Municipality conditions.

Un-mending of nets for windows in commercial buildings to prevent putting the bins according to Municipality conditions

No big doors, metal doors for commercial shops including the commercial buildings and commercial faces that look over the outer.

Article (21): Electrical connections, water, telephone and other services are not made according to the conditions and specifications that are determined by the specialist sides.

Article (22): Un-paving of the main, branch streets that look over the building in the investing, commercial regions and commercial faces as the Municipality and the Ministry of Public Affairs conditions.

Article (23): Occupying the building before the approval from the Municipality, the Ministry of Public Affairs.

Article (23): Inhabiting before the Municipality following using the building for other purposes than as approved in the main license.

Article (24): Work of restoration is not as per the specifications.

Article (25): Cultivating of the area in front of the house without license

Article (29): The following building is not devoid of people through certain period. Non removal of the building through the period determined by the Municipality

3.3.6.4 Outline of Penalties of Building Codes and Regulations in Kuwait Municipality

The following table explains the classification of penalties that are duties of Building Administration, Following, and Monitoring administrations in Kuwait Municipality and the law bases that govern it (Table 3.8):

No.	Penalty Sort	The Law Bases
A	Penalties of building regulations and Conditions, in different Kuwait regions (inside the real estate borders)	Decision no. 30 – 1985 concerning organizing building works schedules, according to the articles 34, 35 law No. 15 – 1972 Kuwait Municipality
B	Violation on state properties (penalties outside real estate borders)	Law No. 105 – 1980, No. 8 – 1988 authorization of Ministry of Finance to Kuwait Municipality Minister decision no. 99/88 Administrative decision no. 88/108 Administrative decision no. 92/64
C	Penalties of exploiting real estates in excellent, private family residential regions for bachelors housing.	Law No. 92/125 – date 29/9/1992 concerning preventing of non-families in private housing regions.
D	Penalties in industrial region (exceeding in buildings area, commercial exploits)	Council of Ministries decision No. 471- date 17-5-1992 occurs of penalties in industrial districts.
E	Buildings Facades that need restoring and beauty.	Article 24 – decision No. 30/85 minister decision no. 90/88 administrative decision No. 233/88
F	Penalty shops (areas without license – penalty for building regulations and Conditions)	Private conditions with shops in schedule (21 – decision 30/85 concerning organizing of building works)
G	Penalties and exceeding in chalet regions (areas without license – use of contradicted building materials).	Ministers decision No. 110/88 in addition schedule of hotels building regulations – to 30/85 concerning organizing building works.

Table 3.8: Classification of Penalties (Al-Abaid, 2001), (Al-Shimali, 2002)

3.3.6.5 General penalties in private residential regions

1. Locking enclosure with lighter materials to be exploited commercially or as stores.
2. Transferring chambers that overlook on the main streets to shops to be exploited commercially.
3. Implementing shops in setback region from the limit of house from lighter materials.
4. Working of chambers in the surfaces or enclosure.
5. Extending of license to include the real estate and back rooms.
6. Work of inside houses by dividing into many inside houses to be rented for bachelors.
7. Transferring one of the rooms into a kitchen, the floor had two kitchens; the owner divides the floor into two flats.
8. Exploiting the house commercially as in the east of Qurain and Jleeb Al-Shuyoukh.
9. Non-implementing of heights as per licensed especially basements.
10. Making inside portions to be rented for bachelors.

There is a general impression that the Municipality is responsible for spreading Penalties. It is necessary to exert efforts for all other sides to implement their tasks. Tables 3.9 and 3.10 show law administration activities.

Instruction	Sittings courts	Complains	Judgments	Notice of courts
Primary	3203	781	143	15.3
Recommending	720	97	81	35
Distinction	104	39	23	9
Total	**4027**	**917**	**247**	**157**

Table 3.9: Law Administration Activity through 1999

(Research and Statistical Department, 1999)

Sector name	Complains no.	Resolved	Percentage of resolved complains
Services affairs	96	73	76 %
Building administration	71	62	87%
Monitoring and following Administrations	46	31	67%
Zoning and Safety administrations	33	18	55%
Workers affairs	54	49	91%
Municipality Parliament			
Secret Honesty	62	12	19%
Law Administration	28	6	21,00%
Total	**390**	**251**	

Table 3.10: Complaining office activity through 1999

(Research and Statistical Department, 1999)

There are other reasons for spreading Penalties. In some construction dispute cases, issues of legal court rules are based on experts' reports of Ministry of Justice. Some of the results of experts' reports are confused about the status of the detailed regulations of building in Kuwait, and some who committed violation are saved from punishment (M. AL-Harris, personal communication, 27 February

2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006), (AL-Fahad, 2005).

3.4 Overview of Problems of Building Codes and its Enforcement in Kuwait

The Concern about Kuwait's construction industry has resulted in many reviews of the industry which led to a series of reports to identify the need to change current building regulations and its enforcement to solve and accommodate Kuwait's construction problems and needs.

Sections 3.4 to 3.8 seek to ***indentify insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait***. In Sections 3.4 to 3.8, an investigate conducted of the problems into four parts of BC namely; the legal, administrative, and technical aspects which investigate the insufficiency of BC, while the social aspect investigates the infringements of BC.

A number of publications were reviewed ***to understand the problem of insufficient enforcement of building codes in Kuwait*** [(Kartam, Flood and Koushki, 2000), (Mahgoub, 2002), (Amin, 2002) and, (Hamed, 2004), (Ministry of Planning, 1995-1997), (Amin, 2002), (Hamed, 2004), (Al-Haider, 2003), (Sadek, 2001), (Al-Bendari, 2003), and (AlQabas, 2004, 2005)].

Another number of publications were reviewed ***to understand the problem of insufficient codes and regulations in Kuwait*** [(Sadeq, 2001), (Al-Fahad, 1998), (MOP, 1997), (Haque, 2003), (Al-Sayed, 2002), (Fereig, Younis, 1985), (Al-Ragom, Omar, 2002), (Al-Temeemi, 1994), (Al-Feel, 1988), (Bofah, 1991), (Al-Azmi, 1997)].

Another number of publications were reviewed ***to understand the problem of*** **infringement** ***codes and regulations in Kuwait*** [(Kuwait Municipality, 2009), (Al-Masaoudi, 2009), (Mohommed, 2004), (Al-Qapas, 2004), (AlQapas, 2004, 2005)].

The following three sections will illustrate the problems of insufficient building codes and it's enforcement in Kuwait.

3.4.1 The Problem of Insufficient Enforcement of Building Codes in Kuwait

Many researchers and government research bodies in Kuwait agree with the ***problem of insufficient enforcement of building codes in Kuwait***. Kartam, Flood and Koushki (2000) discuss the causes of safety problems, and agree that the current governmental safety inspection programs are ineffective because the inspectors are limited both in their number and qualifications. Mahgoub (2002) made a study which proves that the changes of building regulations and the increase of building areas lead to produce hostile and unsuitable environment for pedestrians, lack of privacy, loss of architecture form and identity, inappropriate landscaping, reduction of social relations, absence of historical relevance, and visual pollution. Amin (2002) and, Hamed (2004) stated according to an official reports that the causes of some of the building collapses were due to bad installation and inappropriate execution, inspection, and supervision procedures. Researchers at the Ministry of Planning (1995-1997) declare that there are problems of using outdated many design codes for reinforcement, lack of reviewing structural design for serviceability, and producing designs with excessive amounts of materials. Al-Haider (2003) states that there are faults in the design, supervision and execution that caused weakness in many structural elements. Sadek (2001) agrees on the neglected and improper yet common concrete design practices that may threaten inhabitants and safety of the structure. An official accidents inspector stated that there are deaths and injuries happened for home occupants and users, because of poor electric and lighting works during alteration, movement, and repairing (M. Al-Bendari, personal communication, 15 September 2003). There are many cases of improper documentation procedures result in missing and losing building documents which cause lost of owners and investors rights and financial resources (Al-Qabas, 2004, 2005).

3.4.2 The Problem of Insufficient Codes and Regulations in Kuwait

Many researchers and government research bodies in Kuwait confirm the ***problem of insufficient codes and regulations in Kuwait*** (Sadeq, 2001; Al-fahad, 1998; MOP, 1997). Sadeq (2001) recommend solving the problem of absence uniform building codes to solve the inconsistent building designs which led to the unjustified increase in cost. Haque (2003) suggests setting particular measures for concrete material and works to accommodate external Kuwait weather conditions and built environment in particular condition. Al-Sayed (2002), Fereig, Younis (1985), Al-Ragom, and Omar (2002) suggests reform in the current energy regulations for Kuwait. Sayed (2002) recommends solving negative effect of thermal bridging to columns and beams on energy consumption of typical residential villas in Kuwait. Al-Temeemi (1994), and Al-Feel (1988) suggests to reform current buildings design to save energy. Al-Temeemi (1994) suggests minimizing windows areas to control solar radiation, major windows exposures to face north or south and be shaded, and roof colour to be painted white. A study (Al-Feel, 1988) on the governmental housing projects in Kuwait shows that building materials of cement, wider windows, and roofs don't suit the Kuwait environment. Kuwaiti houses need to be built by blocks produced from local materials and the use of small windows. The walls should be wide, and roofs should be high to allow air movement. Bofah (1991) suggests reform to accommodate the effect and consequences of wind-blown sand. Al-Azmi (1997) suggests recommendations to accommodate for design defects related to wind conditions and natural light.

3.4.3 The Problem of Infringement of Codes and Regulations in Kuwait

According to a report published by the Kuwait Municipality, 90% of residential investment buildings in the Governorates of Hawalli and Farwaniya have committed violations (Kuwait Municipality, 2009). The infringement of Fire Safety Code caused fire accidents in merrymaking building in 2009 which led to losses in life and properties (Al-Masaoudi, 2009). The infringement of administrative code causes illegal construction of 16 commercial residential buildings without permit is a serious crime, and threatens the whole legal and judicial system and encourages others to violate regulations and laws (Mohammed, 2004). The infringements of building regulations caused 150 commercial shopping centres without premises identification which caused customers to lose their way or had insufficient and misleading information when using address of different activities (Al-Qabas, 2004). Infringement of building regulation for abandoned, old and vacant structures causes unsafe status for neighbouring people and buildings (Al-Qabas, 2004, 2005).

3.4.4 The Importance of Investigating the Problems of Building Codes

- **Major problems and disasters are the path for building codes**

Historically, building code development occurred in response to tragedy rather than prevention (BOCA, 1999; Liebing, 1987). The great fire in six oil tanks in 1981 in Al-Ahemedi oil area led Kuwait Government to establish a modern, improved and independent Fire Authority in Kuwait. A new Fire Code was developed for buildings as a result of that disaster (K. Hassan, personal communication, 07 April 2009), (M. ALSaraf, personal communication, 07 April 2009).

The two incidences that discussed in section 6.5.2 "Accident of Gas Pipe Explosion in Religious Facility", and in section 6.5.3 "Accident of the Fire of Merrymaking Building" are further examples where tragedies triggered the development of Building Codes in 2009. These tragedies motivated the government, alert the public opinion, and necessary attention in media result in the initiation of the building codes seriously in Kuwait.

- **To understand the problem of building codes and find remedies**

The investigation of the problems of building codes is the first stage in the development of proper remedies for the problems in current framework of BC in Kuwait.

3.4.5 Overview of Methodology in investigations of the problems of building codes

In accordance with research objective no. Five, sections (3.5, 3.6, 3.7, & 3.8) seek to identify shortcomings in the minimum requirements of public health, safety and general welfare caused due to insufficient and infringements (non compliance) in building codes/regulations in Kuwait. This objective of the investigation has two sections:

- 1st section identify shortcomings **due to insufficient in BC**
- 2nd section: identify shortcomings **due to infringements (non compliance) in Exiting BC**

As explained, the research problem in Section 1.3 of Chapter 1; the first objective about the **insufficiency of BC** will investigate about the unified building regulations that is available for the use of construction practitioners in Kuwait. The investigations focus on the insufficiencies in building regulations, codes. The second objective **infringements of BC** investigates the gross negligence in enforcing the existing laws, such as Safety Law, illegal construction, violation of heights and number of floors, etc.

For the purpose of clarity and focus, the investigation of objective no. Five is through the investigation of four aspects of building codes namely the legal, administrative, and technical aspect are investigating the insufficiency of BC, while the social aspect is investigating the infringements of BC. The problems related to four aspects of building codes are as follows (Fig.: 3.14):

1. problems of building codes in terms of **the legal aspect**

2. Problems of building codes in terms of **the administrative aspect**
3. Problems of building codes in terms of **the technical aspect**
4. Problems of building codes in terms of **the social aspect (infringements)**

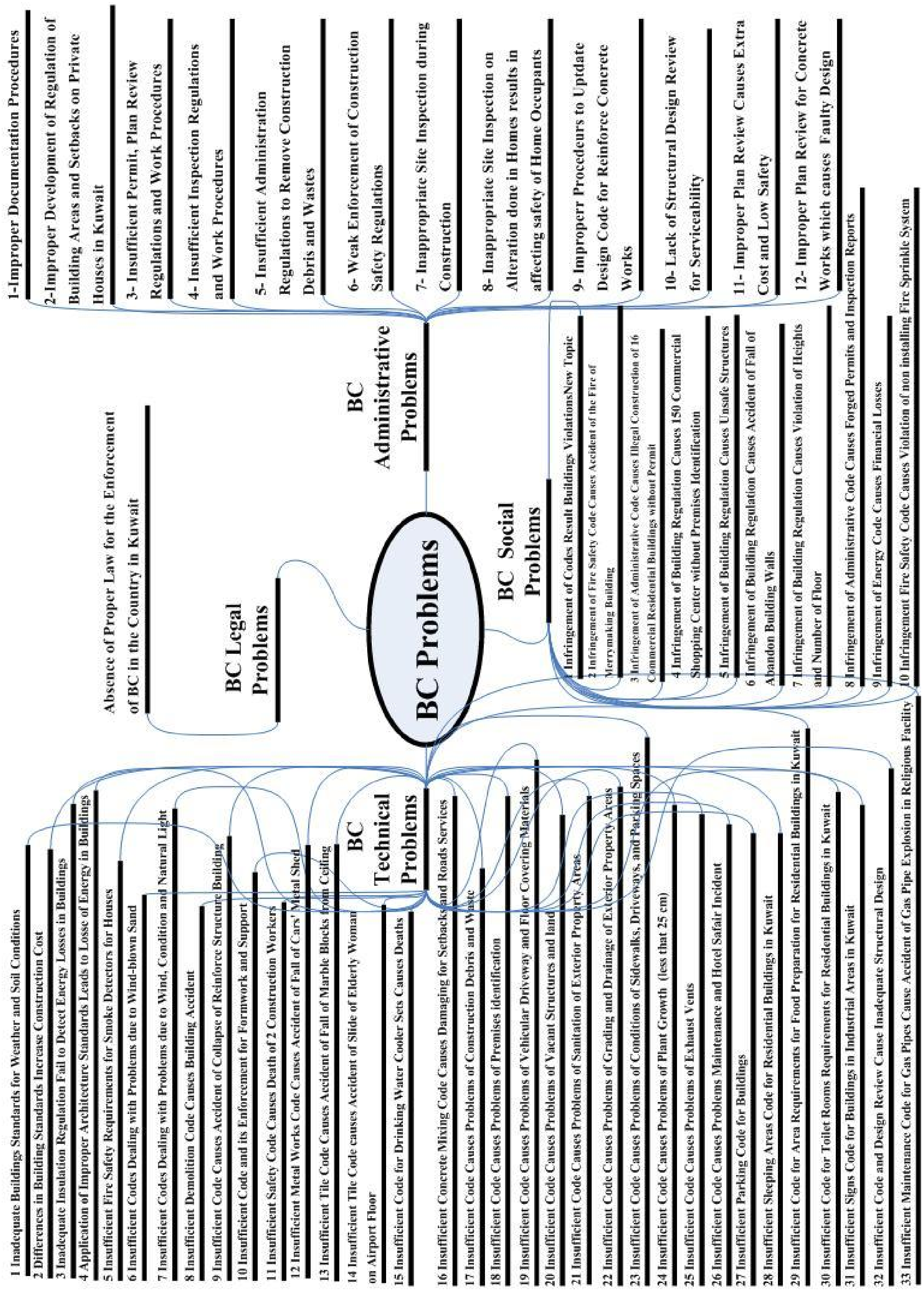

Fig.: 3.14: Mind Map of Building Code Problems in Kuwait

The legal, administration and social aspects of BC are the bridge that connects the technical aspects of BC to construction. Therefore any insufficiencies in the legal, administration and social aspects cause insufficiencies in the technical aspect of BC, and leads to the conclusion that current building regulations and codes in Kuwait are insufficient to protect safety, public health, and general welfare of people.

Sections (3.5, 3.6, 3.7, & 3.8) investigate the problems of building codes through performing five research methods such as: (1) review of previous studies, (2) document analysis, (3) short comparative studies, (4) interviews, (5) inspection and observations (site visits).

3.5 BC Legal Problems

3.5.1 The Absence of Proper Law for the Enforcement of BC in the Country in Kuwait

When reviewing building laws and regulations in Kuwait, we observe that article 19 of Kuwait Municipality law 1972 states the responsibility of the Municipality to safeguard the health, safety, general welfare, and hygiene of the general public.

However, there is no relevant specific article at Kuwait Municipality Law to regulate and mandate BC in Kuwait. Other countries such the US Municipal law in the US State of Montana regulate and mandate BC in Montana through specific article for this propose (Legislative Audit Division , 1997).

According to the US BC document such as the IBC, the purpose of building codes is to establish the minimum requirements for safeguarding the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and properties from fire and other hazards attributed to the built environment (ICC,2000). IBC consist of more than 11 document codes.

Building law 1972 and IBC agree on the objective to safeguard the public health, safety, and general welfare. However, most of codes and regulations in Municipality and other governmental institutions in Kuwait do not include most of the requirements of structural strength, safety to life and properties from fire, and means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, safety to life and properties from other hazards attributed to the built environment.

The previous situations are clear incidences for insufficient legal status of BC, which lead to insufficient building codes and regulations in Kuwait. Most of the practice of building designs and construction in Kuwait are not regulated by approved codes and standards. There is a lack of advanced knowledge among many construction professionals in Kuwait.

3.6 BC Administrative Problems

3.6.1 Improper Documentation Procedures Results in Missing and Lost Building Documents

The unavailability of proper building records is serous fault of the administration system. According to a report published by Kuwait Municipality, half of buildings permit records are missing in Farwanya Governorate (Kuwait Municipality, 2008).The Director of Kuwait Municipality of AL-Farawania Governorate states that some building documents archive is missing, lost, and some are stolen (Al-Qapas, 2004). Deputy Director of Building Licensing at AL-Farawania Governorate states that there are big difficulties in safekeeping of building documents since 1998 (Al-Qapas, 2005).

Three house owners searched for their building records at Kuwait Municipality archive to perform improvement at their houses and all of them faced difficulties to get their files. The status of building files archiving system in Kuwait Municipality is in chaos (J. AL-Fahad, Site Visit, 09 October 2007). Delay in construction caused them social and financial problems, since they need extra accommodation spaces for their families (K. AL-Fudari, personal communication, 13 Febrarury 2006), (M. AlFahad, personal communication, 07 January 2006), (A. AL-gazali, personal communication, 09 October 2007),(M. AL-Aradi, personal communication,. 09 October 2007).

Article 104.7 of International Building Code states that the building officials shall keep official records of applications received, permits and certificates, issued fees collected, reports of inspections, and notices and orders issued (ICC, 2000). Article 104.7 has no legal base in BR 1985 (Kuwait Municipality, 1985).

The enormous incidences of lost records of building projects are causing overall breakdown of judicial and administrative of building regulatory system in the country. Developers, owners, designers, contractors, and others have no proof when to work in their projects, nor dealing in case of disagreement and court cases. These problems may cause lost of rights, and many financial resources. Many people lost their trust in the Municipality activities and responsibilities.

This situation is a clear indication of insufficiency in administration and overall infringement of building regulations caused by the administrative body in the Municipality. The building officials who caused these problems should be punished, and the problem should be corrected.

3.6.2 Improper Development of Regulation of Building Areas and Setbacks on Private Houses in Kuwait

Applying of building regulations had social, cultural effects upon society and man. Improper changes of building regulations led to increase building area and decrease of retreat on the account of good environment and society comfort. There is an absence of awareness and participation by community in regulation process. The Community has no trust with officials implementing the laws and regulations (A. AL-Forih, personal communication, 18 March 2002, 14 March 2009). The study of the impact of changes in regulations of building areas and setbacks on private houses in Kuwait provides evidence that the incidences of changes of building regulations and increasing of building area lead to produce hostile and unsuitable environment against pedestrians, less privacy, loss of architecture form and identity, inappropriate landscaping, reduce social relations, absence of historical relevance, ands visual pollution (J. AL-Fahad, Site Visit, 15 November 2004), (R. Al-Ameri, personal communication, 12 May 2007). The problem in Kuwait is that there are no competent criteria to change zoning regulation to be enforced by building official (Mahgoub, 2002), and no competent laws to prevent the monopoly of lands, which led to the increase of land price and misuse of lands and real estates. Furthermore, unavailable master building plans taking into account the number of families, economic condition and population in the housing units, which led to the misuse of lands, real estates, and an increase of number of children in single house (M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006).

3.6.3 Insufficient Permit, Plan Review Regulations and Work Procedures

The information required for construction documents in building permit is vague. Article no.2 of Building Regulation 1985 has a confusing statement. It gives the authority by law to the Municipality to decide what the contents of construction documents should be. Article no. 2 mentions requirements of architecture and structural plans to be submitted by permit applicant, but, the details and information that these plans constitute are not clear.

However, article no.106 of International Building Code, and other articles of international codes state the information and requirements of construction documents. These information include type of plans required, plan dimensions, electronic media, location, nature and extent of proposed work, shop drawings for fire protection systems, details of means of egress, details of exterior wall envelop, details of site plan, and other requirements. Also, article no.104.7 of International Building Code states that the building officials shall keep officials records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued (ICC, 2000).

The previous situation is clear incidence for insufficient permit and plan review regulations. Permit and plan review regulations should be re-evaluated accordingly with model code as IBC.

3.6.4 Insufficient Inspection Regulations and Work Procedures

The duties and responsibilities of Municipality or engineering office inspections are vague. Article no. 13 of Building Regulation 1985 has a confusing statement. It gives the authority by law to the Municipality or the inspection office to decide what should be the work needed to perform inspection. There are no clear inspection checklists used by inspectors. Furthermore, there is a major fault at inspection work procedure at Municipality. There isn't any evidence or information that the Municipality has copies of inspection reports (A. AL-Forih, personal communication, 14 March 2009), (J. AL-Foziah, personal communication, 07 April 2009).

However, article no. 109 of International Building Code states the information and requirements of inspection. These information include details of Inspections for footing or foundation inspection, concrete slab or underflow inspection, lowest floor inspection, frame inspection, lath or gypsum board inspection, fire-resistance penetration inspection, energy efficiency inspections, other inspections, special inspections, final inspection, required verification and inspection of concrete construction, and required verification and inspection of steel construction. Article no. 109 of International Building

Code states the building officials shall keep official records of applications received, permits and certificates , reports of inspections, and notices and orders issued (ICC, 2000).

Article no.11 of Building Regulation 1985 states that any owner or an individual who intends to construct a building or a structure should follow standard design and construction methods and workmanship. In order to be assured that contractors and inspection offices, follow standard design and construction methods and workmanship, the Municipality should have a sufficient inspection system reports that can be reviewed and then decide. Also, there isn't any article in Kuwait Municipality Law 1972, or any other law in the country, which enforce regulation to conduct examination or test the design offices, inspection office, and contractors, based on scientific test on the skills theoretically and practically.

The previous situation explains that there is a clear evidence for insufficient inspection regulations and work procedures. Inspection regulations and work procedures should be re-evaluated in accordance with model code as IBC. As explained in the above investigation, poor administration of BC leads to the conclusion that the current building regulations and codes in Kuwait are insufficient to protect safety, public health, and general welfare of the people.

3.6.5 Insufficient Administration Regulations to Remove Construction Debris and Wastes

Insufficient building permit regulations for remodelling of interior driveway and floor covering caused social problems, and troubles in the neighbourhood. The project was to remove floor covering of an old interior driveway and other layers within an area of 250 m2 approximately. The owner and contractor started the project without asking permit from the Municipality. Also, the Municipality lacks quality control and management to identify any project operates without permit. During construction a lot of concrete and covering materials accumulated. Since there is lack of spaces and setbacks, the contractor had to move these debris and wastes to open yards close to other houses in the neighbourhood. The owners of these houses started to complain of the accumulation of construction debris near their houses. Therefore, some of these owners started arguments and disputed with the owner regarding construction debris. The conflict results that some of houses' owners in the neighbourhood started to hate each other and one of them wants to raise the issue to the police (K. AL-Foudari, personal communication, 10 October 2005), (J. AL-Fahad, Site Visit, 10 October 2005).

The problem with current building regulations is not considering a need for permit for remodelling construction works of floor covering. However, article no. 105 of International Building Code required permit for driveways works more than 0.76 m2.

The previous situation is a clear incidence for insufficient building regulations. Construction debris and wastes should be removed in manner of respect to other people rights and comfort. The problem in Kuwait is that there isn't firm regulation and enforcement mechanism that can be enforced by building official to prevent these incidences.

3.6.6 Weak Enforcement of Construction Safety Regulations

Kartam, Flood and Koushki (2000) discuss the issue of construction safety in Kuwait. They reported that causes of safety problems are due to lack of safety regulations and legislations, disorganized labour, and other causes. Most of construction workers in Kuwait are unskilled, untrained, and inexperienced. Regulations and enforcement methods followed by several safety inspections authorities are in the status of inconsistency. Current governmental safety inspection programs are ineffective because the inspectors are limited both in their number and qualifications. Also, there are several wrong enforcement practices that lead to accidents. Kuwait Municipality (KM) ***Safety Department identified thousands of safety violations committed in construction sites, and issued thousands of safety warnings. However, they issued only about 100 safety tickets annually, which indicate the less stringent enforcement policy.***

It would be better for a competent person with appropriate credentials and certification to make an independent review of a construction project and its safety plan and to sign off on it before work commences. The problem in Kuwait is that there are no competent regulation and enforcement mechanism that can be enforced by building official to prevent this incidence. The Department of Safety in Kuwait Municipality was almost disintegrated by faulty administration of management (K. AL-Abed AL-Ghafoor, personal communication, 10 October 2006).

3.6.7 Inappropriate Site Inspection during Construction

Kuwait had seen some major building collapses in the past. In 1970 there were several deaths as a result of a car parking collapse, while, in 1997 there were two death incidents as a result of a huge steel shed collapse (Amin, 2002), (Hamed, 2004). In 1998, a villa under construction in Kuwait city suburbs collapsed, which fortunately caused no death, but resulted in financial loses (A. AL-Atram, personal communication, 14 March 2009), (J. AL-Fahad, Site Visit, 21 November 1998). Official reports indicate that the causes of these collapses were due to a bad installation and inappropriate execution, and could have been prevented through properly administrated inspection, and supervision procedures (Kuwait University, 1998). It is the role of Kuwait Municipality and or any approved inspection agency to inspect, supervise, and approve the quality of construction.

3.6.8 Inappropriate Site Inspection on Alteration done in Homes results in affecting safety of Home Occupants

There were deaths and injuries happened for home occupants and users (M. AL-Marshed, personal communication, 26 September 2003).An Accident happened because of poor electric and lighting works during alteration, movement, and repairing, especially external works around the building (gardens and car parking sheds). Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy.

Many people in Kuwait like to donate or supply drinking water for pedestrian next to their houses. Several deaths and major injuries caused by electric short circuits due to contact of pedestrians with drinking water coolers with un-insulated wires due to the carelessness of homeowners in performing proper maintenance, along with the lack of regulation and enforcement by the concerned officials (M. Al-Bendari, personal communication, 15 September 2003), (Al-Watan, 2003).

3.6.9 Improper Procedures to Update Design Code of Reinforce Concrete Works

The Ministry of Planning (1995-1997) study examined the current construction practices in Kuwait. For structural design, Kuwait Municipality allows the use of ACI-89 codes (Strength design Method), a code that is now more that 30 years old. However, an updated version of ACI-89 is used by government sector and by top 10 consultant offices (M. AL-Zohali, personal communication, 27 September 2006).

3.6.10 Lack of Structural Design Review for Serviceability

Major consultants (MOP, 1995; MOP, 1997) comprehensively check their structural design for serviceability. Kuwait Municipality does not have any procedure to carry out a rigor check of the submitted structural design; instead they accept the stamp and signature of a registered structural engineer as being sufficient. Many inconsistent codes are used by other consultants, when performing design analysis and KM is not performing plan review for serviceability. Therefore, the implementation of serviceability by consultants other major ones is uncertain (K. Hassan, personal communication, 11 January 2005).

3.6.11 Improper Plan Review Causes Extra Cost and Low Safety

Consultant offices working in private housing projects usually produce designs with excessive amounts of materials which lead to extra costs, and designs which do not pass minimum safety requirements, resulting in potential expensive and unsafe structures (MOP, 1995; MOP, 1997), (K. Hassan, personal communication, 11 January 2005). The fact that design receives Municipality approval leads the clients to believe, understandably, that the design is satisfactory. This is a dangerous state of affairs.

3.6.12 Improper Plan Review for Concrete Works which causes Faulty Design

The study of reinforced concrete and concrete works defects provides evidence that there are faults in the design, supervision and execution that resulted in weak structures as against the intended design strength of 250 Kg/cm2 as specified in the structural drawings. In addition to that, huge deficiency in steel and shear reinforcement, inadequate concrete cover thickness as specified will result in corrosion of steel and concrete. There isn't a proper enforcement criteria or regulation as ACI 318-99 that can be enforced by building officials to prevent this incidence. This leads to the conclusion that current Building Regulations in Kuwait are insufficient to protect public health or safety (A. AL-Khlofi, personal communication, 27 October 2003), (Al-Haider, 2003).

3.7 BC Technical Problems

3.7.1 Inadequate Buildings Standards for Weather and Soil Conditions

Kuwait weather and surface conditions can be described as a severe environment for construction activities especially during summer, which contribute to safety problems, and low productivity

(Kartam, Flood, Koushki, 2000). Most of structures in Kuwait are made of reinforced concrete (Haque, 2003). The combination of hot, dry, that is characterized by high rates of water evaporation during the day, condensation in coastal areas at night, wind born dust, ground water, (Haque, 2003), and salty climatic conditions that prevail in Kuwait are some of the most demanding exposure regimes to which reinforce concrete structures are subjected (Haque, 2000). In addition, the locally available aggregates are contaminated with chlorides and sulphates. The prevailing climatic conditions in Kuwait can accentuate the deterioration of concrete structures if adequate measures are not taken in the material selection, design, and construction of the structures. Suitable codes and standards should be developed and adopted to accommodate harsh climate condition affecting the built environment particular condition (K. Hassan, personal communication, 07 April 2009).

3.7.2 Differences in Building Standards Increase Construction Cost

Many researchers in Kuwait agree on the problem of insufficient codes and regulations (Sadek, 2001; ALFahad, 1998; MOP, 1997). There are differences in design practices in Kuwait, due to the absence uniform building codes, and the designer depends on different codes of other countries (Sadek, 2001), (K. Hassan, personal communication, 07 April 2009).

Sadek (2001) observed many problems due to inconsistent building designs in Kuwait, which lead to the unjustified increase in cost of typical residential buildings. These problems are caused by the absence of uniform national building code. The study concluded that on the average there is an increase in reinforcement up to 30% for slabs, 60% for beams, and 60% for columns, while columns are substantially over sized.

3.7.3 Inadequate Insulation Regulation Fail to Detect Energy Losses in Buildings

The Ministry of Water and Electricity issued an energy code of practice in early eighties. Based on a latest research, current energy regulations for Kuwait need to be reformed (AL-Sayed Omer, 2002). The current regulation does not require the application of insulation materials on surfaces of columns, beams, or slabs (O. AL-Sayed, personal communication, 11 March 2003), (Design professional, personal communication, 20 March 2003), (Design Manager, personal communication, 25 March 2003), (Fig. 3.15). This research highlights the negative effect of thermal bridging to columns and beams on energy consumption of typical residential villas in Kuwait. It was found that the thermal resistance of construction could be reduced by 48% due to un-insulated columns and beams. Therefore, suitable codes and standards should be developed and adopted to reduce energy losses.

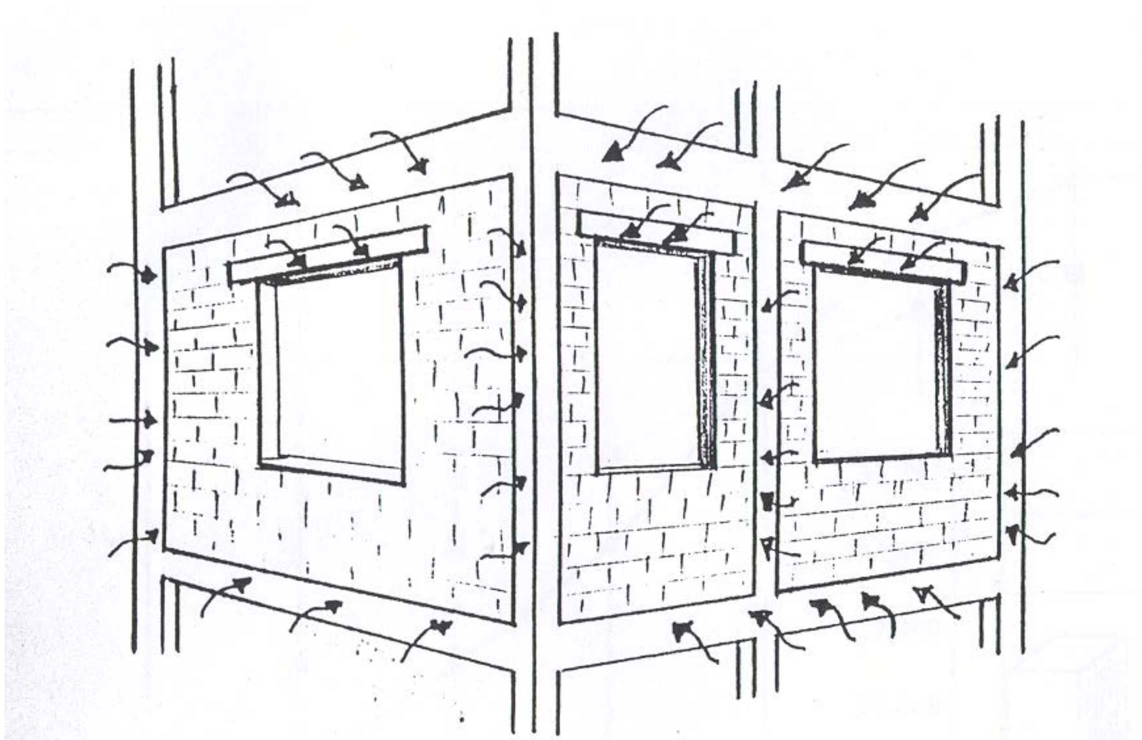

Fig. 3.15: Energy consumption through reinforce concrete surface areas (columns and beams)

3.7.4 Application of Improper Architecture Standards Leads to Loss of Energy in Buildings

Energy conservation regulations in Kuwait need to be revised and reinforced (Fereig, Younis, 1985). According to AL-Ragom and Omar (2002), retrofitting existing residential buildings with energy conservation measures will lead to significant saving in energy consumption. AL-Temeemi (1994) suggests minimizing windows areas to control solar radiation, major windows exposures to face north or south and be shaded, and roof colour to be painted white.

A study (Al-Feel, 1988) on the governmental housing projects in Kuwait shows that building materials of cement, wider windows, and roofs don't suit the Kuwait environment. Kuwait houses buildings need to be built by blocks produced from local materials and the use of small windows. The walls should be wide, and roofs should be high to allow for air movement.

3.7.5 Insufficient Fire Safety Requirements for Smoke Detectors for Houses

There are many deaths and injuries result from residential fires around the world. Residential fires statistics in Kuwait are unambiguous. However, according to a fire official, private houses fire incidents have the highest rate than other types of buildings use (i.e. commercial, industrial projects), (M. AL-Babtain, personal communication, 01 February 2005). Statistics of another country showed that each year in the United States, thousands of people die or are severely injured by fires and burns. One of the most effective ways to prevent deaths and injuries from fires is to install and maintain smoke detectors in households (Department of Health and Human Services, 2005).

The major regulation regarding fire protection in Kuwait is the regulation on Protecting Building from Fire produced and enforced by The Kuwait Fire Service Directorate. This document specified no requirements for any smoke detectors or fire distinguishers for residential flats and houses (KFSD, 2002). Many houses were inspected and found that all of them have no fire smoke alarms (J. AL-Fahad, Site Visit, 20 February 2006).

3.7.6 Insufficient Codes Dealing with Problems due to Wind-blown Sand

In spite of the fact that Kuwait falls within a desert environment, the design of most buildings and codes hardly considers the effect and consequences of wind-blown sand (Bofah, 1991). Apart from wind loading problems, the designer must deal with problems of erosion, sand encroachment, indoors infiltration of sand and dust, soil erosion at building foundation, sand dust deposition on façade, vents, and roof elements.

3.7.7 Insufficient Codes Dealing with Problems due to Wind Condition and Natural Light Cause Defects in Buildings

Another problem, which is common due to design defects is related to wind condition and natural light (J. AL-Fahad, Site Visit, 10 May 2003). AL-Azmi (1997) made an analytical study about the construction and environment harmony for houses in Kuwait. Research results indicate that 95 % of inhabitants did not consider wind conditions, and 76.4% of inhabitants did not consider the use of natural light during their house design. Building codes must be developed to take into consideration the wind problems and benefit of natural lighting in the design stage. Most of studies of housing in Kuwait favour governmental projects neglect private housing that are erected on individual expenses.

3.7.8 Insufficient Demolition Code Causes Building Accident

There are many problems of demolition projects (T. AL-Ghatani, personal communication, 03 March 2008). In October 2005, insufficient building regulations for demolition works cause a six floor commercial residential building to deviate and turn aside during the process of demolition by the contractor. The police had to evacuate nearby residents, and shops in neighbourhood had to be closed as the foundation of one side of the building got separated from the building body (Fig. 3.16 and 3.17) (AL-Shiraki, 2005).

In reviewing building regulations for demolition, article no. 1 of Building Regulation 1985, and article no. 106.1 of International Building Code state that any owner or an individual who intends to demolish building or structure should obtain the necessary permit. In addition, there are other administrative requirements that should be applied when performing the demolition. Building Regulation 1985 and International Building Code order the use of a registered engineer to perform the design and implement demolition. However, neither Building Regulation 1985,nor International Building Code gives more details, specification, methodology procedure standards, or professional certification in how to perform demolition. There is no article in Kuwait Municipality Law 1972, or any other law in the country, which enforces regulatory examination or certification to contractors, based on scientific way, by testing their skills theoretically and practically for such jobs.

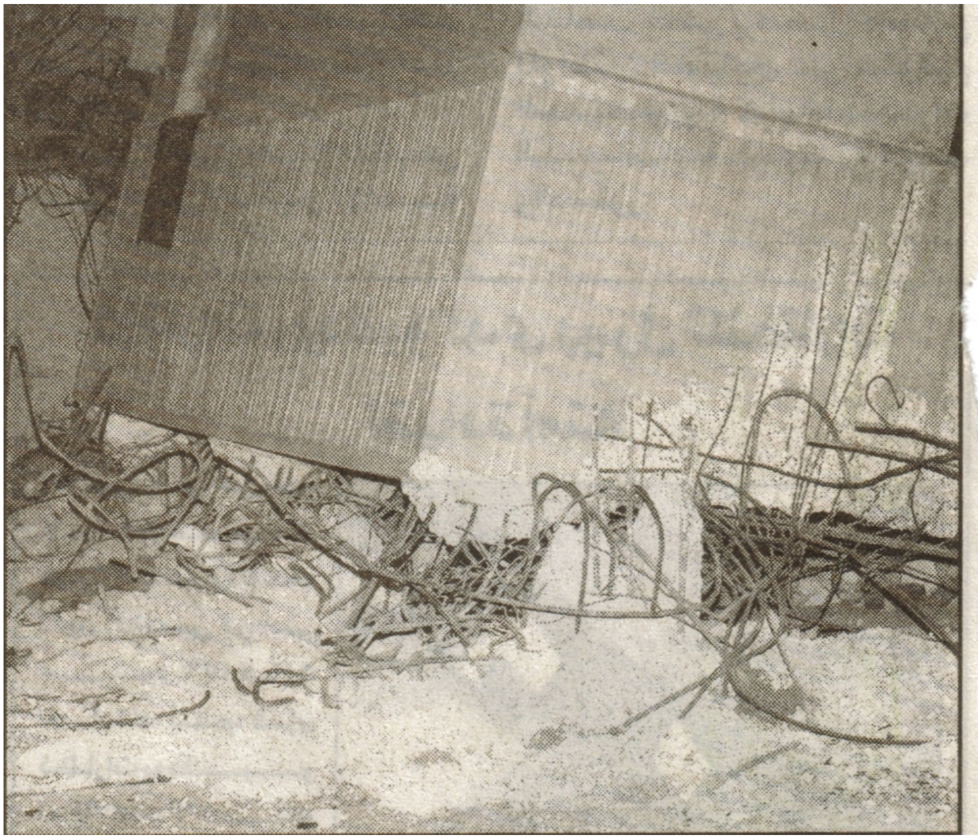

Fig. 3.16: Building foundations

Fig. 3.17: Tilted building during improper demolition process

The previous situation is a clear incidence for insufficient building regulations. Buildings should be demolished by approved qualified contractor. The problem in Kuwait is that there isn't a regulation and enforcement mechanism that can be enforced by building official to prevent these incidences.

3.7.9 Insufficient Code Causes Accident of Collapse of Reinforce Structure Building

Insufficient building regulations for design and construction cause a huge private service building to collapse during the process of construction in December 2004 (AL-Sherhan, 2004) (Fig. 3.18 and 3.19). According to construction professionals who examined the accident on site, the reinforce concrete contractor lack experience to perform proper support for the slabs (Ali, personal communication, 21 December 2004). The supporting woods were weak and insufficient. The local newspaper reported that 32 workers have been injured, 3 of them seriously wounded. Furthermore, the accident caused a huge financial loss to the owner.

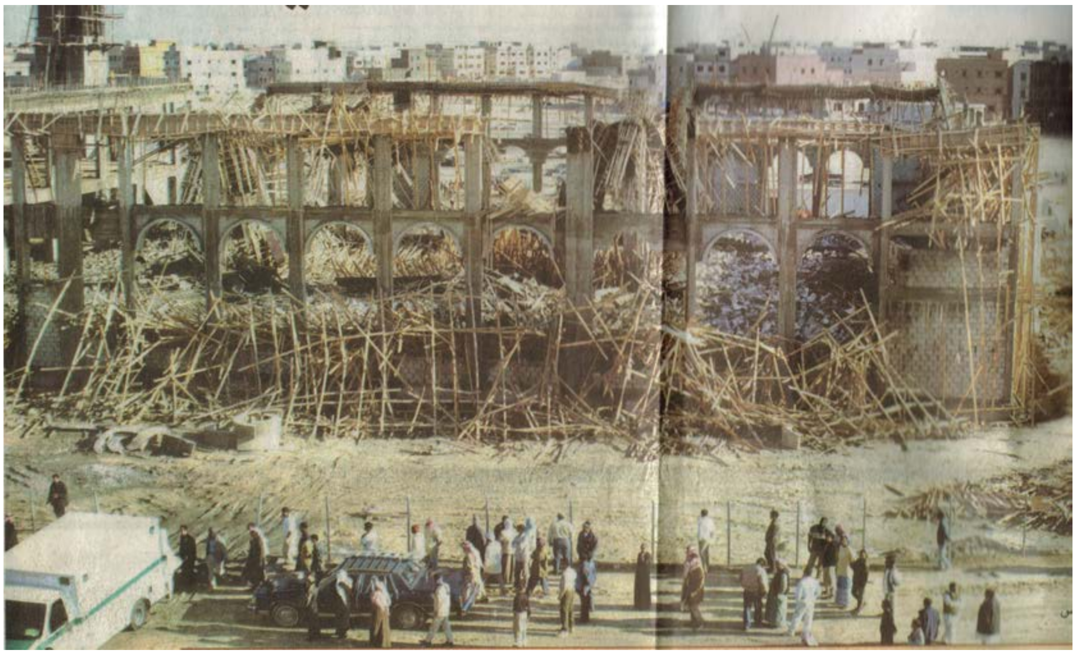

Fig. 3.18: Collapsed building

Fig. 3.19: Collapsed building

When reviewing building regulations for design and construction, we found article no.1 of Building Regulation 1985, and article no.106.1 of International Building Code state that any owner or an individual who intends to construct a building or a structure should obtain a permit prior to such works. In addition, there are other administrative requirements that should be applied when performing construction. Building Regulation 1985 and International Building Code require a registered engineer to perform the design or construction of buildings. However, Building Regulation 1985 does not give more details, specification, methodology, procedure, standards, or professional certification in how to perform reinforce concrete structures. Also, there isn't any article in Kuwait Municipality Law 1972, or any other law in the country which enforce regulation to exam or test contractors, based on scientific way, by testing their skills theoretically and practically.

The previous situation is clear incidence for insufficient building regulations. Reinforce concrete structures should be designed and constructed by approved qualified contractor. The problem in Kuwait is that there isn't a solid regulation and enforcement mechanism that can be enforced by building official to prevent these incidences.

3.7.10 Insufficient Code and its Enforcement for Formwork and Support Cause Accident of Collapse of Building Basemen t

In May 2006, insufficient building regulations for design and construction caused building basement to collapse during construction (Fig. 3.20, and 3.21 of Collapse Accident). According to Fire Department, the cause of collapse is due to the failure of the support of one of the basement walls, due to vibration of an electrical generator nearby caused the soil to become loose and weak (AL-Sherhan, 2006). The accident resulted in death of two workers, two injuries and a tremendous financial loss to owner.

Fig. 3.20: Killing of two construction workers and two seriously injured in basement collapse under construction in Desma town in May 7, 2006

Fig. 3.21 Killing of two construction workers and two seriously injured in basement collapse under construction in Desma town in May 7, 2006

3.7.11 Insufficient Safety Code Causes Death of 2 Construction Workers

Insufficient building regulations for safety in sites, certification of labours to work in high elevations, and machinery maintenance leads to death of 2 construction workers, in April 2005 (AL-Qabas, 2005). The workers installing marble facades while a crane arm separated and fell on the support beam where the two labours where standing, which led to the fall of two workers from 17th floor. According to Fire Department official, the labours were not protected with necessary harness required while working at heights.

According to professional contractor, most of workers who come to Kuwait to work in construction sites are not qualified to do construction works (Ahmed, personal communication, 11 November 2005). A building official ***said many construction safety laws***

and regulations are neglected by the contractor and not enforced by the Municipality (Thafer, personal communication, 11 November 2004).

When reviewing building regulations for safety in sites, we found article no. 2 of Safety Regulation 1981 states that any owner or an individual who intends to perform construction works should follow safety regulations. However, Building Regulation 1985 does not give more details, specification, methodology procedure standards, or professional certification in how to implement safety in sites. Also, there isn't any article in Kuwait Municipality Law 1972, or any other law in the country, which enforces regulation to exam or test construction workers, based on scientific way, by testing their skills theoretically and practically for safety requirements in sites.

There isn't any information regarding machinery maintenance in Building Regulation 1986. Insurances companies in Kuwait have requirements for machinery maintenance. However, the accident proves that there is a lack of proper enforcement for such requirements.

The previous situation is a clear incidence for insufficient building regulations. Construction sites should have approved safety and machinery maintenance standards and qualified labours.

3.7.12 Insufficient Metal Works Code Causes Accident of Fall of Cars' Metal Shed

Insufficient building regulations for design and installation of sheds cause a long metal shed to fall, in December 2004 (Fig. 3.22 Photo of Fall of Cars' Metal Shed). A pedestrian was injured and many cars parked under the shed were damaged (Hamed, 2004).

According to a construction metal expert who is familiar with metal and aluminium works in Kuwait, said that there are a lot of mistakes in the selection of materials and installation works (Hofman, personal communication, 09 October 2003).

There isn't any article in Kuwait Municipality Law 1972, or any other law in the country, which organizes and enforces regulation for the installation or maintenance of sheds.

The previous situation is a clear incidence for insufficient building regulations. Installation or maintenance of sheds should be designed , constructed, and maintained by approved standards and qualified contractor.

Fig. 3.22: Fall of cars' metal shed

3.7.13 Insufficient Tile Code Causes Accidents of Fall of Marble Blocks from Ceiling

The Insufficient building regulations for design, installation, and maintenance of marble blocks on ceiling cause blocks to fall in large gathering room, in January 2002 (Fig. 3.23, 3.24), Photos of Fall of Marble Blocks from Ceiling), (Amin, ALSayed, 2002). The accident caused injury for a group of adults and a child. The child was badly injured. The large quantity of marble caused many people to flee the room in panic, which they mistook as an earthquake happening.

When reviewing building regulations, we found article no. 11 of Building Regulation 1985 states that any owner or an individual who intends to construct building or structure should follow standard's design and construction methods and workmanship. However, there isn't any article in Kuwait Municipality Law 1972, or any other law in the country, which organizes, enforces, or specifies regulations for the design, installation, and maintenance of marble blocks or facades.

The previous situation is a clear incidence for insufficient building regulations. Installation or maintenance of marble blocks or facades should be done by approved qualified contractor.

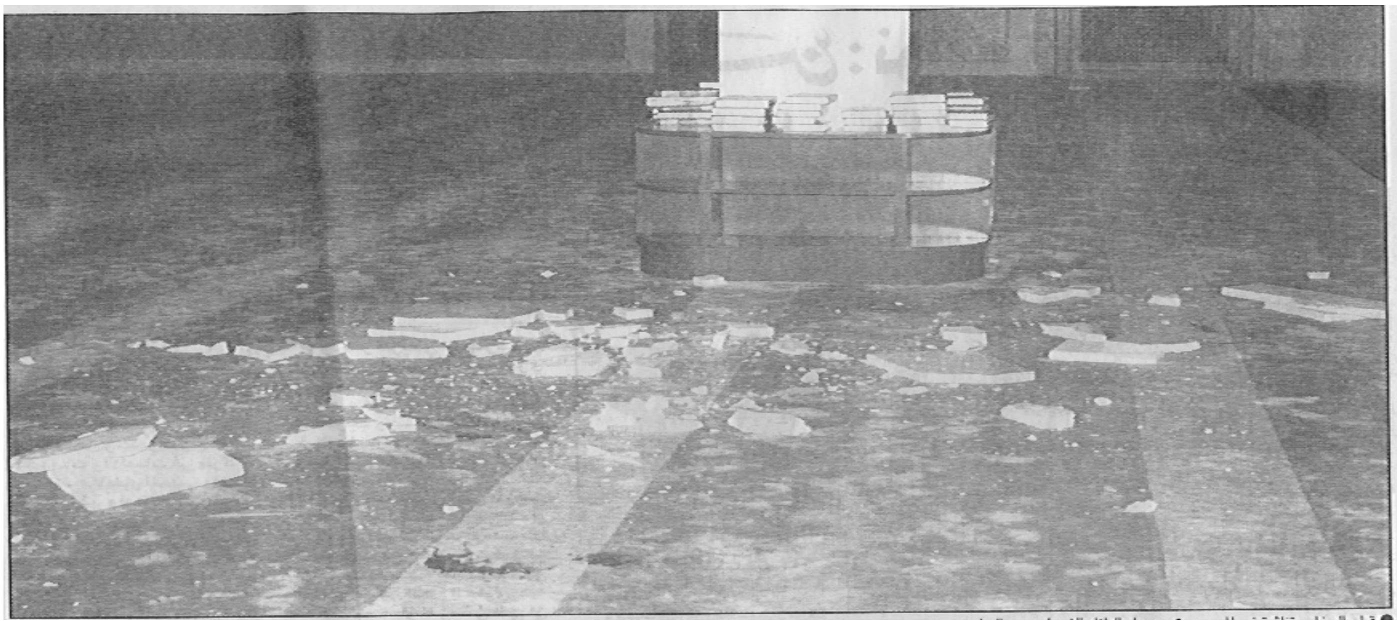

Fig. 3.23: Marble blocks spread on the floor and blood marks of a wounded child

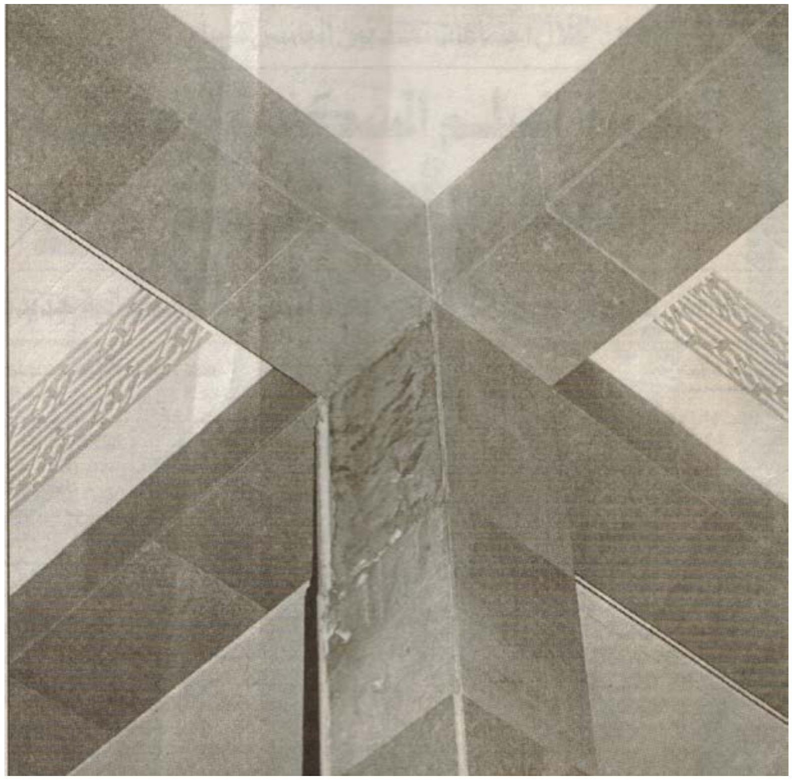

Fig. 3.24: The column where the marble blocks fell down

3.7.14 Insufficient Tile Code causes Accident of Slide of Elderly Woman on Airport Floor

The Insufficient building regulations for design, installation, and maintenance of floor surfaces cause an elderly lady to slip and fall, in February 2002 (AL-Watten, 2004). The incidence occurred in the main entrance hall room of Kuwait Airport. According to a construction professional, the floor surfaces were badly performed (M. AL-Zohali, personal communication, 20 November 2004). The contractor had performed an extra smoothing, which led to very low friction and resistance for human feet. The accident caused severe concussion for the lady, who had been taken to hospital later. The lady's husband had been in a very bad psychological condition.

When reviewing building regulations, we found that article no. 11 of Building Regulation 1985 states that any owner or an individual who intends to construct a building or a structure should follow standard design and construction methods and workmanship. However, there isn’t any article in

Kuwait Municipality Law 1972, or any other law in the country, which organizes, enforces, or specifies regulation for the design, installation, and maintenance of floor services.

The previous situation is a clear incidence for insufficient building regulations. Installation or maintenance of floor services should be designed, constructed, and maintained by approved standards and a qualified contractor.

3.7.15 Insufficient Code for Drinking Water Cooler Sets Causes Deaths

The Non maintenance of drinking water cooler sets result in 2 different death incidents by electrical shots within 2 months in 2 different locations in Kuwait (AL-Watan, 2003). According to Ministry of Electricity and Water officials there are many death incidents caused by drinking water cooler sets (M. AL-Marshed, personal communication, 26 September 2003).

Many house owners have the habit of donating drinking water cooler sets and place these sets in front of their houses, to be used by pedestrians and the public. Cold water is necessary for the public, since Kuwait has many hot weather months. However, the problem is that many donators have no knowledge in how to maintain or buy the right sets. These sets should be able to resist rain, humidity, dust, hot sun rays, and other desert weather characteristics to protect from generating electrical shots.

Article no. 115 of International Building Code states that unsafe equipment or an equipment with inadequate maintenance shall be removed from use. Also, a vacant structure that is not secured against entry shall be deemed unsafe (IBC, 2000).

When reviewing building laws and regulations, we found that article no. 19 of Building law 1972 states that the Municipality's responsibility is to safeguard the public health, safety of food, general welfare, and hygiene. However, there isn’t any article in Kuwait Municipality Law 1972, or any other law in the country, which organizes, enforces, or specifies regulation for the design, installation, and maintenance of drinking water cooler sets.

The previous situation is a clear incidence for insufficient building regulations. Buildings and building accessories and sets should be designed, constructed, and maintained by approved standards and a qualified contractor.

3.7.16 Insufficient Concrete Mixing and Handling Code Causes Damaging for Setbacks and Roads Services

The Insufficient building regulations for a concrete site mixing cause damaging for setbacks and roads services (Sultan, 2002), (J. AL-Fahad, Site Visit, 01 November 2006). According to Director of Quality Control at the Ministry of Housing, the poor methods of concrete site mixing are not based on standard methods or procedures (Sultan, 2002). The result is concrete remains on sidewalks and streets, and incorrect mix, which causes low quality building products.

When reviewing building regulations, we found that article no. 11 of Building Regulation 1985 states that any owner or an individual who intends to construct a building or a structure should follow standards design and construction methods and workmanship. However, there isn’t any article in Kuwait Municipality Law 1972, or any other law in the country, which organizes, enforces, or specifies regulation for the design, installation, and maintenance of concrete works. Also, there isn’t any article in Kuwait Municipality Law 1972, or any other law in the country, which enforce regulation to exam or test contractors, based on scientific way, by testing their skills theoretically and practically. However, article no. 1905 of International Building Code had concrete works regulation for concrete site mixing.

The previous situation is a clear incidence for insufficient building regulations. Buildings should be constructed by approved concrete standards and qualified contractor. The problem in Kuwait is that there isn't solid regulation and enforcement mechanism that can be enforced by building official to prevent these incidences. This leads to the conclusion that the current Building Regulations in Kuwait are insufficient to protect public health, safety and general welfare.

3.7.17 Insufficient Code Causes Problems of Construction Debris and Waste

Construction and buildings debris, remains, and wastes are great threat for human lives and health. It is an infringement of building regulations when there are many sites and open spaces around Kuwait that have a lot of debris, remains, and wastes.

Municipality is not taking actions to remove these debris, remains, and wastes which resulted in accumulation of debris, remains, and wastes in Manguf in the middle of a commercial residential buildings, in Agila in the middle of houses, in Sapah Al-Salem and Mubarak Al Kabeer in open space (Fig. 3.25), (Al-Qapas, 2005, 2006). For many of the pervious incidences, the Municipality did not take any action until now (J. AL-Fahad, Site Visit, 28 November 2006).

Article no. 9 of Safety Regulation of 1981 states that construction and buildings debris, remains, and wastes shall be removed from inside or outside building and construction sites.

The previous situation is a clear incidence for infringement of building regulations caused by the administrative body in the Municipality. Who caused these debris, remains, and wastes should be punished, and the problem should be corrected.

Fig. 3.25: Construction debris and wastes

3.7.18 Insufficient Code Causes Problems of Premises identification

Article no. 303.3 of International Property Maintenance Code states that building shall have approved address numbers placed in a position to be plainly legible and visible from the street or road fronting the property (ICC, 2000).

A house in Yarmook had no approved address number for more than 4 years. This none existent of number caused inconvenient and problematic communication with others (J. AL-Fahad, Site Visit, 05 October 2003).

The previous situation is a clear incidence for non compliance with Article no.303.3. This house should have an approved address number.

3.7.19 Insufficient Code Causes Problems of Vehicular Driveway and Floor Covering Materials

The Insufficient building regulations design for interior driveway caused damage for concrete slab and it's covering materials (Fig. 3.26, and 3.27). A whole interior driveway with an area of 40 m2 approximately had to be removed. The owner had spent additional money for reconstruction of this driveway (J. AL-Fahad, Site Visit, 10 May 2003).

The driveway slab consists of concrete layer and tiles covering. During construction, the concrete work was inspected, and found that the design of driveway is not considering the live loads of cars. There are no reinforcing bars for the slab. The concrete failed to hold live load of cars without reinforcement. The selection of covering materials was not right, and the tiles were not capable to withstand the live load of cars expected to park in the drive way (Fig. 3.26, and 3.27).

When reviewing building regulations, we found article no. 11 of Building Regulation of 1985 states that any owner or an individual who intends to construct a building or a structure should follow standard's design and construction methods and workmanship. However, there isn’t any article in Kuwait Municipality Law 1972, or any other law in the country, which organizes, enforces, or specifies regulation for the design, installation, and maintenance of interior driveway. Also, there isn’t any article in Kuwait Municipality Law 1972, or any other law in the country, which enforces regulation to exam or test contractors, based on scientific way, by testing their skills theoretically and practically. However, article no. 1607 of International Building Code had design load regulation for driveways.

The previous situation is a clear incidence for insufficient building regulations. Buildings should be constructed by approved concrete standards and a qualified contractor.

Fig. 3.26: Damaged interior driveway

Fig. 3.27: Damaged interior driveway

3.7.20 Insufficient Code Causes Problems of Vacant Structures and land

Article no. 301.3 of International Property Maintenance Code states that all vacant structures and premises thereof or vacant land shall be maintained in a clean, safe secure and sanitary condition so as not to cause a blighting or adversely affect the public health or safety (ICC, 2000).

The vacant plots in Hawilli Area (which are parallel to Ben Keldoon Street) are unsafe for humans passing by or for car parking. The plots are full with pot holes. During rainy days, a huge quantity of rain water accumulates accompanied with mud. Moreover, residential complex buildings around these plots use to dump their refuse in arbitrary condition. These plots have potentials to spread diseases and other hazards to human and animals (J. AL-Fahad, Site Visit, 12 April 2003).

The previous situation is a clear incidence for non compliance with Article no.301.3. These vacant lands should be maintained and repaired.

3.7.21 Insufficient Code Causes Problems of Sanitation of Exterior Property Areas

Article no. 302.1of International Property Maintenance Code states that all exterior properties and premises shall be maintained in a clean, safe and sanitary condition. The exterior vacant plot areas in Hawilli Area which are parallel to Ben Keldoon Street are not safe of human health (Fig. 3.28). The accumulations of building debris and rubbish make it unsafe, which may cause various body injuries due to the existence of sharp debris as steel reinforcing and sharp broken tiles. The delay and neglect of Municipality inspectors to check this area and many other areas gave chances for these incidences (J. AL-Fahad, Site Visit, 12 April 2003).

The previous situation is a clear incidence for non compliance with no. 302.1. These exterior properties and premises should be maintained and repaired.

Fig. 3.28: Construction debris and wastes

3.7.22 Insufficient Code Causes Problems of Grading and Drainage of Exterior Property Areas

Article no.302.2 of International Property Maintenance Code states that all premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water thereon, or within any structure located thereon. The exterior property of house number at Yarmook isn't safe for human health (J. AL-Fahad, Site Visit, 03 May 2003). The ungraded area of the road caused frequent accumulation of stagnant water (Fig. 3.29). The cause for water accumulation is that many house owners in the neighbourhood are washing their interior and exterior yards, and water stops in this house exterior. The combination of stagnant water and refuse left over during long periods of time may cause serious problems, especially if children fall in these dirty spots. Kuwait Municipality and the Ministry of Public Works should correct this problem by making proper grading for this area.

The previous situation is a clear incidence for non compliance with Article no. 302.2. These exterior properties and premises should be maintained and repaired.

Fig. 3.29: Problems of grading and drainage of exterior property areas

3.7.23 Insufficient Code Causes Problems of Conditions of Sidewalks, Driveways, and Parking Spaces

Article no 302.3 of International Property Maintenance Code states that all sidewalks, stairs, and driveways, parking spaces and similar areas shall be kept in proper state of repair, and maintained free from hazards conditions.

Good sidewalks are crucial for human safety. The incidence of missing tiles in Fahad Al Salem Street, narrow walking paths for house in Yarmmok, expose passing to stumble and fall (Fig. 3.30, and 3.31), (J. AL-Fahad, Site Visit, 17 June 2003). The Municipality should penalise any house or building owner not preparing damaged front pathways.

Good driveways and parking spaces are crucial for human and automobile safety. The incidence of car park lots with holes and are not an even land in Salem AL-Mobarek Street exposes the hardship and suffering of drivers. The Municipality should punish any building owner not preparing damaged driveways and parking spaces.

The previous situation is a clear incidence for non compliance with Article no. 302.3. These sidewalks, stairs, and driveways, parking spaces and similar areas should be maintained and repaired.

Fig. 3.30: Problems of conditions of sidewalks, driveways, and parking spaces

Fig. 3.31: Problems of conditions of sidewalks, driveways, and parking spaces

3.7.24 Insufficient Code Causes Problems of Plant Growth (less that 25 cm)

Article no. 302.4 of International Property Maintenance Code states that all premises and exterior property shall be maintained free from weeds or plant growth in excess of 10 inches (254 mm). During the last few years, it is very common in Kuwait, that home owners grow plant (Conacapris) as fencing which exceeds 2 to 4 meters. Many of these homeowners build illegal rooms, and use these plants as a cover to not be seen by others (J. AL-Fahad, Site Visit, 23 October 2003).

The previous situation is a clear incidence for non compliance with Article no. 302.4. Plant growth should not of excess of 10 inches (254 mm).

3.7.25 Insufficient Code Causes Problems of Exhaust Vents

Article no. 302.6 of International Property Maintenance Code states that pipes, ducts, conductors, fans or blowers shall not discharge gases, steam, vapour, hot air, grease, smoke, odours or other gaseous or particulate wastes directly upon abutting or adjacent public or private property or that of another tenant.

The adjacent house in Yarmook has a large kitchen which has a blower discharging a huge amount of gases and smoke especially during cooking time at early morning and noon. This action prevents neighbours to open a window to access fresh air for most of the time. Many times, the neighbour tried to open a window, which lead to accumulation of odour on bed rooms. The exhaust vent is about 3 to 4 meters away from the window (J. AL-Fahad, Site Visit, 19 March 2003).

The previous situation is a clear incidence for non compliance with Article no. 302.6. This exhaust vent should be repaired to stop discharge of gases and smoke.

3.7.26 Insufficient Code Causes Maintenance Problems for Hotel

The demolition of Hotel Safair at Kuwait City on January 2004 was a result of improper maintenance for air conditioning units (Thafer, personal communication, 11 November 2004). Unobserved water leakage from air conditioning units caused deterioration of the reinforcement of beams and columns of the hotel concrete frame. This lead to structural failure, and the owner had to eventually demolish the hotel for safety reasons (Site Visits 03 November 2004), (Fig. 3.32). This problem resulted in a great financial loss to the owner.

The previous situation is a clear incidence for non compliance with Building Maintenance Code.

Fig. 3.32: Destruction of Hotel Safir, Kuwait City (photo by the author - 2004)

3.7.27 Insufficient Parking Code for Buildings

There is no proper parking spaces regulation for private or commercial housing in Kuwait (Building Regulation 1985, 2000). According to International Zoning Code, the number of parking spaces required is 2 parking spaces per a dwelling unit. The code explains the dwelling unit as a single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitations (ICC 2000).

The house in Yarmook has 4 dwelling units. The parking spaces required for this house is 8. However only 2 parking spaces are available. This shortage of parking spaces caused frequent street conjunctions, continuous nuisance for neighbouring houses, that many times visitors for this house occupy their parking spaces, which results in social problems with neighbours (J. AL-Fahad, Site Visit, 10 May 2003).

According to Building Regulation, Salwa town is classified as private housing zone (Building Regulation 1985, 2000). Few houses in Salawa town in Kuwait have been inspected regarding the availability of parking spaces requirements. Each house has 4 to 6 dwelling units. The parking spaces required for this house is 8 to 12, however only 2 parking spaces are currently available. Inspections shows that parking spaces requirements are not fulfilled in these houses (J. AL-Fahad, Site Visit, 11 May 2004).

According to Building Regulation, Nugra town is classified as a commercial residential buildings zone (Building Regulation 1985, 2000). Few residential buildings in Nugra town in Kuwait have been inspected regarding the availability of parking spaces requirements. Each building has 60 to 80 dwelling units. All inspected residential units showed that parking spaces requirements are not fulfilled (J. AL-Fahad, Site Visit, 15 November 2004).

3.7.28 Insufficient Sleeping Areas Code for Residential Buildings in Kuwait

Overcrowding of sleeping areas is causing great inconvenience for human. It is an infringement of building regulations when there are thousands of labours' buildings and houses around Kuwait have overcrowded sleeping areas (AL-Romi, 2005).The Municipality is not taking actions to correct the infringement practices. These problems are common in Khaithan, Julib AL-Shoyokh, Bnid AL-Gar, AL-Jahra, and some other areas of Kuwait. Many of these incidences and the Municipality has not taken any action until now (Fig. 3.33).

Article no. 404.5 of International Property Maintenance Code states that every bedroom occupied by one person shall contain at least 6.5 m2 of floor area, and every bedroom occupied by more than one person shall have at least 4.6 m2 of floor area for each occupant (ICC, 2000).

Few houses in Khaithan town in Kuwait have been inspected regarding the availability of sleeping areas requirements (Asam, Site Visit, 28 November 2005). Most of the buildings inspected are not in compliance with article no. 404.5 of International Property Maintenance Code (ICC, 2000).

Fig. 3.33: Immense Problems of Thousands of labours' buildings

3.7.29 Insufficient Code for Area Requirements for Food Preparation at Residential Buildings in Kuwait

Article no. 404.7 of International Property Maintenance Code states that all spaces to be occupied for food preparation purposes shall contain suitable space and equipment to store, to prepare and serve foods with proper sanitation requirements. There shall be adequate facilities and services for the hygiene disposal of food wastes and refuse, including facilities for temporary storage (ICC, 2000).

There are thousands of labours' buildings and houses around Kuwait, which are in adequate facilities for food preparation found in Khaithan, Julib AL-Shoyokh, Bnid AL-Gar, AL-Jahra, and some other areas. In many of these incidences, the Municipality did not take any action until now. Figures 3.34 and 3.35 show examples of inappropriate food preparation facilities which lack many basic necessary health requirements (AL-Romi, 2005).

Article no. 404.7 of International Property Maintenance Code states that for 6 or more occupants shall contain at least 6.57 m2 of floor area for food preparation purposes.

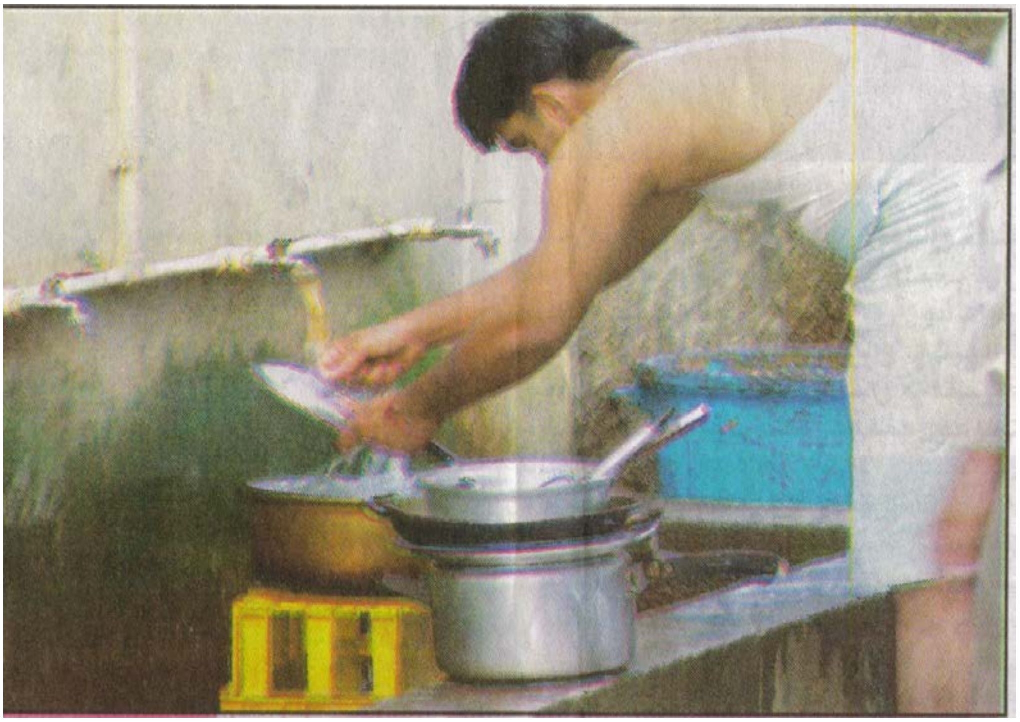

Fig. 3.34: Inappropriate dish washing facility

Fig. 3.35: Inappropriate food storing facility

Few houses in Khitan town in Kuwait have been inspected regarding the availability of food preparation area requirements (Asam, Site Visit, 28 November 2005). Most of buildings inspected are not in compliance with article 404.7 of International Property Maintenance Code (ICC, 2000).

3.7.30 Insufficient Code for Toilet Rooms Requirements for Residential Buildings in Kuwait

Lacks of toilet requirements are great harm for human welfare. It is infringement of building regulations when there are thousands of labours' buildings and houses around Kuwait, which have incidences of insufficient toilet requirements. These incidences occur in Khaithan, Julib AL-Shoyokh, Bnid AL-Gar, AL-Jahra, and some other areas. In many o f the pervious incidences the Municipality did not take any action until now (Fig. 3.36).

Article no. 502.2 of International Property Maintenance Code states that at least one closet, lavatory and bathtub or shower shall be supplied for each four room units (ICC, 2000).

Fig. 3.36: Inappropriate toilet lacking many necessary health requirements

Few houses in Khaithan town in Kuwait have been inspected regarding the availability of toilet requirements (Asam, Site Visit, 28 November 2005). Most of the buildings inspected are not in compliance with article no. 502.2 of International Property Maintenance Code (ICC, 2000).

3.7.31 Insufficient Signs Code for Buildings in Industrial Areas in Kuwait

Lacks of efficient and high-quality sign regulations cause harm for human welfare and safety. There are many buildings around Kuwait which lack efficient and quality signage. The Municipality has not taken any actions to correct these instances of infringement practices. There are thousands of buildings around Kuwait with disordered and disorganized signs, which cause awful, confusing, and unpleasant looking buildings (Fig. 3.37, and 3.38). These incidences occurred a lot in Showikh, Julib AL-Shoyokh and some other industrial areas. Despite the pervious incidences the Municipality did not take any action until now.

Fig. 3.37: Disorganized signs create awful, confusing, and unpleasant looking buildings in Shuwaikh Industrial Area

Fig. 3.38: Disorganized signs create awful, confusing, and unpleasant looking buildings in Shuwaikh Industrial Area

Article no. 1001.1 of International Zoning Code states that the purpose of regulations of signs and signs structures is to protect safety, and orderly development of the community. The code gives details for sign types and the computations of sign area required (ICC, 2000).

Chapter 10 of International Zoning Code requires architecture and technical details for signage, with more details regarding installation requirements, alteration, and repair (ICC, 2000).

Few automobile repair shops in Shuawakih in Kuwait have been inspected regarding the availability of proper signs requirements (J. AL-Fahad, Site Visit, 07 December 2005). Most of the buildings inspected are not in compliance with Chapter 10 of International Zoning Code (ICC, 2000).

3.7.32 Insufficient Code and Design Review Cause Inadequate Structural Design

One of the improper common design practices is ignoring the ground beams in design that may threaten inhabitants and safety of the structure. This practice is contrary to international engineering specifications. Other practice is the use of complete reinforce concrete system for the frame, and ignoring the use of mixed system of reinforce concrete and load bearing. Other practice is the design of reinforced concrete members with excessive steel, which may lead to sudden structure collapse, low durability, and extra costs (Sadek, 2001).

3.7.33 Insufficient Maintenance Code for Gas Pipes Cause Accident of Gas Pipe Explosion in Religious Facility

A gas pipe explosion in religious facility in January 2009 led to the death of 2 people, injuries to 9 people, and damages for properties (Fig. 3.39, and 3.40). According to government reports, the causes for these accidents are due to improper maintenance for gas pipes in the kitchen (AL-Sharhan, 2009). This incident led the government to establish improved Municipality and Fire Fighting Authorities (J. AL-Foziah, personal communication, 07 April 2009).

According to the International Fuel Gas code, the purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, and quality of materials, location, operation and maintenance or use of fuel gas systems (ICC, 2006).

Article no. 3102.3 of the code which deals with maintenance states that those installations both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe condition. Devices or safeguards which are required by this code shall be maintained in compliance with the code edition under which they were installed. The owner or the owner's designated agent shall be responsible for maintenance of installations. To determine compliance with this provision, the code official shall have the authority to require an installation to be re-inspected (ICC, 2006).

The previous situation is a clear incidence for non compliance with Article 3102.3. This religious facility should have proper maintenance and operation for its gas piping system.

Fig. 3.39: Explosion in religious facility in Al-hmedi in January 2009

Fig. 3.40: Explosion in religious facility in Al-hmedi in January 2009

3.7.34 Insufficient Minimum Requirements of Earthquake Code

Researchers detected the occurrence of around 800 earthquakes in Kuwait. The first earthquake which occurred in Kuwait that was large enough to be detected by international networks was in 1931, with a magnitude of 4.8. This was followed by a number of earthquakes in 1973, 1976, 1977, 1993 and 1997, with magnitudes ranging from 3.2 to 4.8. The Kuwait National Seismic Network (KNSN) recorded more than 300 local earthquakes from March 1997 to December 2006. One of the most important earthquakes that occurred in Kuwait and recorded by the KNSN was in the Minagish, close to the Saudi Arabian-Kuwaiti border on 30 December 1997. It measured 4.3 locally and was felt by people, but presented no danger (Al-enezi, 2009).

Kuwait has no regulations concerning earthquakes (AL-Enezi, 2009). According to research and professional expert in earthquakes design for buildings. most of buildings in Kuwait have insufficient minimum requirements of Earthquakes Code. The expert explained the potential high risk and the kind of buildings which suffer damages in earthquakes. These kinds of buildings are residential multi story building with more than ten floors, and houses and other buildings which has span of beams or slaps more than seven meters. The expert further states that even though many tower buildings are designed and constructed based on international standards, there are no guarantees that these buildings are designed with minimum requirements of Earthquakes Code (A. Sadek, personal communication, 02 December 2009).

3.8 BC Social Problems

3.8.1 Infringement of Codes Result Buildings Violations

According to a report published by Kuwait Municipality, 90% of residential investment buildings at Hawalli and Farwaniya Governorates have violations (Kuwait Municipality, 2009), (A. AL-Atram, personal communication, 14 March 2009).

Moreover, there are delays of issuing and enforcing legal court rules based on violation cases, unclear regulations texts, more laws and codes and the resulting conflict among them, and unconstitutional decisions to collect fees (A. AL-Forih, personal communication, 18 March 2002, 14 March 2009), (M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006). The following table is explaining the penalty sort, and the law bases (Table 3.11):

No.	Penalty Sort	The Law Bases
1	Penalties of building regulations and Conditions, in different Kuwait regions (inside the real estate's borders)	Decision no. 30 – 1985 concerning organizing building works Schedules, according to the articles 34, 35 law No. 15 – 1972 Kuwait Municipality
2	Violation on state properties (penalties outside real estate's borders)	Law No. 105 – 1980, No. 8 – 1988 authorization of Ministry of Finance to Kuwait Municipality Minister decision no. 99/88 Administrative decision no. 88/108 Administrative decision no. 92/64
3	Penalties of exploiting real estates in excellent, private family residential regions for bachelors housing.	Law No. 92/125 – date 29/9/1992 concerning preventing of non-families in private housing regions.
4	Penalties in industrial region (exceeding in buildings area, commercial exploits)	Council of Ministries decision No. 471- date 17-5-1992 occurs of penalties in industrial districts.
5	Buildings Facades that need restoring and beauty.	Article 24 – decision No. 30/85 minister decision no. 90/88 administrative decision No. 233/88
6	Penalty shops (areas without license – penalty for building regulations and Conditions)	Private conditions with shops in schedule (21 – decision 30/85 concerning organizing of building works)
7	Penalties and exceeding in Shalleh regions (areas without license – use of contradicted building materials).	Ministers decision No. 110/88 in addition schedule of hotels building regulations – to 30/85 concerning organizing building works.

Table 3.11: Classification of Penalties (AL-Abaid, 2001) (AL-Shimali, 2002)

According to the Legal Depart Report, the general penalties in private residential regions are (Kuwait Municipality, 2004), (K, AL-Abid, personal communication, 27 May 2005).

a. Locking enclosure with lighter materials to be exploited commercially or as stores.
b. Converting chambers that over look on the main streets to shops to be exploited commercially.
c. Implementing shops in setback region from the limit of house from lighter materials.
d. Working of chambers in the surfaces or enclosure.
e. Extending of license to include the real estate and back rooms.
f. Modify houses by dividing into many small enclosures to be rented for non-families.
g. Transferring one of the rooms into kitchen, the floor had two kitchens; the owner divides the floor into two flats.

h. Exploiting the house commercially as in east of Qurain and Jaleeb Al-Showiukh using residential area for commercial purpose.
i. Non-implementing of heights as per licensed especially basements.
j. Making inside portions be rented to bachelors.

There is a general impression that the municipality is responsible for imposing penalties. The following table is explaining law administration activity through 1999 (Tables 3.12, and 3.13).

Instruction	Sittings courts	Complains	Judgments	Notice of courts
Primary	3203	781	143	16.3
Recommending	720	97	81	35
Distinction	104	39	23	9
Total	**4027**	**917**	**247**	**157**

Table 3.12: Law Administration Activity Through 1999

(Research and Statistical Department, 1999)

Sector name	Complains no.	Resolved	Percentage of resolved complains
Services affairs	96	73	76 %
Building Administration	71	62	87%
Monitoring and Following Administrations	46	31	67%
Zoning and Safety Administrations	33	18	55%
Workers affairs	54	49	91%
Municipality Parliament			
Secret Honesty	62	12	19%
Law Administration	28	6	21,00%
Total	**390**	**251**	

Table 3.13: Complaining Office Activity through 1999

(Research and Statistical Department, 1999)

3.8.2 Infringement of Fire Safety Code Causes Accident of Fire of Merrymaking Building

The accident of fire of merrymaking building in April 2009 led to the killing of 3 persons and 64 injuries, 5 children of them, and damages for properties. According to government reports, the causes for these accidents are improper fire safety requirements (Fig. 3.41, 3.42, and 3.43). Egress exits are used for food storing; there are insufficient fire safety protection equipments, and the status of overcrowding which always the case in wedding occasions (AL-Masaoudi, 2009). This incident let the government to work with more attention to establish improved Municipality and Fire Fighting Authorities (J. AL-Foziah, personal communication, 07 April 2009).

The major regulation regarding fire protection in Kuwait is Protecting Buildings from Fire Regulations produced and enforced by The Kuwait Fire Service Directorate. This document has requirements for egress exits, and fire distinguishers (KFSD, 2002).

According to the International Fire code, the purpose of this code is to establish the minimum requirements consistent with nationally recognized good practice for providing a reasonable level of life safety and property protection from the hazards of fire, explosion or dangerous conditions in new and existing buildings, structures and premises and to provide safety to fire fighters and emergency responders during emergency operations (ICC, 2006).

Article no. 107.6 of the code which deals with overcrowding, states that overcrowding or admittance of any person beyond the approved capacity of a building or a portion thereof shall not be allowed. The fire code official, upon finding any overcrowding conditions or obstructions in aisles, passageways or other means of egress, or upon finding any condition which constitutes a life safety hazard, shall be authorized to cause the event to be stopped until such condition or obstruction is corrected (ICC, 2006).

The previous situation is a clear incidence for non compliance with Kuwait and the International Fire codes. These merrymaking buildings should have proper safety protection equipments requirements, egress exits, and control overcrowdings.

Fig. 3.41: Fire of merrymaking building in April 2009

Fig. 3.42: Fire of merrymaking building in April 2009

Fig. 3.43: Fire of merrymaking building in April 2009

3.8.3 Infringement of Administrative Code Causes Illegal Construction of 16 Commercial Residential Buildings without Permit

Infringement building regulations for design or construct buildings without permit is a serious crime. It threats the hull legal and judicial system, and promotes others to over regulations and laws. In May 2004, an ex-member of municipality council announced in newspapers conference that 16 commercial residential buildings had been constructed without permit (Mohommed, 2004).

When reviewing building regulations for design and construction, we found article no. 1 of Building Regulation of 1985 and article no. 106.1 of International Building Code state that any owner or an individual who intends to construct a building or structure should obtain a permit.

The previous situation is a clear incidence for infringement of building regulations caused by the administrative body in the Municipality. The building owner should be punished.

3.8.4 Infringement of Building Regulation Causes 150 Commercial Shopping Center without Premises Identification

It is infringement of building regulations when there isn't premises identification. Deputy Director of Building Licensing at AL-Farawania Governorate stated that 150 commercial shopping centres were without premises identifications (Al-Qapas, 2004). Regulation of Public Authority for Civil Information, Department of Construction at Municipality, and article no. 303.3 of International Property Maintenance Code states that building should have proof of address numbers placed on a position to be plainly legible and visible from the street or road fronting the property. The Department of Construction at the Municipality is the one in charge to enforce this regulation.

The unavailability of premises identification causes customers of shopping centres, institutions and companies who are dealing with these centres to get lost or having insufficient and misleading information when using address for different activities.

The previous situation is a clear incidence for infringement of building regulations caused by the administrative body in the Municipality. The building owner should be punished, and the problem should be corrected.

3.8.5 Infringement of Building Regulation Causes Unsafe Structures

Unsafe structures are great threat for human lives. It is infringement of building regulations when there are many buildings and houses around Kuwait which are unsafe. The municipality is not taking actions to make them safe. There is an old unsafe and vacant building in Frawania in the middle of a commercial residential building (AlQapas, 2005).There is an old very unsafe and vacant building in Adelia in the middle of houses (AlQapas, 2005), There is an old unsafe and vacant building in Kuwait City in the middle of commercial buildings (AlQapas, 2004). There is an old unsafe and vacant building in Hawalli in the middle of commercial residential buildings (Al-Qapas, 2005), (Fig. 3.44, and 3.45). Many of the pervious incidences show that the Municipality did not take any action until now (Fig. 3.46), (J. AL-Fahad, Site Visit, 23 November 2005).

Article no. 29, 30, and 31 of Building Regulation of 1985 and article no. 115 of International Building Code state and made clear that unsafe structures shall be taken down and removed or made safe. Also, a vacant structure that is not secured against entry shall be deemed unsafe.

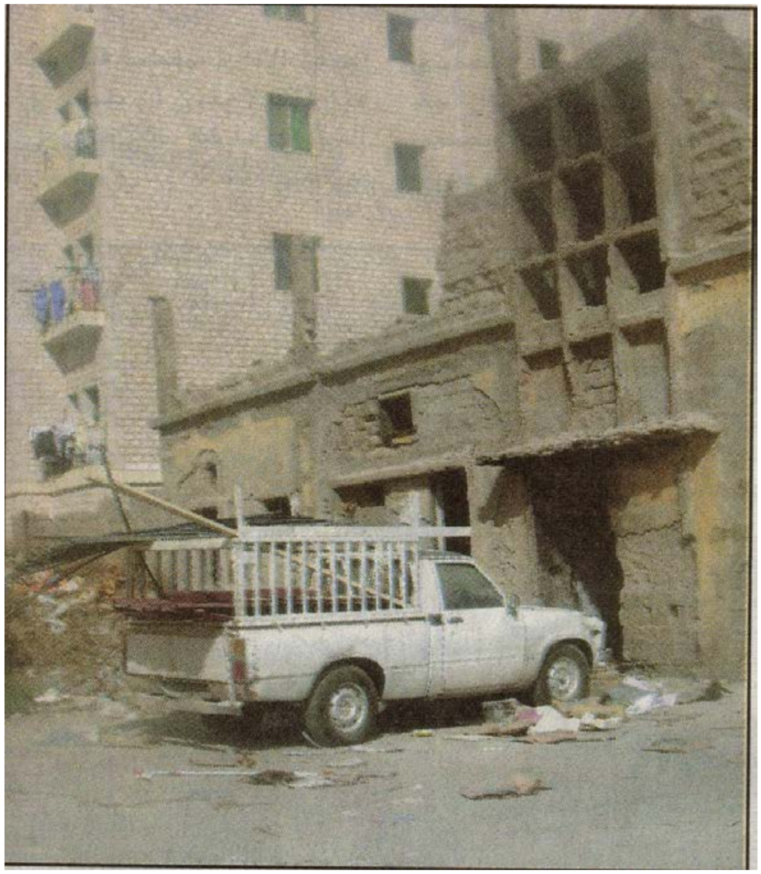

Fig. 3.44: Unsafe Structures

The previous situation is a clear incidence for infringement of building regulations caused by the administrative body in the Municipality. The unsafe and vacant structure owner should be punished, and the problem should be corrected.

Fig. 3.45: Unsafe Structures

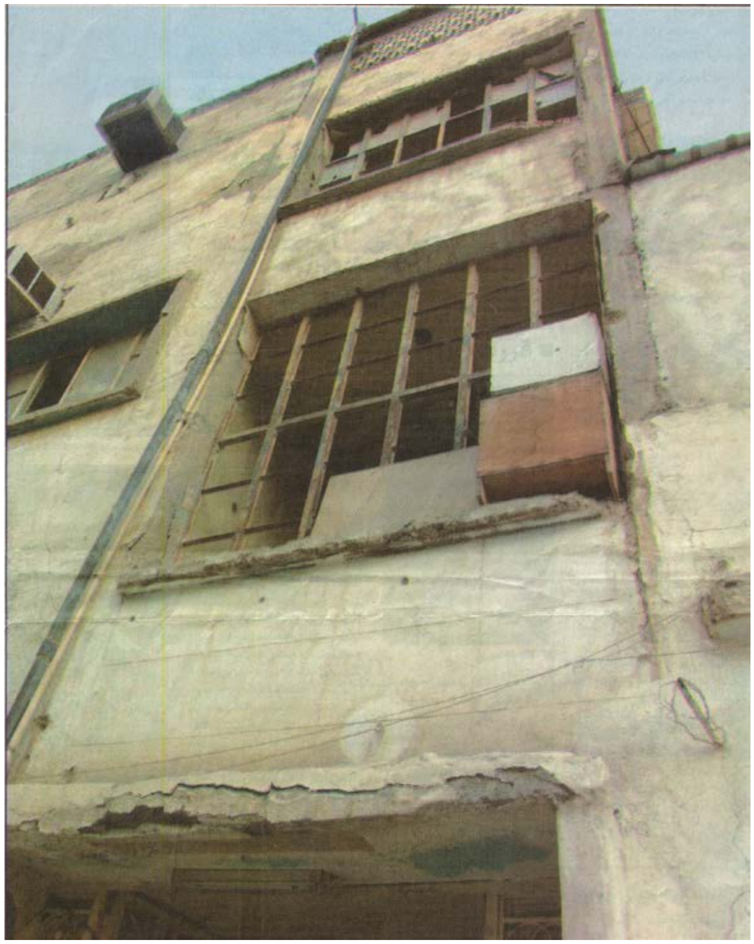

Fig. 3.46: Unsafe Structures

3.8.6 Infringement of Building Regulation Causes Accident of Fall of Abandon Building Walls

Infringement and Insufficient building regulations for design and installation of abandon building cause parts of its walls to fall, in December 2004 (Fig. 3.47 Photo of Fall of Abandon Building Walls). The accident caused damage for cars which were parked near the building. Neither institution, nor insurance company was willing to reimburse for the damages. The car driver was almost getting killed; while he was very close the accident area. These shaky walls create great threat for the safety of pedestrian. Also, this vacant neglected building is giving an ugly looks, and damaging the views and shape of the neighbourhood. The building had been used illegally by a group of workers for many years, which caused frequent fires according to neighbours (AL-Qabas, 2004). The neighbouring building owners' submitted a complaint for the Municipality to fix the problem, but the Municipality ignored them for more than 2 months.

Fig. 3.47: Part of Building Collapse on January 2004 at Kuwait

When reviewing building regulations, we found articles no. 29, 30, and 31 of Building Regulation of 1985 state that any building leading to collapse fully or partially should be demolished and removed by the owner or Municipality. However, the Municipality ignored and neglected their duties for a year, even though when neighbouring buildings owners submitted complaint.

The previous situation is a clear incidence for infringement of building regulations caused by the administrative body in the Municipality. The building owner should be punished if he refused to remove the building. Municipality should remove any old and safe buildings.

3.8.7 Infringement of Building Regulation Causes Violation of Heights and Number of Floor

Infringement building regulations for buildings heights and number of floors is a serious crime. It threatens legal and judicial system, and promotes others to violate regulations and laws.

There are many hotels which violate building regulations. The Building Regulation of 1985 for sea side stated that the max allowable number of floors is three, and maximum height allowed is 12 meter. In 2003, I was in charge in a task to request from Kuwait Municipality to allow hotel to add extra forth floor in the sea side. The process for appeal was very hard. It was quiet shocking, that the there are hotels in the sea side that has more than the limits that allowed by the regulations (Fig. 3.48, & 3.49), (J. AL-Fahad, Site Visit, 12 June 2003).

A research found that all hotels along the coast are violating the maximum allowable number of floors, which is three floors (Table 7.9, Fig. 7.30 & 7.31), (ALFahad, 2010).

No.	Hotel Name	No. of Floors	Address
1	A	4	Salmiya
2	B	6	ALbedih
3	C	4	ALbedih
4	D	4.5	ALbedih
5	F	6	ALMissilah

Table 3.14: No. of Floors of hotels constructed along the coast in Kuwait

Fig. 3.48: Map of location of hotels constructed along the coast in Kuwait

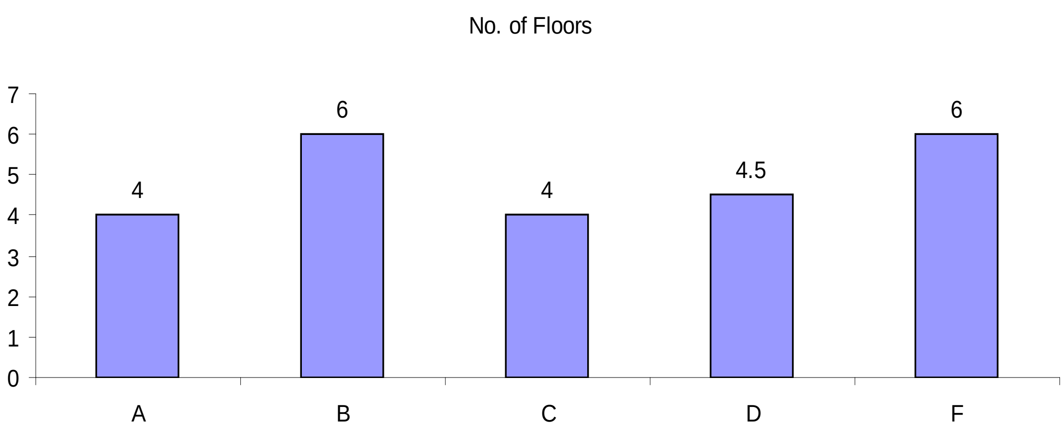

Fig. 3.49: No. of Floors of hotels constructed along the coast in Kuwait

There are many houses which are in non compliance with building regulations. The Building Regulation of 1985 for house stated that the max allowable number of floors is Three. It was quiet shocking, that the there are many houses in Kuwait especially in Farwaniya, Ahmadi and Jahra Governorates that have four to five floors which is more than the limits that allowed by the regulations (Fig. 3.50, & 3.51), (J. AL-Fahad, Site Visit, 04 January 2009), (M. AL-Harris, personal communication, 11 November 2005).

The previous situation is a clear incidence for infringement of building regulations caused by the administrative body in the Municipality. These owners of hotels and houses should be punished.

Fig. 3.50: A Hotel has four floors and Half in violation with BR 1985

Fig. 3.51: A Hotel has more than six floors in violation with BR 1985

Fig. 3.52: A House (in Abdualla ALMubarak) has four floors in violation with BR 1985

Fig. 3.53: Two houses (in Ashbilyah) have four floors in violation with BR 1985

Fig. 3.54: A House (in Salwa) has four floors in violation with BR 1985

Fig. 3.55: A House (in Julib ALShuokh) has four floors in violation with BR 1985

Fig. 3.56: A House (in Fith Ring Roud) has five floors in violation with BR 1985

3.8.8 Infringement of Administrative Code Causes Forged Permits and Inspection Reports

Fake building permits and inspection reports are serous faults on the administration system. It is insufficient administration of building regulations when there isn't quality control to perform safe work procedures. for few years, the practice of bribe and corrupt work procedures to get building permit or inspection report is increasing. The investigation is showing this practice.

A house owner submitted a complaint for the Kuwait Municipality director asking to solve his problem (Al-Wattan, 2004). The problem is that the owner wants to sell his house, and the Municipality refused his request for three years. The house documents had fake building permits and inspection reports. The owner requests explanations from Municipality, in how this house has been built illegally. The problem is that the owner can't get his money back by selling the house again. He paid a lot of money. He is saying it is not his fault that the house is illegal, and the Municipality should punish the original owner who built the house. For three years, and he has been struggling with the Municipality. He lost a lot of finical resources, and the problem caused him many sociological and time waste problems.

The incidence of fake building permits and inspection reports are causing lost of finical resources, sociological and time waste problems. This is a breakdown for judicial and administrative system of building and real-estate activities in the country. Building and projects developers, owners, designers, contractors, and others have no trust in dealing with building and real-estate activities. Many people will have no trust, nor the support of the Municipality activities and responsibilities. The problem is that the Municipality is the main local government in the country, and hence the breakdown for the Municipality is a breakdown for the country inside.

The previous situation is a clear incidence for insufficient of administration and infringement of building regulations that caused by the administrative body in the Municipality. The building official who caused these problems should be punished, and the problem should be corrected.

3.8.9 Infringement of Energy Code Causes Financial Losses

According to energy code, the walls should be constructed with insulation bricks. However, some building projects are ignoring the code by filling up parts of walls with non insulating bricks (Fig. 3.55, and 3.56). Code violation is due to the weak enforcement of the code by Municipality.

Fig. 3.57: Side View of Villa showing violate code by filling up parts of walls with non insulating bricks

Fig. 3.58: Front View of Villa showing violate code by filling up parts of walls with non insulating bricks

According to a local contractor in Kuwait some of newly constructed houses and supervised by house owners are complying with energy code by constructing walls with insulation breaks. However, some houses which are built by a contractor for the purpose of trading are usually ignoring the energy code requirement in order to save some money (around 1200 bounds). Therefore, investigating houses projects under construction constructed by contractors without owners monitoring may produce houses are in non compliance with current energy codes (W. Al-Forih, personal communication, 01 April 2009).

3.8.10 Infringement Fire Safety Code Causes Violation of non installing Fire Sprinkler System

Fire building regulations and codes which are developed and implemented for the protection of lives and properties. Statistics of other countries such as the US, showed that for specific types of occupancies, the reduction in the average number of civilian deaths due to the presence of sprinkler protection is reported to be 60% for manufacturing properties, 74% for stores and offices, 75% for selected health care occupancies, and 91% for hotels and motels. Property loss reductions average 53% for stores and offices, 64% for manufacturing properties, 66% for selected health care occupancies, and 70% for public assembly occupancies (Fleming, 2002).

In other countries the law punishes building owners for violations of codes. In Canada, an owner of apartment building was fined $18,750 in court for sprinkler system violations. The company pleaded guilty to failing to maintain the building's sprinkler system in operating condition and failing to notify the fire department when the sprinkler system was shut down. The company was fined $7,500 for each offence, including victim surcharge (The Standard, 2009).

It was quiet shocking, that there are office buildings in Kuwait ignoring the fire regulations. Infringement of building regulations for non installing fire sprinkler system is a serious crime. It threatens the legal and judicial system, and promotes others to ignore regulations and laws.

In January 2009, I conducted a training workshop for real-estate department in a government organization. This government organization is occupying huge tower building. It consists of 11 floors with estimated 80 meters width and 40 meters long. In this building there were around 1100 employees working for 5 days a week, and around 300 customers visiting the building per working day. The building had been used for more than 30 years (J. AL-Fahad, Site Visit, 04 January 2009).

While using the training room, I recognized that there were no sprinkles in ceiling. With the permission and help of building inspectors of my class, the building has been inspected for the existence of fire sprinklers. We found that only the basement and the ground floors have sprinklers. I asked a senior fire official for the cause of this violation. He said the enforcement of fire building regulations is affected negatively by political status of the country (J. AL-Foziah, personal communication, 07 April 2009).

According to Kuwaiti Anti-fire System in Building Regulations, and article no. 903.2.1 of International Fire Code, an automatic sprinkler system shall be provided throughout building including Group F occupancies such as for office uses (ICC, 2006).

The previous situation is a clear incidence for infringement of fire building regulations caused by the administrative body in the Kuwait Fire Service Directorate. The lives and properties of this building are in great risk. There are many building fires in Kuwait. According to Kuwait Fire Service Directorate (KFSD) statistics, that in the year 2008 there were 1616 fires in all kind of residential building including offices and commercial uses (KFSD, 2008). This building owner should be punished, and sprinkles should be installed in the building.

3.9 Summary

This chapter is reviewing Kuwait built environment, building and construction practice, in details the subject of building regulations and codes in Kuwait, and problems of insufficient building codes and its enforcement in Kuwait.

- **Section 3.1: Kuwait and the Construction Environment**

1. Kuwait is situated in the North West corner of the Arabian Gulf.
2. Topography and environmental factors are the important factors in choosing the constructing sites. Kuwait is distinguished by a levelled surface with some hills and some low levelled areas. The altitude is about 300 meters north from the sea surface in the west south.
3. Many old Kuwait sites disappeared after oil was discovered that reflected upon life, particularly, the construction sector that saw more changes by modern constructing planning for Kuwait.
4. The areas of these houses were very small. But they had enough services to people's needs, also roads were narrow and unpaved. The building materials were simple from the mud coming from the sea or land, like the clay or raw brick {it was made from mud and water}. The stones on the sea are cut and the straw is used in Kuwait.
5. This fast change in the construction sector was accompanied by change in buildings. The buildings transferred from mud, wooden and simple into progressing buildings of all shapes. Whereas, the economy of oil and outer investment produced more revenue and the ability to construct large amount of buildings, roads, and factories and useful civil buildings.
6. Kuwait relied on the influx of workers to perform different projects especially construction. Because no local workforce was available and since the locals could not do all the work, it created a conflict of imported experiences and beginning of the progress.

7. Residential region consists of many housing units according to certain areas to each region and for Master planning signed by Kuwait municipality.

- **Section 3.2: Building and Construction Practice in Kuwait**

1. Kuwait witnesses a big prosperous building construction movement through the last forty years.
2. Building and construction industry is very important. There is a need for statistic or indicator for volume and sorts of construction cases. There is a need for strategic plan for administration and organizing building for the country. There is a need for deploying advance technology in building and construction industry.
3. The section raises the following questions for further investigations:
    - Importance of building and construction industry.
    - Statistic or indicator for volume and construction of legal cases
    - Strategic plan for administration and organizing building industry for the country
    - Advanced technology in building and construction
4. There are different causes of professional practice and workmanship Standards. These causes are technical, regulatory, administrative, and social. The section raises the following questions for further investigations for causes of professional practice and workmanship standards with regard to technical, regulatory, administrative, social, and political sides.
5. The Total number of inhabitants in Kuwait is 2753656.The Total population of Kuwaiti families is 1365121. The Total population of private houses is 122343. The Total population of workforce is 183337, and the total population of construction workforce is 115163.
6. It is very common in Kuwait that owners supervise the construction of their villas .The majority of owners in Kuwait act as general contractors when they decide to build their homes or when they intend to embark on the renovation works.
7. The cost of building private homes in Kuwait is as high as up to KD 70,000 KD (=£140,000).

- **Section 3.3: Building Regulations and Codes in Kuwait**

This section review is related to objectives no. 2, 3 and part of 7 which are re-arranged in two parts. These two parts are:

- 1st Part: Review of **building codes** in Kuwait
- 2nd Part: Review **enforcement** of building codes in Kuwait

1st Part of the objective is fulfilled through the review of the BC legal, and technical issues. The BC legal issues are dealing with law for the enforcement of BC in the country. The BC technical issues are dealing with BC name, volumes, titles, objectives, technical requirements, and kinds of codes.

2nd Part of the objective is fulfilled through the review of the BC administration issues. The BC administration issues are dealing with main administration organization, technical advisory body for main administration organization, services of main administration organization, enforcement agency, model code, BC production schedule, publishing format, BC translation to English, development and updating of BC, BC change impact studies, guide books for BC, training and certification for BC, plan review, and site inspection.

This section (**Section 3.3)** is linked to Section 3.5.2 "Comparative Study (Benchmarking) of building codes in Kuwait and other countries" in Research Methodology chapter. The results of the literature review in this chapter, and the result of the Comparative Study (Benchmarking) conducted in Chapter 5 "Comparative Study (Benchmarking) of building codes in Kuwait, US, England and Wales, Australia, and Jordan", with other investigations in other chapters led to the development of framework for the enforcement of BC in Kuwait.

- **Section 3.4 Overview of Problems of Building Codes and its Enforcement in Kuwait**

In this section, literature review is performed to understand the problems of insufficient building codes and its enforcement in Kuwait. Most of the investigated problems lead to the conclusion that the current Building Regulations in Kuwait are insufficient to protect public health, safety and general welfare, or to protect the public from the risk of death or injury and to limit damage to property.

- **Sections 3.5 to 3.8 (Building Codes Problems in Kuwait)**

These sections summarize the main findings of the **(i)** previous studies, **(ii)** document analysis, **(iii)** short comparative studies, and **(iv)** inspection/observations (site visits). It relates the findings to research objectives, and showing links to Chapter Six Research Methodology.

In these sections, there are a total of 35 objective investigations, and 21 subjective investigations. 22 studies have been reviewed, 43 documents have been analyzed, 22 studies have been compared, 25 inspection performed, and 32 interviews conducted (Table 3.14).

Research Method	***Legal***	***Administrative***	***Technical***	***Social***	**Total**
Objective	**-**	**11**	**18**	**6**	**35**
Subjective	**1**	**2**	**14**	**4**	**21**
previous studies	**-**	**8**	**9**	**5**	**22**
document analysis	**-**	**13**	**24**	**6**	**43**
comparative studies	**-**	**5**	**15**	**2**	**22**
inspection/observations (site visits)	**-**	**3**	**18**	**4**	**25**
Interviews	**-**	**11**	**16**	**5**	**32**

Table 3.15: Summary of research activities

In these sections, an investigation conducted for 1 legal problem, 20 administration problems, 42 technical problems, and 14 social problems in Kuwait and in other countries.

Most of the investigated problems lead to the conclusion that the current Building Regulations in Kuwait are insufficient to protect public health, safety and general welfare, or to protect the public from the risk of death or injury and to limit damage to property.

Partially Fulfilling Objective Number Five

In accordance with research objective no. 5, in these sections an investigation conducted for the problems into four parts of building codes. These parts are:

1. **the legal part**
2. **the administrative part**
3. **the technical part**
4. **the social part (infringements)**

This objective of the investigation has two parts:

- 1st Part: identify shortcomings **due to insufficient in BC**
- 2nd Part: identify shortcomings **due to infringements (non compliance) of Exiting BC**

1st Part of the objective is partially fulfilled through investigating the problems of BC into three parts of BC such as the (i) legal, (ii) administrative, and (iii) technical.

The insufficiencies of the legal part of BC in Kuwait are dealing with inexistence of law for the enforcement of BC in Kuwait, which cause many shortcomings of minimum BC requirements.

The insufficiencies of the administrative part of BC in Kuwait are explained in 13 investigations, which caused different shortcomings for minimum requirements of public health, safety and general welfare. Another 8 investigations are explained from the practices of BC in other countries.

The insufficiencies of the technical part of BC in Kuwait are explained in 33 investigations, which causes different shortcomings for minimum requirements of public health, safety and general welfare. Another 9 investigations are explained from the practices of BC in other countries.

2nd Part of the objective is partially fulfilled by investigating the problems of BC in the social part. **The insufficiencies of the social part (infringements) of BC in Kuwait** are explained in 12 investigations, which caused different shortcomings for minimum requirements of public health, safety and general welfare. Another 3 investigations are explained from the practices of BC in other countries.

Chapter Four

Insufficiency Factors Related to Problems of Building Regulations, and Codes in Kuwait

Chapter Four

Cause and Impact Factors Related to Problems of Building Regulations, and Codes in Kuwait

4.1 Introduction

The literature on factors of insufficiency and infringements in building codes (BC) which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait, shows that a number of insufficiencies and infringements list had been generated by (i) many researchers in the area, (ii) observation, and (iii) views of many researchers, and professionals in the building environment. Most of insufficiency and infringement lists are being conceptualized into groupings and dimensions on the basis of the insufficiency and infringement factors characteristics and common themes. This research is proposed to categorize the insufficiency and infringement factors into a (legal, Administrative, technical, & social framework) typically used by many countries, and in particular the Australian government (refer to Section 1.2.1 research scope), (The Productivity Commission, 2004).

In this chapter, the focus is on extracting the generic factors of insufficiencies and infringements from the literature reviews of building codes/regulations which are common in most building projects in Kuwait. The factors of insufficiencies and infringements extracted were organized into relevant categories of framework of building code (legal, Administrative, technical, & social framework) to make them more useful and meaningful for the building officials and researchers.

The following sections will illustrate the four aspects of building and the extraction of cause and impact factors of the research.

4.2 Extraction of Insufficiency factors related to the legal part of BC

The BC legal issues deal with law required for the enforcement of BC in the country. Kuwait Municipality Law 1972 is the basic law which primarily concerns with the Building regulations for Kuwait .An Article in Kuwait Municipality Law has some of the objectives of BC was defined; however the administration and enforcement of BC is not completely addressed in this law. The

Building Regulations of 1985 can be considered the BC of Kuwait, and it is limited to administration of work and simple general technical requirements.

By comparing Kuwait with other countries for the enforcement of BC in the country, it was found that the Kuwaiti laws have clear statements in the building act regarding some of the objectives of BC. However, Kuwait Municipality Law 1972 lacks information which is necessary to creat clear and suitable Building regulations for the State of Kuwait. Kuwait is the only country other than the compared countries (The U.S., The U.K., Australia, and Jordan) which has no clear statement in the building act to develop or enforce BC (Table 4.1).

Country	Law for the Enforcement of BC in the country
(1) Kuwait	The article in Kuwait Municipality Law has objectives of BC, but was not a law to enforce BC
(2) The U.S.	An Article in Federal/State/City/Municipality law
(3) The U.K.	An Article in The Building Act 1984
(4) Australia	An Article in Federal/State/City/Municipality law
(5) Jordan	An Article in National Building Act
Comments	Kuwait is the only country which has no clear statement in the building act to develop or enforce BC.

Table 4.1: Results of the Comparative Study

According to The Productivity Commission, an institution of the Australian Government, building regulation has a broad definition. The range of possible regulations that are associated is quite wide. The Building Code, prescriptive or performance, is a key element of building regulations, relates mainly to technical specifications. Building regulations may also include or be affected by building approval process, planning approval process, standard settings and accreditation of products, people and process, environmental regulation, some social regulations, some economic and financial regulations, and occupational health and safety regulation (The Productivity Commission, 2004). Therefore, the list of insufficiency factors, their related literature, related to the legal part of building code based on the review of Chapter 3, and comparative study is as shown in Table 4.2:

Section 1: Legal & Technical Parts of Bulding Codes	Res. Coding	Reference	Section
Inexistence of law to prepare and enforce Building Codes to safeguard minimum requirements of public health, safety and general welfare	LV1	(Kuwait Municipality, 1972), (Legislative Audit Division	3.5.1
Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	LV2	(Al-Fahad, 1998), (Kuwait Municipality, 1972)	3.2.6, 3.3.3.1
Inexistence of building materials testing system (because of the law)	LV3	(Kuwait National Assembly, 1972), (Al-Deen, 1998), (Legislative Audit Division , 1997)	4.2, 3.3.3.1, 3.5.1, 3.3.3.4
Major obstacle to approve standard building specifications for Kuwait is the none existence of related article in Municipality laws	LV4	(Kuwait Municipality, 1972)	4.2, 3.3.3.1
Major obstacle to approve system of building methods for Kuwait is the none existence of related article in Municipality laws	LV5	(Kuwait Municipality, 1972)	4.2, 3.3.3.1
Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	LV6	(Kuwait Municipality, 1972), (Kuwait Municipality, 1985)	4.2, 3.3.6.3
More laws and codes and the resulting conflict among them	LV7	(A. AL-Forih, personal communication, 18 March 2002, 14 March 2009), (M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006)	4.5
Not taking into account the changes in building technology in current law	LV8	(BOCA, 1999), (Ministry of Planning,1995-1997), (Kuwait Municipality, 1985)	2.2, 3.2, 3.6.9, 3.7
Lack in many technical requirements in building regulations in Kuwait	LV9	(Kuwait National Assembly, 1972), (Al-Deen, 1998), (Legislative Audit Division , 1997)	3.3.3.1, 3.5.1, 3.3.3.4
Unavailable laws to prevent the monopoly of lands, which led to the increase of land price and the misuse of lands and real estates	LV10	(M. ALHarris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006)	3.6.2
Unclear regulation texts	LV11	(A. AL-Forih, personal communication, 18 March 2002, 14 March 2009), (M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006)	4.5
Unconstitutional decisions to collect fees	LV12	(A. AL-Forih, personal communication, 18 March 2002, 14 March 2009), (M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006)	4.5
Weak regulations by Municipality Council	LV13	(AL-Qabas, 2003; AL-Korafi, 2002; Khalifa, 2002; Abdul-Ghani, 2000)	3.3.5.1.1, 3.2.4, 3.6.2
Weak regulations from National Parliament	LV14	(AL-Qabas, 2003; AL-Korafi, 2002; Khalifa, 2002; Abdul-Ghani, 2000)	3.3.5.1.1, 3.2.4, 3.6.2

Table 4.2: Insufficiency variables related to legal & technical parts of bulding codes

4.3 Extraction of Insufficiency factors related to the Administrative and Social parts of BC

The administrative part relates to the building code organizations, and its main functions, which constitutes the issuing of permits, performing plan review, and inspection (ICC, 2009). In this section (4.3), the social part is related to violations.

4.3.1 Enforcement Agencies of Administrative organization

Results of **Focus Group** agree with results of **interviews** criticizing the management and political status of administration BC in Kuwait. Findings are as follows: There is no support from government neither politically nor financially. There is a lack in powerful administrative government to enforce building regulations; "the codes need claws and nails". Some officials and businessmen have the intent and the will to avoid and not obey or follow rules. Negative political status affects the efficiency of enforcement of building regulations. There is a conflict and incorporation in issuing the licenses among Ministry of Trade and Municipality, many organizations participating in administration of building process, poor management at the relevant government institutions in the Building Regulations of the Municipality and other, weak technical and financial capabilities at Municipality branches at governorates, weak reimbursements for workers at Municipality, and weak legal departments at Municipality branches at governorates (M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006).

Therefore, the list of insufficiency factors, their related literature, related to the administration part of building code based on the review of Chapter 3, and focus group study are as shown in Table 4.3:

Section 2: Administration Part of Bulding Code	Res. Coding	Reference	Section
(1) General Management			
Administrative procedures at Municipality are the main obstacles to implement and enforce regulations and laws	AV1	(ICC, 2000, BOCA, 1999), (Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	2.13.2, 3.2.6, 3.3.1 ,3.8.8, 3.6.3
Assigning many additional tasks for engineers of the technical department	AV2	(Kartam, Flood and Koushki, 2000)	3.6.6
Building decisions and regulations were created without proper study which affect the investors	AV3	(The Productivity Commission, 2004), (AL-Qabas, 2003; ALKorafi, 2002; Khalifa, 2002; Abdul-Ghani, 2000).	3.3.5.1, 3.3.5.1.4
Conflict in issuing the licenses among Ministry of Trade and Municipality	AV4	(M. ALHarris, personal communication, 27 Febrauray 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 Augest 2006)	4.3.2
Difficulty in implementing some matters	AV5	(A. ALForih, personal communication, 14 March 2009), (J. ALFoziah, personal communication, 07 April 2009)	3.6.4
lose and damage of documents and records of building projects at Kuwait Municipality	AV6	(Al-Wattan, 2004),	3.8.8
Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible of direct communication with citizens	AV7	(M. ALHarris, personal communication, 27 Febrauray 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 Augest 2006), Focus Group	4.3.2
It is hard to obtain specific information from Municipality, Kuwait Fire Department, Ministry of Electricity and Ministry of Public Work	AV8	(BOCA, 1999), (Building Regulation 1985, 2000), (ICC, 2000),	2.2, 3.6.3, 3.3.1
Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	AV9	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3
Many participating organizations in administration of building process	AV10	(M. ALHarris, personal communication, 27 Febrauray 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 Augest 2006), Focus Group	4.3.2
None of the government organizations performed their tasks of updating the construction requirements related to the use of latest construction materials or methods	AV11	(Ministry of Planning, 1995-1997), (M. ALZohali, personal communication, 27 September 2006)	3.6.9, 3.3.5.2.5
Procedures of following and monitoring of building and construction works at Municipality are not clear and not with satisfying performance	AV12	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3
(2) Certification and qualification for BC			
Conflict and unclear area of expertise of organizations participated in administration of building process	AV13	(M. ALHarris, personal communication, 27 Febrauray 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 Augest 2006)	4.3.2
Design and supervision engineers from engineering offices usually get licenses by Municipality, but they are not tested technically to know their abilities	AV14	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3
Improper Municipality technical and managerial capabilities to follow up and control building and construction works	AV15	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3
Many construction problems are due to unclear professional practice and workmanship standards	AV16	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000),	3.2.6, 3.3.1 ,3.8.8, 3.6.3

Section 2: Administration Part of Bulding Code	Res. Coding	Reference	Section
		(Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	
Municipality Council members don't have the necessary technical education or qualification in preparing the building regulations	AV17	(AL-Qabas, 2003; ALKorafi, 2002; Khalifa, 2002; Abdul-Ghani, 2000)	3.3.5.1.1, 3.2.4, 3.6.2
Small contractors usually get licenses by Municipality, but they are not tested technically resulting in engineering problems	AV18	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3
Unsuitable qualification of workforce at Municipality departments	AV19	(Kartam, Flood and Koushki, 2000)	3.6.6
Weak workforce at Municipality departments	AV20	(Kartam, Flood and Koushki, 2000)	3.6.6
Weak legal departments at Municipality branches at governorates	AV21	(M. ALHarris, personal communication, 27 Febrauray 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 Augest 2006), Focus Group	4.3.2
Weak reimbursements for workers at Municipality	AV22	(M. ALHarris, personal communication, 27 Febrauray 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 Augest 2006), Focus Group	4.3.2
Weak technical and financial capabilities at Municipality branches at governorates	AV23	(M. ALHarris, personal communication, 27 Febrauray 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 Augest 2006), Focus Group	4.3.2
(3) Plan Review, Site Inspection and Violations			
Building Department, Inspection Department, and Safety Department at Kuwait Municipality don’t perform its responsibilities properly in controlling and following local construction works	AV24	(A. ALForih, personal communication, 14 March 2009), (J. ALFoziah, personal communication, 07 April 2009), (ICC, 2000), (K. ALFoudari, personal communication, 10 October 2005), (J. ALFahad, Site Visit, 10 October 2005), (Kartam, Flood and Koushki, 2000), (K. ALAbed ALGhafoor, personal communication, 10 October 2006)	3.6.4, 3.6.3, 3.6.4, 3.6.5, 3.6.6
Difficulties facing Municipality technical workforce in acquiring correct data and information to implement and check what have been done on the site with issued licenses	AV25	(Al-Wattan, 2004),	3.8.8
It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control	AV26	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003), (Amin, 2002), (Hamed, 2004), (Al-Haider, 2003), (Kuwait University, 1998), (A. ALKhlofi, personal communication, 27 October 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3, 3.6.7, 3.6.12
Kuwait Municipality don’t perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labors, and labor	AV27	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003),(T. ALGhatani, personal communication, 03 March 2008), (Ali, personal communication, 21 December 2004), (AL-Sherhan, 2006)	3.7.8, 3.7.9, 3.7.10
Many owners and investors have no trust in the supervision capabilities of the engineering offices	AV28	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of	3.2.6, 3.3.1 ,3.8.8, 3.6.3, 3.6.7,

Section 2: Administration Part of Bulding Code	Res. Coding	Reference	Section
		Planning,1995-1997), (Al-Haider, 2003), (Amin, 2002), (Hamed, 2004), (Al-Haider, 2003), (Kuwait University, 1998), (A. ALKhlofi, personal communication, 27 October 2003)	3.6.12
Neglecting of testing of building materials and concrete by certified testing canters during projects execution	AV29	(A. ALKhlofi, personal communication, 27 October 2003), (Al-Haider, 2003)	3.6.12
Most owners and investors don't care to fulfill the demands of energy conservation in buildings because due to the low cost of electricity, and weakness of regulations and enforcement	AV30	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3
Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy	AV31	(Al-Fahad, 1998), (M. ALMarshed, personal communication, 26 September 2003), (M. Al-Bendari, personal communication, 15 September 2003), (Al-Watan, 2003)	3.2.6, 3.6.8
Unclear and inadequate procedures of review of building plans at Municipality	AV32	(Al-Fahad, 1998), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3
There is no government controlled inspection on building at construction sites	AV33	(Kartam, Flood, Koushki, 2000), (A. ALForih, personal communication, 14 March 2009), (J. AL-Foziah, personal communication, 07 April 2009), (A. AL-Atram, personal communication, 14 March 2009), (J. AL-Fahad, Site Visit, 21 November 1998)	3.3.1, 3.6.4, 3.6.7
To reduce the cost of construction and to finish work quickly, many private projects are not executed as per professional standards and proper workmanship	AV34	(Al-Fahad, 1998), (MOP, 1995; MOP, 1997), (K. Hassan, personal communication, 11 January 2005)	3.2.6, 3.6.11, 3.7.7
Workers at Kuwait Municipality don't care to use comprehensive checklists to review plans, and monitor projects to faithfully fulfil their work requirements	AV35	(A. ALForih, personal communication, 14 March 2009), (J. AL-Foziah, personal communication, 07 April 2009)	3.6.4

Table 4.3: Insufficiency variables related to administration part of bulding codes

4.4 Extraction of Insufficiency factors related to the Social Part of BC

The list of insufficiency factors, their related literature ,and the relation to the social part of building codes have been based on the review of Chapter 3, and on the focus group study, and are as shown as shown in Table 4.4:

Section 3: Social Part of Bulding Code	Res. Coding	Reference	Section
Absence of community awareness in building regulations and nature tasks of Municipality	SV1	(A. AL-Forih, personal communication, 18 March 2002, 14 March 2009)	3.6.2
Delay of issuing and enforcing legal court rules based on violation cases	SV2	(A. AL-Forih, personal communication, 18 March 2002, 14 March 2009), (M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006)	4.5
Low monetary value of penalty by Municipality law (max. 500 k .d. = 1000 £)	SV3	(M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006)	4.5
No deterrent punishments for violators	SV4	(Kuwait Municipality, 2009), (A. AL-Atram, personal communication, 14 March 2009)	3.8.1
Weak power of law in enforcing correction decisions of violations	SV5	Kartam, Flood and Koushki (2000) (K. AL-Abed AL-Ghafoor, personal communication, 10 October 2006)	3.6.6
Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	SV6	(Al-Fahad, 1998), (Al-Ali, 1997), (Al-Wattan, 2004), (Kartam, Flood, Koushki, 2000), (Mahgoub, 2002), (Ministry of Planning,1995-1997), (Al-Haider, 2003), (Amin, 2002), (Hamed, 2004), (Al-Haider, 2003), (Kuwait University, 1998), (A. AL-Khlofi, personal communication, 27 October 2003)	3.2.6, 3.3.1 ,3.8.8, 3.6.3, 3.6.7, 3.6.12

Table 4.4: Insufficiency variables related to social part of building codes

4.5 Extraction of Insufficiency factors related to the Technical Part of BC

The BC technical issue deals with the BC name, volumes, titles, objectives, technical requirements, and kinds of codes.

- **BC Name**

A comparison with other countries has been conducted, and this has shown that Kuwait is the only country which has no comprehensive BC among the compared countries (The U.S., The U.K., Australia, and Jordan), (Table 4.5).

Country	BC Name
(1) Kuwait	Kuwait has no comprehensive BC
(2) The U.S.	International Building Codes converted to states and cities codes
(3) The U.K.	Building Regulations
(4) Australia	Building Code of Australia (BCA)
(5) Jordan	Jordanian National Building Codes
Comments	Kuwait in the only country which has no comprehensive BC

Table 4.5: Results of the Comparative Study

- **BC Objectives**

The objectives of the Municipality Act are to organize building industry in Kuwait and to preserve the buildings and citizens from dangers. The current BC objectives in Kuwait focus only on a single area which is the "Public Safety". The Municipality Act has no clear BC requirements specific for buildings within the objective statement of BC as that exists in other acts of other countries considered in this study (The U.S., The U.K., Australia, and Jordan). The ICC codes objective are more comprehensive so as to deal with the three essential areas of public health, safety, and general welfare, and Kuwait Municipality endorses the ICC code as model codes for Kuwait (Table 4.6).

Country	BC Objectives
(1) Kuwait	The objectives are limited to public safety. There are no clear requirements for buildings in objective statement. The objectives are to organize building in Kuwait, and to preserve the buildings and citizens from dangers concerning the public safety inside the country
(2) The U.S.	The objectives of US BC consider three areas such as public health, safety, and general welfare. The objective statement specifies 12 building requirements in the objective statement. The objectives are to establish the minimum requirements for safeguarding the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and properties from fire and other hazards attributed to the built environment.
(3) The U.K.	The objectives of UK BC consider two areas such as public health and safety. The objective statement is not specifying building requirements. The objectives are to ensure the health and safety of people in and around buildings, and the energy efficiency of buildings
(4) Australia	The objectives of Australia BC consider one area require safety. The objective statement is specifying four building requirements. The objectives are to enable the achievement of nationally consistent, minimum necessary standards of relevant, health, safety (including structural safety and safety from fire), amenity and sustainability objectives efficiently.
(5) Jordan	The objectives domains are not clear. The building requirements domains are not included in objective statement. The objectives are a set of rules, conditions and technical requirements related to the realization of planned reconstruction of the Board and approved by the Council of Ministers
Comments	The ICC code's objective are more comprehensive to deal with the three essential areas public health, safety, and general welfare

Table 4.6: Results of the Comparative Study with respect to BC objectives

Results of **Focus Group** agree with results of **Comparative Study** that Kuwait laws have no clear objectives of BC. There is misunderstanding and ambiguity towards the definition of codes. The codes are misunderstood as standards, and specification of work procedure to execute the tasks. The specifications are usually included in the construction contracts. Any violation in specification is prosecuted by penalties articles in the contract.

- **BC Technical Requirements**

The Kuwaiti Building Regulations (BC) contains 4 technical requirements that include architecture requirements, fire resistance requirements, electrical requirements, and energy efficiency requirements. The ICC codes and the Building Regulations 2000 both have 14 requirements. These requirements are structural safety/strength, fire safety, properties safety, stability, sanitation, adequate light and ventilation, energy conservation, accessibility, mechanical, plumbing, property maintenance, zoning and occupancy, and electrical.

In addition, Australia and Jordan codes are similar to US and UK codes. Some of the requirements are overlapped (Table 4.7).

Country	**BC Technical Requirements**
(1) Kuwait	The Kuwaiti BC (Building Regulations) contains 4 technical requirements such as architecture requirements, fire resistance, electrical requirements, and energy efficiency.
(2) The U.S.	The ICC BC has 14 requirements such as structural safety/strength, fire safety, properties safety, stability, sanitation, adequate light and ventilation, energy conservation, accessibility, mechanical, plumbing, property maintenance, zoning ,occupancyand electrical.
(3) The U.K.	The Building Regulations 2000 has 14 requirements such as structure fire safety, site preparation and resistance to contaminants and moisture toxic substances, resistance to the passage of sound, Ventilation, hygiene, drainage, and waste disposal combustion appliances and fuel storage systems protection from falling, collision and impact conservation of fuel and power access to and use of buildings glazing – safety in relation to impact, opening and cleaning electrical safety
(4) Australia	The BCA has 6 requirements such as structure, fire resistance, access and egress, services and equipment, and energy efficiency as well as certain aspects of health and amenity.
(5) Jordan	Technical requirements are not clear. There are 35 different code names.
Comments	The ICC codes and the Building Regulations 2000 both have 14 requirements. In addition, Australia and Jordan codes are similar to US and UK codes. Some of the requirements are overlapped .

Table 4.7: Results of the Comparative Study (Benchmarking)

Findings from **Literature Review** agree with results of **Comparative Study** that current building regulations (Codes) lack most of the 14 requirements of the ICC codes and the Building Regulations of 2000. One of these requirements is fire safety. The Fire Code of Kuwait has no requirements specifically for houses. Some Fire officials agree with the need to create and enforce fire regulations for Kuwait houses. Fire officials belief that the best suggestions are to tell owners of houses, and villas about the means of fires protection to preserve lives and properties.

- **Building Codes Main Details**

The following are the main components of current Building Regulations and Codes at Kuwait (General Administration of Fire Fighting, 1996; Ministry of Electricity and Water, 1983, 1999):

4. Building Regulations 1985 (Kuwait Municipality)
5. Protecting Building from Fire Regulations (The General Administration of Fire Fighting)
6. Electrical and Energy Conversation Regulations (Ministry of Electricity and Water)

The Kuwait BC (Building Regulations) contains some of the technical provisions for the design and construction of buildings and other structures, covering matters such as architecture requirements to check for building use (educational, commercial, health, etc.), classification, building areas, height, space allocation, stairs, balconies, basement, elevators, and applications for the disabled. Kuwait BC lack many technical details. It has more zoning requirements and aspects than building or construction regulations.

The fire regulations contain some of the technical provisions for the fire resistance (access and egress, services and equipment). The electrical regulations contain some of the technical requirements for (installations, load, A/C systems and equipments); and Energy efficiency (building peak load requirements, and application of insulation materials). Kuwait fire, electrical and energy regulations lack many technical details (refer to sections 3.3.1, 3.3.2, and 3.6.8). However, the US has detailed building codes. There are 12 different building codes (Table 4.8).

No.	Model Building Code
1	International Building Code
2	International Residential Code
3	International Energy Conservation Code
4	International Fuel Gas Code
5	International Fire Code
6	International Mechanical Code
7	International Property Maintenance Code
8	International Plumbing Code
9	International Privet Sewage Disposal Code
10	International Zoning Code
11	ICC Electrical Code Administrative Provisions
12	ICC Performance Building Code For Building Facilities

Table 4.8: Model Building Code

International Building Code (IBC) has many technical requirements that are not available in Kuwait code. These IBC technical requirements are (Table 4.9):

	1. INTERNATIONAL BUILDING CODE	20	Aluminium
1	Administration	21	Masonry
2	Definitions	22	Steel
3	use and occupancy classification	23	Wood
4	special use and occupancy	24	glass and glazing
5	general building heights and areas	25	gypsum board and plaster
6	type of construction	26	Plastic
7	fire resistance rated construction	27	Electrical
8	interior finishes	28	mechanical systems
9	fire protection systems	29	plumbing systems
10	means of egress	30	elevators and conveying systems
11	Accessibility	31	special construction
12	interior environment	32	encroachments into public right of way
13	energy conservation	33	safeguards during construction
14	exterior walls	34	existing structures
15	roof assemblies and rooftop structures	35	Signs
16	structural design	36	sign regulations
17	structural tests and inspections	37	Sheds
18	soil and foundations	38	construction equipment
19	Concrete	39	referenced standards

Table 4.9: International Building Code

Therefore, the list of insufficiency factors, their related literature and the relation to the technical part of building codes are based on the review of Chapter 3, and ICC building codes, and comparative study as shown in Table 4.10:

Section 4: Technical Part of Bulding Code	Res. Coding	Reference	Section
Accessibility	TV1	International Building Code, (N. Bouresli, personal communication, 08 October 2000)	Appendix G, 3.3.2
Aluminium	TV2	International Building Code, (Hofman, personal communication, 09 October 2003)	Appendix G, 3.7.12
Billers/water heaters	TV3	International Residential Code	Appendix G
Concrete and reinforce concrete works	TV4	International Building Code, (Ministry of Planning, 1995-1997), (Al-Haider, 2003), (M. AL-Zohali, personal communication, 27 September 2006), (K. Hassan, personal communication, 11 January 2005), (A. AL-Khlofi, personal communication, 27 October 2003), (Al-Haider, 2003)	Appendix G, 3.3.1, 3.6.9, 3.6.10, 3.6.12
Construction equipment	TV5	International Building Code	Appendix G
Demolition of buildings and facilities	TV6	International Building Code, (T. AL-Ghatani, personal communication, 03 March 2008)	Appendix G, 3.7.8
Electrical works	TV7	ICC Electrical Code Administrative Provisions, (M. Al-Bendari, personal communication, 15 September 2003), (Al-Watan, 2003)	Appendix G, 3.3.1, 3.6.8
Elevators and conveying systems	TV8	International Building Code	Appendix G
Encroachments into public right of way	TV9	International Building Code	Appendix G
Energy conservation	TV10	International Energy Conversation Code, (Al-Sayed, 2002), (Fereig, Younis, 1985), (Al-Ragom, Omar, 2002), (Al-Temeemi, 1994), (Al-Feel, 1988)	Appendix G, 3.3.2
Existing structures	TV11	International Building Code, (J. AL-Fahad, Site Visit, 12 April 2003), (Al-Qapas, 2005), (J. AL-Fahad, Site Visit, 23 November 2005), (AL-Qabas, 2004)	Appendix G, 3.7.20, 3.8.5, 3.8.6
Exterior walls	TV12	International Building Code	Appendix G
Gas piping installations	TV13	International Fuel Gas Code, (AL-Sharhan, 2009), (J. AL-Foziah, personal communication, 07 April 2009)	Appendix G, 3.7.33
Glass and glazing	TV14	International Building Code	Appendix G
Gypsum board and plaster	TV15	International Building Code	Appendix G
Increase number of persons occupying housing unit	TV16	(M. AL-Harris, personal communication, 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006)	3.6.2
Interior environment	TV17	International Building Code	Appendix G
Interior finishes	TV18	International Building Code	Appendix G
Maintenance of drinking water cooler sets	TV19	(M. Al-Bendari, personal communication, 15 September 2003), (Al-Watan, 2003)	3.6.8
Masonry	TV20	International Building Code	Appendix G
Mechanical systems	TV21	International Building Code	Appendix G
Parking	TV22	International Building Code, International Property Maintenance Code, (Building Regulation 1985, 2000), International Zoning Code, (J. AL-Fahad, Site Visit, 10 May 2003), (J. AL-Fahad, Site Visit, 11 May 2004) و(J. Al-Fahad, Site Visit, 15 November 2004)	Appendix G, 3.7.23, 3.7.27
Plastic	TV23	International Building Code	Appendix G
Plumbing systems	TV24	International Building Code	Appendix G

Section 4: Technical Part of Bulding Code	Res. Coding	Reference	Section
Poor electric and lighting works during alteration, movement, and repairing	TV25	repairing (M. Al-Bendari, personal communication, 15 September 2003)	3.4.1
Property maintenance	TV26	International Property Maintenance Code, (Amin, AL-Sayed, 2002), (J. AL-Fahad, Site Visit, 12 April 2003), (J. AL-Fahad, Site Visit, 03 May 2003), (J. AL-Fahad, Site Visit, 23 October 2003), (Site Visits 03 November 2004), (Thafer, personal communication, 11 November 2004), (AL-Romi, 2005), (Asam, Site Visit, 28 November 2005),	Appendix G, 3.7.13, 3.7.20, 3.7.21, 3.7.22, 3.7.24, 3.7.26, 3.7.28
Safeguards during construction	TV27	International Building Code, (Kuwait Municipalituy,1985), (Kartam, Flood, Koushki, 2000), (K. AL-Abed AL-Ghafoor, personal communication, 10 October 2006), (AL-Qabas, 2005), (Ahmed, personal communication, 11 November 2005), (Thafer, personal communication, 11 November 2004), (Al-Qapas, 2005, 2006), (J. AL-Fahad, Site Visit, 28 November 2006)	Appendix G, 3.3.6.3, 3.6.6, 3.7.11, 3.7.17
Sanitation of exterior property areas	TV28	International Property Maintenance Code, (J. AL-Fahad, Site Visit, 12 April 2003)	Appendix G, 3.7.21, 3.7.27
Sewage disposal	TV29	International Building Code	Appendix G
Sheds and Car metal shed	TV30	International Building Code, (Hamed, 2004), (Hofman, personal communication, 09 October 2003)	Appendix G, 3.7.12
Signs	TV31	International Building Code, (J. AL-Fahad, Site Visit, 07 December 2005)	Appendix G, 3.7.31
Site preparation	TV32	International Building Code	Appendix G
Smoke detectors for houses	TV33	International Fire Code, (M. AL-Babtain, personal communication, 01 February 2005), (Department of Health and Human Services, 2005), (J. AL-Fahad, Site Visit, 20 February 2006)	Appendix G, 3.7.5
Soil and foundations	TV34	International Building Code, (Haque, 2003), (Haque, 2003)	Appendix G, 3.7.1
Solar systems	TV35	International Residential Code	Appendix G
Sound transmission	TV36	International Residential Code	Appendix G
Steel	TV37	International Building Code, (Ministry of Planning, 1995-1997), (Al-Haider, 2003), (M. AL-Zohali, personal communication, 27 September 2006), (K. Hassan, personal communication, 11 January 2005), (A. AL-Khlofi, personal communication, 27 October 2003), (Al-Haider, 2003),	Appendix G, 3.3.1, 3.6.9, 3.6.10, 3.6.12,
Structural design	TV38	International Building Code, (Ministry of Planning, 1995-1997), (Al-Haider, 2003), (M. ALZohali, personal communication, 27 September 2006), (K. Hassan, personal communication, 11 January 2005), (A. ALKhlofi, personal communication, 27 October 2003), (Al-Haider, 2003)	Appendix G, 3.3.1, 3.6.9, 3.6.10, 3.6.12
Structural tests and inspections	TV39	International Building Code, (Ministry of Planning, 1995-1997), (Al-Haider, 2003), (M. AL-Zohali, personal communication, 27 September 2006), (K. Hassan, personal communication, 11 January 2005), (A. AL-Khlofi, personal communication, 27 October 2003), (Al-Haider, 2003)	Appendix G, 3.3.1, 3.6.9, 3.6.10, 3.6.12
Swimming pools	TV40	International Residential Code	Appendix G
Type of construction	TV41	International Building Code	Appendix G
Weather condition such humidity , dust and wind condition	TV42	International Building Code, (Al-Ajmi, 1987), (Haque, 2003), (Bofah, 1991)	Appendix G, 3.7.15, 3.1.3, 3.7.1, 3.7.6
Wood	TV43	International Building Code	Appendix G

Table 4.10: Variables related to the technical part of building codes

4.6 Summary

The chapter shows how the four divisions of the building code framework (legal, administrative, technical, & social) can be used to organize variables related to insufficiencies, infringements and penalties of building codes and regulations. The extraction of insufficiency variables from the literature was explained. The chapter synthesizes the findings in chapters Four, Three and Two for forming the variables. The insufficiency variables were incorporated into relevant divisions of building code framework. The new framework of insufficiency variables will be used in the questionnaire design for the data collection process. The framework will be used to survey and analyze the opinions and perceptions of building codes experts and professionals in relation to the likelihood of occurrence of insufficiency variables and their impact on the enforcement and implementation of building codes in Kuwait.

Chapter Five

Research Methodology

Chapter Five

Research Methodology

5.1 Introduction

This chapter gives an outline of the plan of action and the research methods followed in the study. O'leary (2004) describes methodology as the framework associated with a particular set of paradigmatic assumptions that you will use to conduct your research, i.e. scientific method, ethnography, action research. According to Dawson (2002) the research methodology is the philosophy or general principle which guides the research.

I consider the technique of Biggam (2008) who explains the number of sections of research methods' chapter, which typically include sub-sections of introduction, research strategy, data collection, framework for data analysis, limitations and potential problems. However, in order to provide more details and clarity to the contents of the chapter, the research strategy sub-section was further divided into two sub-sections including: (i) research design, and (ii) research style and approach. The structure of this chapter is as follows:

- Research Design
- Research Style and Approach
- Data Collection (Research Process Adopted)
- Data Analysis
- Limitations and Potential Problems
- Research Validity
- Summary

The main purpose of this chapter is to present the methodologies and process employed to develop and design the questionnaires for the research. Questionnaires' surveys were conducted for this research in order to indentify the likelihood factors of insufficiencies and infringements and their impact on the building codes' objectives such as public safety, health and general welfare on building and construction projects in Kuwait.

5.2 Research Design

The following sections will explain (1) research problem, (2) aim, (3) scope, (4) objectives, (5) novelty, and (6) process.

5.2.1 Problem Statement

The research problem can be defined as the relationship between cause and effect, and it has two folds as follows:

(3) **Cause: Insufficient and infringements of building regulations (codes)**

(4) **Effect: Not meeting the minimum requirements of public health, safety and general welfare**

5.2.2 Determine Overall Research Aim

The aim of this research is *to identify the impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait.*

5.2.3 Determine Research Specific Objectives

In this step, I need to divide my research aim into specific, achievable research objectives. I have used keywords to indicate the depth of study to be carried out. There a whole host of keywords, such as identify, assess, evaluate, explore, outline, discuss, analyze, etc. These are verbs used to indicate the type of study activity linked with each objective.

The specific objectives of the research are:

7. Review of previous work in the subject
8. Review of building codes/regulations in Kuwait
9. Review of how building codes/regulations are enforced and any penalties for non-compliance in Kuwait
10. Review of building codes and their enforcement in other countries
11. Identify insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait
12. Identify impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait

Hence, objectives 1 to 4 use the keyword – review – implying an evaluation of publications, objectives 5 and 6 use the keyword – indentify - implying identifying of characteristics of the investigated area.

5.2.4 Verifying Novelty of the Research Subject

There are absences of PhD or Master research in the wide range area of building codes and enforcement for a country. ***This research subject is strategic, unique, and the first in its kind in the study of building codes in Kuwait. It is reported to indentify the gaps of the system of building codes in Kuwait.***

This research subject is strategic and unique as a PhD and a master work because most of the existing research findings address only a fragmented aspect of the subject area. George (1998) worked on the subject of "Public and private regulation: a socio-legal study of building control in England and Wales (BL)" as D.Phil., at Oxford. Green street (1983) worked on the subject of "Investigation and analysis of the structure of the building control process" as Ph.D., at CNAA. Harper (1987) worked on the subject of "The evolution of the English building regulations, 1840-1914" as Ph.D., at Sheffield. Neeves (1991) worked on the subject of "A pattern of local government growth: Sheffield and its building regulations 1840-1914." as Ph.D., at Leicester. Riba (1998) worked on the subject of "Feasibility of representing selected elements of The 1985 Building Regulations in Prolog or other rule-based form (BL)" as Ph.D., at Open University. Salagoor (1990) worked on the subject of "The influence of building regulations on urban dwelling in Jeddah" as Ph.D., at Newcastle upon Tyne. Samo (1999) worked on the subject of "Energy conservation in UK housing, and the effect of building regulations" as Ph.D., at Glasgow. Abdullah (1987) worked on the subject of "Planning and building regulations in Saudi Arabia in relation to privacy and Islamic tradition" as M.Arch., at Glasgow. Cowden (1990) worked on the subject of "Listed building control - simply the control of development of listed buildings?" as M.Sc., at Strathclyde. Goodier (1991) work on the subject of "Application of a distributed computer system to automate the commissioning of building control systems" " as M.Sc., at Oxford. Mackay (1970) worked on the subject of "A comparative study of private house-building in England and Scotland, with a particular reference to the differences in building costs caused by the differences in building regulations" as M.Sc., at Heriot-Watt.

5.2.5 Research Process

The research process consists of : a statement of research problems or question, designing research methodology, defining population and sample, selecting instrumentation or source of information, data collection procedures, data analysis and reporting procedures, and at last the result of the study is stating findings, conclusions, and recommendations (Dereshiwsky, 2008).

The research uses five kinds of research methods including: **(1) a questionnaire (2) a Comparative Study, (3) a Focus Group, (4) Interviews, and (5) a Document Analysis.**

The research process has seven main steps including: a research problem, a literature review (theory),a literature review (research),a field work, methodology, and the last drawn results. The following figure (Fig. 5.1) clarifies and summarizes the structure of research design with its main parts, tasks, methods, and its referencing chapters in thesis report.

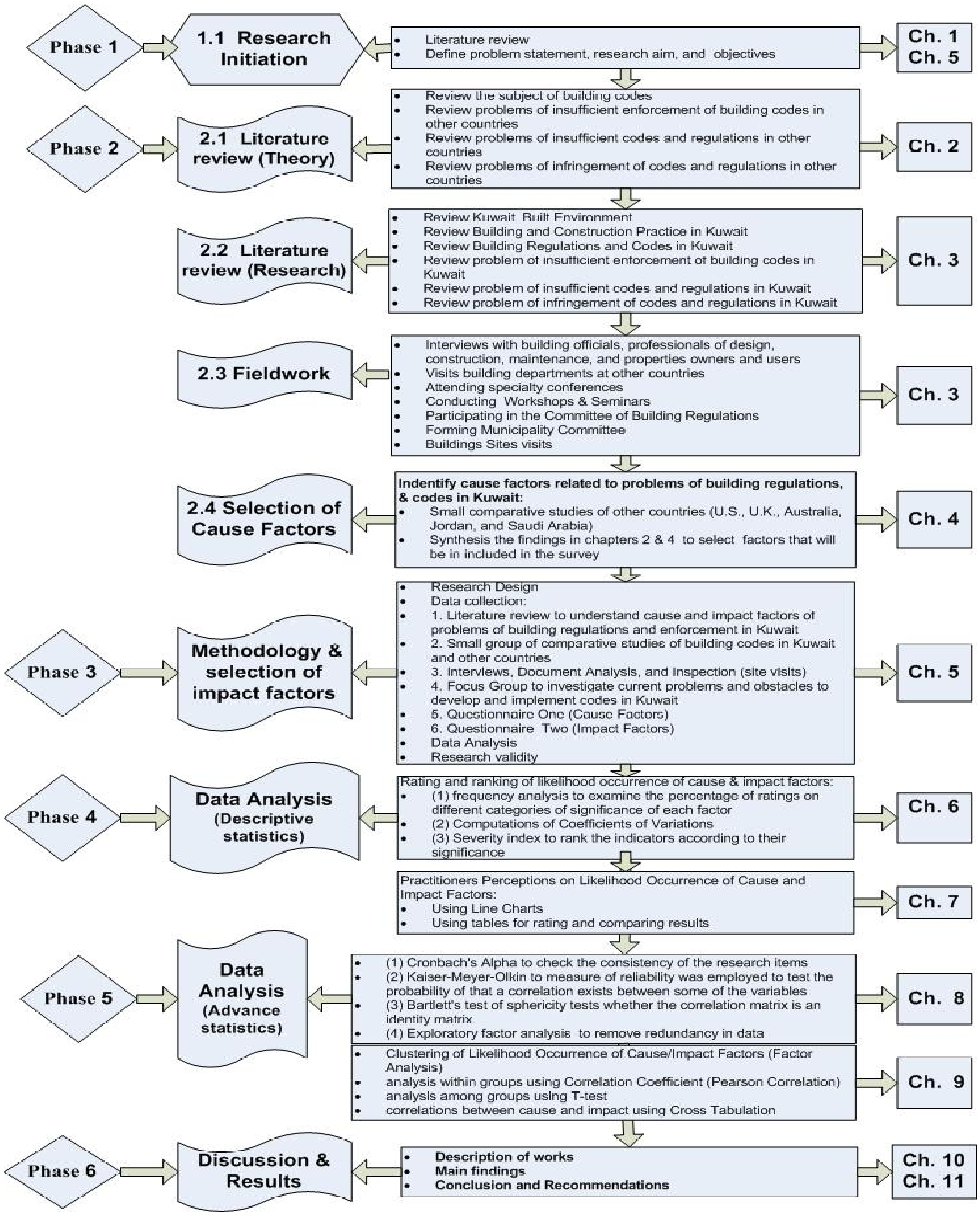

Fig. 5.1: Research Design Structure

5.3 Research Style and Approach

In determining what is the most appropriate approach (method) to adopt, the research design is the logical one that links the data collection and the analysis to yield results, and conclusions, to the main research issue being investigated. The main priority is to ensure that the research is realizing its objectives. Therefore the research design must take into account the research questions, determine the required data, and how to be analyzed.

A number of publications were reviewed to establish the appropriate style and approach for this research:

- These include: O'leary (2004), Biggam (2008), Swetnam (2005), Marczyk , DeMatteo, Festinger (2005), and DeMarrais , Lapan, (2004), Fellows, Liu (2002), and Wson (2002).

The previous researches provide some indications about research approaches that have been undertaken. It was established that this research can be categorized as a combination of:

i. An Action Research

ii. Comparative

iii. **Quantitative:** ***(Questionnaire 1 & 2)***

iv. **Qualitative: (*Comparative Study, Literature Reviews, Interviews, and Focus Group)***

Triangulation or two kinds of research approaches have been used in this study. These are ***quantitative and qualitative approaches***. Wson (2002) states that in an action research, the consideration of quantitative and qualitative approaches may be equally useful.

The following paragraphs explain these approaches. Both qualitative and quantitative approaches were adopted to reduce or eliminate the disadvantages of each individual approach whilst gaining the advantages of each.

5.3.1 Objective and Subjective Research Style

Swetnam (2007) states that the research falls into two basic styles which are objective and subjective (or homothetic and idiographic).

The word "objective" is based on facts rather than thoughts or opinions (Microsoft Encarta, 2009). The objective researches are concerned with physical characteristics and the external world, universally applicable rules and laws, tested through hypothesis, experiment, and survey.

The word "objective" is defined as not impartial, and based on somebody's opinions or feelings rather than on facts or evidence (Microsoft Encarta, 2009). According to O'leary (2004) subjectivism emphasizes the subjective elements in experience and accepts that personal experiences are the foundation for factual knowledge. Swetnam (2007) states that the subjective approach deals with groups and individuals through observation and explanation.

Both styles are systematically controlled and empirical and may be used by physical or social scientists.

5.3.2 Action research

Fellows and Liu (2002) explain action research which involves active participation by the researcher in the process under study, in order to identify, promote and evaluate problems and potential solutions. A Swetnam (2007) states that this style of the researcher tackles a real problem, intervenes, makes changes and monitors the effects. He states that action research sometimes called 'participative'.

Wson (2002) states that in an action research, the researcher works in close collaboration with a group of people to improve a situation in a particular setting. The researcher does not 'do' research 'on' people, but instead works with them, acting as a facilitator. Action research begins with a process of communication and agreement between people who want to change something together. Action research is designed to suggest and test solutions to particular problems; and it falls within the applied research category, whilst the process of detecting the problems and alternative courses of action may lie within the category of basic research.

The action research is adopted where the research actively and intentionally endeavours to effect a change in social welfare system of people and country (Fellows, Liu, 2002).

One of the main objectives of BC is to safeguard public welfare. Acquired knowledge from the research was used to effect the change which then creates knowledge about the process of change and the consequences of change.

It is clear from the review of research activities that our research is an action research type. The research activities involve actual project of BC, government and professional society's reports, conferences, workshops, seminars, meetings, and news articles. The summary of these activities are as follows:

- Conducting five seminars in Building Codes Project in: (1) Architecture Department at Kuwait University, (2) Civil Engineering Department at College of Technical Studies, (3) The President Office at Kuwait Municipality, (4) Kuwait Society for Engineers, The Training Department at Kuwait Municipality (from 2000, to 2001)
- Working as a manager of National Building Code Project at Kuwait Municipality (from 1999 to 2002)
- Conducting The Municipal Qualification and Training Workshop for GCC Countries (in 2001)
- Performing a visit to National Building Centre in Cairo Egypt (in 2001)
- Performing a visit to Dubai Municipality (in 2001)
- Conducting Building Codes Workshop: Evaluation of Building Codes and their Relation to the Architecture and the Urban Context in Kuwait Workshop (in 2001)
- Formatting of National Building Code Project Terms of Reference TOR (in 2002)
- Publishing a paper in the Symposium of the Engineering Design Specifications and the Importance of Unifying Them which initiates the Saudi Building Code Project in Dammam, Saudi Arabia (in 2002)
- Participating in the Committee of Building Regulations and Planning in 2003
- Conducting Five days Workshop for Building Experts from Ministry of Justice (in 2003)
- Putting Research Solutions in Practice and establishing Municipality Development Committee (in 2006)
- Conducting a Workshop to Develop a Framework for the Enforcement of Building Codes in United Arab Emirates (in 2008)
- Development of Kuwait Society for Engineers Report for the Enforcement of Building Codes in Kuwait (in 2008)
- Conducting the first Workshop to Develop Framework for the Enforcement of Building Codes in Kuwait (in 03/2009)

- Conducting the second Workshop to Develop Framework for the Enforcement of Building Codes in Arabian Gulf (in Apr 2009)
- Organizing Kuwait Municipality Conference "KuwaitMunicipality.com", Head of the Scientific Committee (in Oct/2009)
- Organizing the First Conference of Kuwait Building Code "Kuwaitbuildingcode.com", Head of the Scientific Committee (in Dec/2009)
- Working as a member and head of the Strategic Team of National Building Codes Committee, Kuwait Government (10 Oct/2009 till -now)

5.3.3 Quantitative and Qualitative Approaches

Over the years there has been a large amount of complex discussions and arguments surrounding the topic of research methodology and the theory of how inquiry should proceed. Much of this debate has been centered on the issue of qualitative versus quantitative inquiry – which might be the best and which is more ‘scientific’. All methodologies have their specific strengths and weaknesses (Dawson, 2002), (DeMarrais, Lapan, 2004).

According to Dawson (2002) quantitative research is not ‘better’ than qualitative research. Neither of them is better than the other. They are just different and both have their strengths and weaknesses. Many researchers believe that the use of triangulation is a good way of approaching research since it enables you to counteract the weaknesses in both qualitative and quantitative research. According to Biggam (2008) quantitative research answers "how" questions, whereas the "why" questions are left to the qualitative research.

- **Quantitative research**

O’leary (2004), Biggam (2008), and Swetnam (2005) explain quantitative data as numerical data; and quantitative refers to the research that is concerned with quantities, measurements, and numbers. Marczyk , DeMatteo, Festinger (2005) state that the quantitative variables are variables that vary in kind, and quantitative research involves studies that make use of statistical analyses to obtain their findings. Key features include formal and systematic measurement and the use of statistics.

- **Qualitative research**

Marczyk , DeMatteo, Festinger (2005) define quantitative variables are variables that vary in amount. O'leary (2004) states that qualitative data are data collected as words and/or images' not numerically coded for analysis. Swetnam (2005) explains that qualitative is concerned with description, qualities and observation.

Qualitative research involves studies that do not attempt to quantify their results through statistical summary or analysis. Qualitative studies typically involve interviews and observations without formal measurement. A case study, which is an in-depth examination of one person, is a form of qualitative research. Qualitative research is often used as a source of hypothesis for later testing in quantitative research (Marczyk , DeMatteo, Festinger, 2005).

- **Our research approaches**

In our research, there are reasons to select more than one approach. The use of triangulation is appropriate for our research, because "**it aids to offset the weaknesses in of each the used approaches and methods**". Furthermore, the subject of building codes in Kuwait has multiple dimensions such as legal, administrative, technical, and social.

According to Biggam (2008) qualitative research is linked to deeply exploratory studies in our study exploring, why Kuwait has no building codes like other countries?. According to Mauch and Park (2003) qualitative research seeks to provide full and accurate descriptions of phenomena in all their complexity. Qualitative research begins with broad questions or problems and attempts to narrow them. In order to fulfill the research aim, there is a need to compare and asses Kuwait building codes with other countries. Dawson (2002) states that the comparative study is an example of qualitative method.

Usually in academic engineering discipline, there are needs to conduct an objective research. Quantifying the problems of building codes in Kuwait is a requirement for this research. Therefore, quantitative approach is also used in our research. The aim of quantitative research is to reveal or establish cause-and-effect relationships in, or among experiences or occurrences.

5.4 Data Collection

5.4.1 Introduction

The following sections will explain data collection for the selected research methods namely the literature review, comparative study, focus group, and questionnaires.

5.4.2 Literature review to understand cause and the impact factors of problems of building regulations and enforcement in Kuwait.

The methodology used for the identification and selection of articles for this literature review started with broad categories and search terms and then progressively narrow the group of studies down to only those that meet certain criteria as conducted through a group of stages as follows:

- **Stage 1: develop a list of search terms**
- **Stage 2: identify articles**
- **Stage 3: narrow the selection of identified articles**
- **Stage 4: review articles for relevance and methodological rigor**
- **Stage 5: review articles based on quality standards of synthesis**

- **Stage 1: develop a list of search terms**

Relevant literature reviewed, interviews, and field visits are conducted to understand the purpose of the synthesis and develop a list of search terms that appeared to fit with that purpose.

Interviews were conducted with building and fire officials, researchers and experts in building codes; consulting professionals like contractors, designers, and inspection offices; interviewing owners of houses, residential and commercial buildings. Field visits were performed for different kinds of building and building projects.

- **Stage 2: identify articles**

Articles were identified through Internet and library searches for keywords and phrases related to the topics of problems of building regulations and enforcement.

- **Stage 3: narrow selection of identified articles**

The search process yielded many studies, and in order to narrow the results further, abstracts were reviewed to determine if the studies met the predefined criteria. The criteria was based on the parameters of building codes and their enforcement.

The parameters of building codes are the requirements, which are as follows: (1) structural safety, (2) structural strength, (3) fire safety, (4) properties safety, (5) stability, (6) sanitation, (7) adequate light and ventilation, (8) energy conservation, (9) accessibility, (10) mechanical, (11) plumbing, (12) property maintenance, (13) zoning occupancy, and (14) electrical. The parameters of building codes enforcement are divided into three major divisions these are (i) general management, (ii) plan review, and (iii) site inspection.

- **Stage 4: Review articles for relevance and methodological rigor**

The remaining articles were reviewed more closely for relevance and methodological rigor. Studies which are chosen for this research synthesis have been checked for additional criteria:

- They were empirical.
- They meet accepted standards for quality research (e.g., reliable and validated instruments, appropriate study design, and necessary controls).

- **Stage 5: Review articles based on quality standards of synthesis**

The resulting collection of studies was then evaluated, and additional exclusions were made with deeper reading of studies revealed in a way that they did not meet the purposes or the quality standards of this synthesis. Studies that were of poor quality, off topic, out-of-scope, have focused on construction problems caused by other aspects rather than insufficient building codes, where as lacked descriptions of data and methods were excluded. The resulting synthesis includes approximately 60 studies that were thoroughly reviewed.

5.4.3 Small Group of Comparative Studies of Building Codes in Kuwait and Other Countries

A comparative study is used to study certain areas in building regulations. The study is intended to compare and contrast the features of Building Code frameworks of Kuwait with other countries by analyzing the similarities and differences between these countries. It is an attempt to understand insufficiencies in building codes framework in Kuwait. The benefits to be gained involve deeper understanding of other building regulations' structures and their work mechanism, and successes (DUP Science, 2002).

5.4.3.1 The Frame of Reference

A frame of reference was formulated by placing various references exerted from the practices of the enforcement of BC in various countries in term of three categories namely: legal, technical, and administrative which were then expanded into subcategories to perform the literature review as follows:

Part 1: The BC Legal Issues

- A law for the Enforcement of BC in the country

Part 2: Technical Issues

- BC Name
- BC Objectives
- BC Technical Requirements
- Building Codes Main Details

Part 3: Administration Issues

- Enforcement Agencies of Administrative organization

5.4.3.2 Grounds for Comparison

The Building Code System in Kuwait was compared with other Building Code Systems of four counties namely: USA, England, Wales, Australia and Jordan. The reasons for their selection are as follows:

- **The US**

The USA is one of the eight countries in the world that implemented the performance building codes. The USA building codes are called ICC building codes. ICC model codes are a single package, which consists of guide books, manuals, available consultancy services for code development and administration, educational programs, certification programs, technical handbooks and workbooks, plan reviews, automated products, monthly magazines and newsletters, publication of proposed code changes, training and informational videos.

The ICC model codes are highly relevant and applicable to the region as applied and tested by ARAMCO in southern part of Saudi Arabia, a country located about 200 km from Kuwait. The ICC codes are the official model for Kuwait and Saudi Arabia due to the fact that ICC codes are comprehensive, and advanced. The ICC codes are in a compatible language, relevant to the Middle Eastern region, and applied in similar whether environment conditions, and tested by various states in The USA.

The selection of a model building code for Kuwait has been influenced by the document produced in May 2001 by Kuwait Municipality Building Code committee titled ***''Terms of Reference for National Building Code Project''*** (KM, 2001). Kuwait Institute of Scientific Research (KISR) has been selected as the consultant to produce the code. It was decided to study the ICC codes of the US as major model codes, supported by other codes recommended by the consultant, KISR, by taking account of approval of Kuwait Municipality. However, this project had been later suspended due to management changes, restructuring of the Kuwait Municipality which was a sponsor of this project.

- **UK and Australia**

The UK building standards "BSI" are highly relevant and applicable to the region as applied and tested by Kuwait, Saudi Arabia, and other countries in the region. UK and Australia building standards and regulations are comprehensive, and advanced. They are in a compatible language and relevant to the Middle Eastern region. UK and Australia are among the eight countries in the world which implemented the performance building codes. UK and Australia building regulations and codes consist of guide books, manuals, available consultancy services for code development and administration, and educational programs.

- **Jordan**

Jordan is the first country in the Arab world which developed building codes and building codes administration organization. Jordan developed two sets of structure codes for Arab League Organization. The Jordanian building codes structure is relevant and applicable to the region, endorsed by Kuwait, and all other Arab countries. It is convenient for Kuwait to adopt BC practice from Jordan as the Jordanian culture and other social aspects are similar to Kuwait. Building officials usually have difficulties to understand and communicate well to adapt the knowledge of other countries that are non Arabic speaking. Jordan BC structure is a good reference as a starting point for Kuwait to get the chance to adapt its preliminary structure.

Furthermore, these four countries are selected from four separate continents/regions, and hence this brings in a good level of representation of the frameworks as BC around the world.

5.4.4 Interviews, Document Analysis, and Inspection (site visits)

- **Interviews**

An interview is a series of questions addressed personally to respondents. According to O'leary (2004) interviewing is asking questions and listening to individuals in order to obtain information or opinions. Most interviews conducted aimed to identify shortcomings in the minimum requirements of public health, safety and general welfare caused due to insufficient and infringements (non compliance) in building codes/regulations in Kuwait (Chapter 3).

The interviews conducted were mostly structured in asking specific single question related to building regulations, problems and practice in Kuwait. The participants in interviews are from building codes and regulations field. These are building officials and professionals from Kuwait Municipality, Municipality Council, General Fire Department, and other institutions. Most of participants are experts in their field, and their level of education is above university level.

- **Document Analysis**

According to O'Leary (2004) document analysis is exploring written documents for content and/or themes. The document analysis method is used to examine building regulations codes and documents such as: Building regulations 1985, International Building Codes, government reports, inspection reports, and accidents reports, in order to investigate building regulations and codes practice and problems (Chapter 3). The focus of the analysis is a critical examination, rather than a mere description, of the documents.

- **Inspection and observations (site visits)**

According to O'Leary (2004) observation involves the recognition and recording of facts, situations, occurrences, and empathetic understanding. Another meaning or definition for observation is inspection. The inspection method is used to examine building regulations and codes practice in Kuwait. Inspections conducted were mostly planned investigating specific single issue related to building regulations problems and practice in Kuwait (Chapter 3). The inspections were mostly organized, examined and evaluated on building regulations practices. It involves measurements to building regulations activity such as counting the number of parking spaces available for a building, or the number of floors, or the type of structured steel in concrete slab. The results are usually compared with specified requirements and standards for determining whether the items or activities are long with building standards.

5.4.5 Focus Group to investigate current problems and obstacles to develop and implement codes in Kuwait

The methodology of conducting a focus group is divided into two main phases (i) before conducting the focus group, and (ii) during/after conducting the focus group (Blank, 2008).

(i) Before conducting the focus group

5.4.5.1 Defining the purpose and objectives of the focus group

By discussion with the forum organizers, the aim and objectives were defined. The aim of this focus group is to perform intensive discussion to encourage an invited group of participants to share their thoughts, feelings, attitudes and ideas on the subject of building codes' problems and development in Kuwait. The objectives are to discuss the following issues:

- The importance of the building codes.
- Current problems and obstacles to develop and implement codes in Kuwait.
- The approach to develop and implement codes in Kuwait.

5.4.5.2 Establishing a timeline

Planning started several months before the actual session. Participants were indentified, development and testing of main questions and themes were performed, the site was located, and the invitation for participants was performed.

5.4.5.3 Identifying the participants

The selection of participants is based on the purpose of the focus group. There is a list of characteristics to select possible participants such as:

- Experiences with the development of building codes.
- Building officials in charge of enforcement.
- Researchers create codes.

Therefore, the participants are:

1. Head of The Technical Committee in Kuwait Municipality, the ex-President of Kuwait Society for Engineers
2. Researcher and Head of Electric and Energy Code at Kuwait Institute for Scientific Research.
3. Head of Structural research at Kuwait Institute for Scientific Research.
4. Assistance Manager of Building Committee, and Manger of Design Department at Authority of Housing Care in Kuwait.
5. Director of Building Projects, and Member of Fire Code Committee at Kuwait General Fire Department.
6. An official from Ministry of Public of Works
7. Director of Standards from Authority of Industry

5.4.5.4 Generating the issues/questions

Since the focus group will last for one or two hours, there is only a time for four to seven questions. The duration of discussion was set for two hours and fifteen min. The discussion themes were:

- Current problems and obstacles to develop and implement codes in Kuwait
- The approach to develop and implement codes in Kuwait

5.4.5.5 Developing a script

The focus group script is divided to three parts:

i) The opening is a time for the facilitator to welcome the group, introduce the purpose and context of the focus group, explain what a focus group is and how it will flow, and make the introductions.
ii) The question section is where you ask the questions that you designed and tested in Step 4.

iii) The closing section wraps up the focus group. This includes thanking the participants, giving them an opportunity and an avenue for further input, telling them how the data will be used, and explaining when the larger process will be completed.

5.4.5.6 Selecting a facilitator

The facilitator is an ex-Minster of Municipality, an ex-Assistance director of Kuwait Municipality, and an ex- advisor of Kuwait Municipality for Building Code Project. He has the abilities to deal tactfully with outspoken group members, keep the discussion on track, and make sure every participant is heard. He is knowledgeable about the building codes in development, and enforcement.

5.4.5.7 Choosing the location

The forum organizers are experts in conducting workshops and conferences. They developed a setting which let participants feel comfortable expressing their opinions. The forum hall is large enough to accommodate the eight participants, and seating for more than a hundred persons.

(ii) During and after conducting the focus group

During the discussion, notes are recorded. At the end of discussion, results are interpretated, and summarized.

5.4.5.8 Reporting results of discussions

The focus group discussions generate many information and details regarding the research subject. The summery of these details is shown in Appendix H (Focus Group Details).

5.4.6 Questionnaire One:

- **Questionnaire Objectives**

The questionnaire objective is to investigate insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait. It has the following parts as shown in the Fig 5.2 [Questionnaire form -Appendix D].

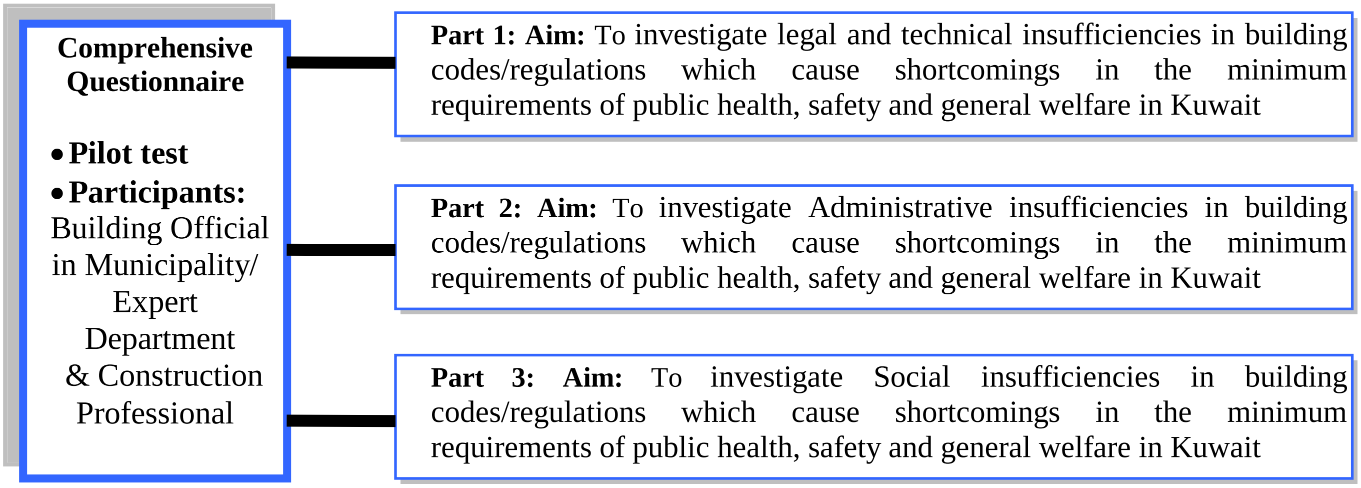

Fig. 5.2: Comprehensive questionnaire aims

- **Data Sources**

The source of information gathered is opinions of:

i) Building Officials at Kuwait Municipality or Department Expert

ii) Construction Professionals

5.4.6.1 Questionnaires Construction

Data collection was performed by performing literature review, and by surveying the opinions of selective groups through interviews. Questionnaire construction was started by listing ideas, and then developing these ideas into specific questions about the main objectives of the research (Fig. 5.3).

Research Objectives

+

Interviews, site visits & literature review

↓

Lead to Issues, topics and ideas

↓

Lead to Questions

↓

Lead to Questionnaire

Fig 5.3: Diagram showing questions and questionnaire development

adopted from Naoum (1998) with amendment

Stage 1: Identifying the first thought questions

Possible questions, related to the research, were compiled and based on research objective, literature review, and interviews conducted. Main focus of the questionnaire is as follow:

(i) Legal insufficiencies in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait.

(ii) Administrative insufficiencies in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait

(iii) Technical insufficiencies in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait

(iv) Social insufficiencies in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait

At this point, the questions are further divided into legal, technical, administration, and social issues related to building codes.

Stage 2: Selection of Questionnaire Variables

The selection of questionnaire variables are based on the identification of the insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait. The identification is addressed in Chapter Four (Section 4.2 to 4.4), and as shown in Table: 5.1:

Part of Bulding Code	Selection of Questionnaire Variables
Section 1: Legal & Technical	**LV1 to LV14**
Section 2: Administration	**AV1 to AV35**
Section 3: Social Part	**SV1 to SV6**

Table: 5.1: Selection of Questionnaire Variables

Most of indentified legal and technical variables have similar objectives and purposes. Variable (LV9: Lack many of the technical requirements in building regulations in Kuwait) is used instead of the detailed study of the technical variables (TV1 to TV43). Variable (LV9) shows that there is a considerable shortage in building laws and regulations to cover many aspects of building construction. Therefore, legal and technical variables are combined in one section.

Stage 3: Wording of Questionnaire

A Group of example questionnaire from different fields have been examined and the questionnaire was refined and logically sequenced to minimize, double, presuming, hypnotically, any other ambiguity.

The questionnaire's closed form or restricted type of questions requires a short response, easy to ask, and quick to answer. The questions require no extra writing by either respondent or interviewer, and their analysis is straightforward forward.

Factual questions are mostly used to collect data from the background of code officials, Construction Professional, and their experiences.

Rating scale has been used to question respondents about their views and opinions, where as a respondent has the choice to express his/her degree of agreement or disagreement or a particular scale. The response categories in such questions reflect the intensity of a particular judgment involved.

Stage 4: Formulating of Rating Scales and response choices

The following rating scale has been used for the questionnaire based data collection (Tables 5.2):

Response	**Intensity of the response (Points)**
Strongly Disagree (SD)	1
Disagree (D)	2
Neither/Nor (N)	3
Agree (A)	4
Strongly Agree (SA)	5

Table 5.2: Rating Scale for Questionnaire

Stage 5: Defining the Participants for answering the Questionnaire

A similar approach was preformed as in the case of the Australian study to gather the views of experts (building surveyors with broad industry experience), (Productivity Commission, 2004). Building officials from Kuwait Municipality, Ministry of Justice (Expert Department), and construction professional from public and private sector, were targeted as the questionnaire population.

Stage 6: Designing Questionnaire

- **General information questions**

The first section of questionnaire starts with general information about the respondents to identify the type of profession and experience.

- **Contact information for assistance**

The questionnaire has the researcher's name, mobile contact number, and e-mail for any assistance.

- **Covering letter**

The questionnaire has an explanation and a covering letter to explain the purpose of the study, and statements describing the benefits of the study for the Kuwait society and building and construction industry. Two to three introductory statements, also explained the purpose of the study, and the potential benefits.

- **The use of closed questions**

The questionnaire has closed questions. Closed questions or restricted type require short response, and are easy to ask and quick to answer and they require no writing, while their analysis is easily straightforward. These questions were reviewed and tested to verify that they are not biased.

Stage 7: Pilot Tests and Final Questionnaire Form

The purpose of pre-testing the questionnaire is to determine (Crawford, 1997):

- whether the questions are worded will achieve the desired results
- whether the questions have been placed in the best order
- whether the questions are understood by all classes of respondent.
- whether additional or specifying questions are needed or whether some questions should be eliminated.
- Whether the instructions to interviewers are adequate.

Pilot tests provided valuable feedback about how to improve the wording and appearance of the questionnaire. The questionnaire was carefully piloted, and pre-tested to identify any mistakes that need correcting by five professionals in construction and codes. The questionnaire was refined by changing ambiguous questions, and wording along with considering answering time, length of questions, length of questionnaire, and their effectiveness. Table 5.3 shows pilot test form. Table 5.4 shows summary of respondents' comments regarding amending questionnaire questions.

No.	**Questions**	**Please, provide us with your comments, mention:** • **The suitability of questions to the subject!** • **Validity of question, linguistically, & time to answer!** • **Were any questions unclear or ambiguous?**
1		
2		

Table 5.3: Pilot Test Form

Variable No.	Part of BC	Before	• After & Justification
-	Legal	• Construction issue of legal court rules based on experts' reports of Ministry of Justice	• Removed, not suitable cause factor
-	Admin.	• Getting the right, the contractor is the most difficult work in the local construction market	• Removed, not suitable cause factor
-	Legal	• Articles of agreement are not effective, in particular for the private housing projects. Municipality and other organizations could not develop criteria for this issue	• Removed, not suitable cause factor
TV16	Technical	• Unavailability of master building plans taking into account the number of families and population in the housing units, which led to the misuse of lands and real estates	• Reworded: Increase number of persons occupying housing units
•	Social/ Admin.	There were three questions • It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control • Many owners and investors have no trust in the supervision capabilities of the engineering offices • Guarantees related to design and supervision that are offered by engineering offices to Municipality are ineffective to pass violations or cheatings	• Combine in one question and reworded: • Ineffective engineering supervision and inspection tasks to prevent violations or cheatings
	Legal	• Major obstacle to approve testing and certification system for building engineers, contractors, and skilled labors for Kuwait is the non existence of country Municipality laws	• Reworded: • Inexistence of testing and certification system for building engineers, contractors, and skilled labors (because of the law)
	Admin.	There were two questions: • Documents and records of building projects at Kuwait Municipality are easily lost and damaged • lose and damage of documents and records of building projects at Kuwait Municipality	• Combined in one question: • lose and damage of documents and records of building projects at Kuwait Municipality
		• There is a considerable shortage in building laws and regulations to cover many aspects of building construction especially at Kuwait Municipality	• Reworded: • Inexistence of many BC requirements (because of the law)
	Admin./ Legal	• Procedures of following and monitoring of building and construction works at Municipality are not clear and not with satisfying performance • Kuwait Municipality couldn't develop decisions to organize the works of consultant offices in preparing plans and engineering supervision on building projects	• Combined in one question: • Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects
	Admin.	There were seven questions • An existence of a good and qualified superintendent to manage the project which might increase the quality at work and decrease problems and differences • Small contractors usually get licenses from Municipality, but they are not tested technically which results in engineering problems • Getting the right to the contractor is the most difficult work in the local construction market • Design and supervision engineers from engineering offices usually get licenses from Municipality, but they are not tested technically to know their abilities • Kuwait Municipality failed in its performance to develop decisions to license building contractors depending on the quality of work • Kuwait Municipality doesn't perform its	• Combined in one question: • Inexistence of testing and certification system for building engineers, contractors, and skilled labours

Variable No.	Part of BC	Before	• After & Justification
		responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labours. • Major obstacle to approve testing and certification system for building engineers, contractors, and skilled labors for Kuwait is the inexistence of country Municipality laws	
	Admin.	• Many times, during projects execution, testing of building materials and concrete by certified testing centres get neglected.	• Reworded: • Neglecting of testing of building materials and concrete by certified testing centres during projects execution
	Admin.	There were two questions: • There is no government controlled inspection on building at construction sites • Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following up local construction works	• Combined in one question: • Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following up local construction works

Table 5.4: Pilot tests results

The forms and boxes of the questionnaire were redesigned to facilitate the easiness for answering, and to lower the number of pages .The first forms of the questionnaire were prolonged and not including appropriate covering letter .The Content of the covering letter has been rewritten to import a sense of national value to improve building and construction industry, in order to encourage participant's involvement in the questionnaire.

5.4.6.2 Research Sample

The term "sample" means a specimen or part of a whole (population), which is drawn to show what the rest is like (Naoum, 1998). The author took all necessary care to ensure that the characteristics of the sample are the same as its population and acts as a representative of the population as a whole.

The data was collected using the "Random sampling" technique. The questionnaires were randomly distributed to professionals in Kuwait by the assistance directors of organizations involved in construction. The estimated total population of professionals in construction in Kuwait is around 15,000 professional.

- **Sample Size**

The following formula was used to calculate the number of sample size required to estimate P with abound on the error of estimation B (Scheaffer, Mendenhall, Ott, 2005):

$$n = \frac{NPq}{(N-1)D + pq}$$

Where:

n = the sample size

N = number of population

P = the percentage in favour

B = permissible error

$q = 1 - p$

$D = B^2 \div 4$

<u>1st trail (B = 0.03):</u>

Considering the total number (N) of professionals in Kuwait of 15,000, P = 0.5 .

$$n = \frac{NPq}{(N-1)D + pq}$$

$q = 1 - p$

q = 1 – 0.5 = 0.5

$$n = \frac{15000 \times 0.5 \times 0.5}{(15000-1) \times (0.03^2 \div 4) + .5 \times .5}$$

n = 1035

<u>2nd trail (B = 0.04):</u>

$$n = \frac{15000 \times 0.5 \times 0.5}{(15000-1) \times (0.04^2 \div 4) + .5 \times .5}$$

n = 600

3rd trail (B = 0.05):

$$n = \frac{15000 \times 0.5 \times 0.5}{(15000 - 1) \times (0.05^2 \div 4) + .5 \times .5}$$

n = 390

Considering an error of estimation B of 0.05 for this research, the sample size required is 390. Hence 390 professionals of different organizations in Kuwait are chosen as the sample size for this research.

5.4.6.3 Distributing the Questionnaire

The questionnaire was distributed directly by the author to many governments and private agencies. Help of the department heads was situated to disseminate questionnaires to the employees of different agencies. The agencies are as the following: (Table 5.5):

Agency	No. of Questionnaire Delivered
Kuwait Society for Engineers	**100**
Engineers Union	**100**
Ministry of Public of Works	**250**
Ministry of Housing	**150**
Kuwait Municipality	**250**
Kuwait Municipality (Legal Department)	**50**
Ministry of Justice (Expert Department)	**50**
Construction Training Institute	**50**
Total	**1000**

Table 5.5: Professionals Participants in the Questionnaire

5.4.6.4 Collecting the Questionnaire

Table 5.6 shows the number of responses revealed from the questionnaire. 390 no's of the questionnaire forms were returned as complete which is fairly an adequate number.

Organization Respondents	No. of Quest. Delivered	No. of Quest. Returned	Response Rate	No. of Quest. Not valid	No. of Quest. Analyzed
Kuwait Society for Engineers	100	37	37.00%	3	34
Engineers Union	100	44	44.00%	2	42
Ministry of Public of Works	250	73	29.20%	1	72
Ministry of Housing	150	48	32.00%	1	47
Kuwait Municipality	250	126	50.40%	2	124
Kuwait Municipality (Legal Department)	50	21	42.00%	1	20
Ministry of Justice (Expert Department)	50	24	48.00%	0	24
Construction Training Institute	50	27	54.00%	0	27
Total	**1000**	**400**	**42.08%**	**10**	**390**

Table 5.6: Approximate response of the Questionnaire

10 no's of the questionnaire forms were discarded (incomplete forms). The actual responses rate was 46.08%.

5.4.6.5 Questionnaire Data Entry

SPSS software has been selected to analyze the collected data. The author with the help of a statistical expert designed Excel sheets for data entry. This data sheets where checked and later transferred for the SPSS software for analysis.

5.5.5 Questionnaire Two:

Questionnaire Objectives

The questionnaire objective is to identify the impacts of insufficient Building codes on public health, safety and general welfare in Kuwait. It has the following parts as shown in the Fig 5.2 [Questionnaire form - Appendix F].

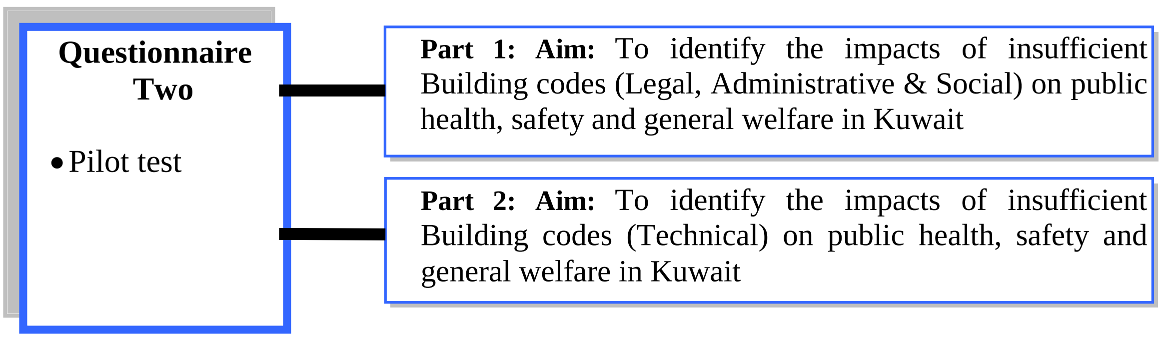

Fig.5.4: Aims of Questionnaire Two

- **Data Sources**

The source of information gathered is opinions of:

(i) Design and Plan Review Professionals

(ii) Construction/Maintenance and Site Inspection Professionals

5.5.5.1 Questionnaires Construction

Stage 1: Selection of Questionnaire Variables

- **The first selection of variables**

The selection of questionnaire variables are based on the identification of the insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait. The identification is addressed in Chapter Four (Section 4.2 to 4.5).

- **The Second selection of variables**

However, some potential impact variables are addressed in Chapter Four (Section 4.2 to 4.4) these are related to legal, administration, and social parts of building codes have been discarded to be used in the investigation to indentify their impacts. Some of these variables have no direct impact on BC objectives. The method used to re-evaluate these factors by surveying opinions of five experts with broad experience in construction and codes (more than 10 yrs experience)where put to assess the direct relation of these factors and three objectives of Building Codes. Table 5.7 shows the survey sheet to re-evaluate potential impact variables to assess the direct relation between these variables and three objectives of Building Codes.

No.	**The variable has direct relation with BC objectives (Public Safety, Public Health, & Public Welfare):**	**(SA)**	**(A)**	**(N)**	**(D)**	**(SD)**
	variable					

Table 5.7: Survey sheet to assess relation of factors and the three objectives of BC

The following rating scale has been used for Survey sheet (Tables 5.8):

Response	**Intensity of the responses (Points)**
Strongly Disagree (SD)	**1**
Disagree (D)	**2**
Neither/Nor (N)	**3**
Agree (A)	**4**
Strongly Agree (SA)	**5**

Table 5.8: Rating Scale the questionnaire

All technical variables mentioned in Section 4.5 (Chapter 4) are used in the questionnaire, because all technical variables have direct impact/relation with the three objectives of Building Code. Appendix C shows the results of the assessment by experts on the selection of potential impact for Questionnaire Two. Since the survey has only five respondents, simple statistics (average percentages mean using MS Excel 2007) was used to calculate the results of experts' opinions. The selected variables have more than 80% average mean of respondents' results. The selected variables related to legal, administration, technical, and social parts of building codes are as shown in Table 5.9 to 5.12:

Part of Bulding Codes	Selection of Questionnaire Variables
Section 1: Legal	**LC2, LC3, LC6, LC8, LC9**
Section 2: Administrative	**AC15, AC24, AC29, AC31, AC32, AC6, AC9**
Section 3: Social	**SC1, SC4, SC5, SC6**
Section 4: Technical	**TV1 to TV43**

Table 5.9: Selection of Questionnaire Variables

Section 1: Legal Part of Bulding Code	
Selected Variable	Average Mean (%)
LC2	84
LC3	84
LC6	88
LC8	88
LC9	84

Table 5.10: Selected Variable (Section 1: Legal Part of Building Code)

Section 2: Administration Part of Bulding Code	
Selected Variable	Average Mean (%)
AC15	88
AC24	84
AC29	84
AC31	84
AC32	84
AC6	88
AC9	88

Table 5.11: Selected Variable (Section 2: Administration Part of Building Code)

Section 3: Social Part of Bulding Code	
Selected Variable	Average Mean (%)
SC1	84
SC4	84
SC5	84
SC6	88

Table 5.12: Selected Variable (Section 3: Social Part of Building Code)

Stage 2: Formulation and Classification of Questions

Main sections or categories for the questionnaire were formulated and classified into four main sections, and three areas according to building code objectives. The four section of questionnaire are:

- Section 1: Legal
- Section 2: Administrative
- Section 3: Social Part
- Section 4: Technical

The three areas according to building code objectives are:

- Public Safety
- Public Health
- Public Welfare

Stage 3: Type of Questions

The questionnaire is in closed form or in a restricted type of questions. These types of questions require a short response, are easy to ask, and quick to answer. Factual questions mostly used to collect data from the background of professionals of design, plan review, construction, site inspection, and maintenance in relationship with their experiences in building and construction.

Rating scale has been used to question respondents on their views and opinions, where as a respondent has the choice to express his/her degree of agreement or disagreement or a particular scale. The response categories of such questions reflect the intensity of a particular judgment involved.

Stage 4: Formulations of Rating Scales and response choices

The following rating scale has been used three times in the questionnaire according to the three areas of building code objectives (Tables 5.13):

Response	Intensity of the response (Points)
High Impact (HI)	4
Impact (I)	3
Low Impact (LI)	2
No Impact (NI)	1

Table 5.13: Rating Scale for the questionnaire

Stage 5: Defining the Participants for answering the Questionnaire

A similar approach is preformed as in the case of the Australian study to collect the views of experts (building surveyor with broad industry experience), (Productivity Commission, 2004). Professionals working in design, plan review, construction, site inspection, and maintenance were targeted as the questionnaire population.

Stage 6: Designing the Questionnaire

- **General information questions**

The first section of the questionnaire starts with general information about the respondents to identify the background of professionals and building experts.

- **Covering letter**

The questionnaire has an explanation of a covering letter to explain the purpose of the study, and statements describing the benefits due to the study of the Kuwait society, building and construction industry. Two to three introductory statements, also explained the purpose of the study, and the potential benefits.

- **Contact information for assistance**

The questionnaire had the researcher's name, mobile contact number, and e -mail for any assistance.

- **The use of closed questions**

The questionnaire has closed questions. Closed questions or a restricted type which requires short response, and are easy to ask and quick to answer and they require no writing, while their analysis is easily straightforward. These questions were reviewed and tested to verify that they are not biased.

Stage 7: Pilot Tests and Final Questionnaire Form

The questionnaire was carefully piloted, and pre-tested to identify any mistakes that need correcting by five professionals in construction and codes. The questionnaire was refined by changing ambiguous questions, and wording along with considering answering time, length of questions, length of the questionnaire, and their effectiveness. Table 15.4 shows a pilot test form. Table 15.5 shows a summary of respondents' comments regarding amending questionnaire questions.

No.	Question	Please, provide us with your comments, regarding: • The suitability of question to the subject? • Validity of question, linguistically, & time to answer? • Were any questions unclear or ambiguous?
1		
2		

Table 5.14: Pilot Test Form

Variable No.	Part of BC	Before	After & Justification
-	Technical	• There were two questions: • Concrete works • Reinforce concrete works	• Combined in one question: • Concrete and reinforcement concrete works
-	Technical	• There were two questions: • Sheds • Car metal shed	• Combine in one question: • "Sheds and Car metal shed"

Table 5.15: Pilot tests results

5.5.5.2 Sample Research

Sample size selection and justification are according to Section 5.4.6.2 of this Chapter.

5.5.5.3 Distributing the Questionnaire

The questionnaire was distributed directly by the author to many governments and private agencies. Help of the organization administration were situated to distribute questionnaires to the professionals of different agencies. The agencies are as follow (Table 5.16):

Agency	No. of Questionnaire Delivered
Kuwait Society for Engineers	150
Engineers Union	150
Ministry of Public Works	250
Ministry of Housing	150
Kuwait Municipality	250
Construction Training Institute	50
Total	1000

Table 5.16: Professionals Participants in the Questionnaire

5.5.5.4 Collecting the Questionnaire

Table 5.17 shows the number of responses revealed for the questionnaire. 390 no's of the questionnaire forms were returned as complete which is fairly an adequate number.

Organization Respondents	No. of Quest. Delivered	No. of Quest. Returned	Response Rate	No. of Quest. Not valid	No. of Quest. Analyzed
Kuwait Society for Engineers	150	**53**	**35.33%**	**2**	**51**
Engineers Union	150	**77**	**51.33%**	**4**	**73**
Ministry of Public Works	250	**83**	**33.20%**	**2**	**81**
Ministry of Housing	150	**73**	**48.67%**	**1**	**72**
Kuwait Municipality	250	**74**	**29.60%**	**0**	**74**
Construction Training Institute	50	**39**	**78.00%**	**0**	**39**
Total	1000	399	46.02%	9	390

Table 5.17: Approximate responses of the Questionnaire

9 no's of questionnaire forms were discarded for being incomplete. The actual responses rate was 46.02%.

5.5.5.5 Questionnaire's Data Entry

SPSS software has been selected to analyze the collected data. The author with the help of a statistical expert designed Excel sheets for data entry. This data sheets where checked and later transferred for the SPSS software for analysis.

5.6 Data Analysis

5.6.1 Introduction

Figure 5.9 describes the process and framework of data analysis. **The framework of data analysis** is an outline of how the collected data is analyzed. It consists of:

- a theory (hypothesis)
- data description
- data analysis

A hypothesis is a prediction about the outcome of a study. It gives us an indication of where we have been and where we are headed. This prediction is what we believe will "hold up" or be true for the population at large, as a result of what happens in our study sample. **The research question or problem statement** is in "open-ended" form, while the hypothesis states a definite outcome or a set of outcomes that we might predict. Fig.5.10 describes the process of setting a hypothesis (Dereshiwsky,1998).

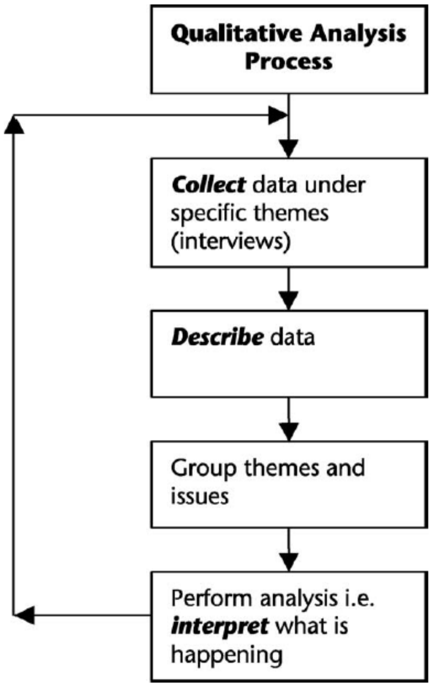

Fig. 5.5: Process and framework of data analysis for qualitative and quantitative approaches (Biggam, 2008)

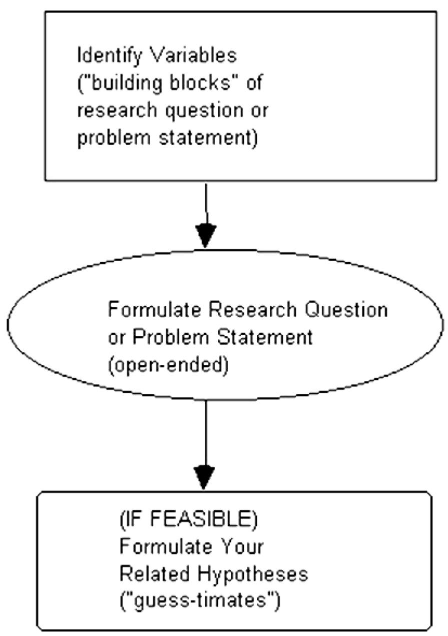

Fig.5.6: Process of setting a hypothesis (Biggam, 2008)

The **data description** to explain what I found from case study or survey, then assembling similar themes and issues from survey and case studies.

Statistical methods were used to analyze data by collecting and analyzing numerical data, especially in, or for, large quantities, and usually inferring proportions as a whole from proportions in a representative sample (Walliman, Baiche, 2001).

Various groups of **statistical tools and techniques** were used to describe and analyze data. These tools and techniques are descriptive statistics and some advanced statistics (Table 5.18), (Biggam, 2008), (Walliman, Baiche, 2001).

Descriptive statistics	Advanced statistics
Summary Statistics (mean, median, mode, range, central tendency, standard deviation, variance); **Tabulation** (simple tabulation and cross-tabulation); **Graphics** (bar chart, pie chart, line chart, multi-series line chart).	Student's *t*-test; Chi-square test; Analysis of variance (ANOVA); Regression analysis; Correlation; Fisher's least significant difference test; Time-series analysis.

Table 5.18: Statistical tools and Techniques (Biggam, 2008)

Before rationalizing the test in the analysis, it is necessary to highlight the basic insights involved in the selection of appropriate statistics for different situations. In statistics, it is evident that the methods employed in collecting data and scores' define and limit manipulations and operations that are responsible in handling the scores. The statistical tests that are used for data analysis will depend on the type of data being collected (O'leary, 2004).

5.6.2 Literature review

The reporting of research synthesis is by bringing together strands of argument and discussion, expressed at different stages of research synthesis, to create a coherent structure of the analysis of the problems of building codes in Kuwait.

5.6.3 Comparative Study

The Comparative Analysis is intended to compare and contrast the features of the Building Codes framework of Kuwait with other countries by analyzing the similarities and differences between these countries. It is an attempt to indentify the insufficiencies in building codes framework of Kuwait. The five countries structures provide a good cross-section of Building Codes framework for Kuwait. The framework development is by using patterns and configurations across successful practices of other countries and Kuwait. The study report is linking each point in the argument back to the Frame of Reference.

5.6.4 Focus Group, Interviews, Document Analysis, and Inspection

Most of the interviews, document analysis, and inspection conducted were mostly structured seeking single specific issues related to the building regulations' problems and practice in Kuwait. The results of the interviews, document analysis, inspection etc., were reported and inserted in a specific text in the analysis chapters (refer to chapters 4, 5 and 6). Appendix" H "shows a focus group details. The focus group variables are:

- There is no support from government neither politically nor financially.
- There is a lack of powerful administrative government to enforce building regulations; "the codes need claws and nails".
- Some officials and businessmen have an intent and will to avoid and disobey or follow rules.
- Negative political status affects the efficiency of enforcement of building regulations.
- There is a conflict and incorporation in issuing the licenses between The Ministry of Trade and the Municipality.
- There are many participating organizations in the administration of building process.
- There are poor managements at the relevant government institutions in the Building Regulations of the Municipality and other.
- There is a weakness in technical and financial capabilities in Municipality branches governorates.
- There are weak reimbursements for workers at Municipality.
- There is a weakness in legal departments at Municipality branches and governorates.

- Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible for direct communications with citizens.
- A variety in participating organizations in administrations for building process.
- Weakness in legal departments in Municipality branches at governorates.
- Weak reimbursements for workers at Municipality.
- Weakness in technical and financial capabilities in Municipality branches at governorates.
- Absence of society awareness and participation by community in regulation process.
- Delay in issuing and enforcing legal court rules based on violation cases.
- Low monetary charge for penalty by Municipality law (max. 500 k.d. = 1000 £)
- No deterrent punishments for violators.
- Weak power of law in enforcing correct decisions for violations.
- Ineffective engineering supervision and inspection tasks to prevent violations or cheatings.
- Kuwait laws have no clear objectives of BC.
- There is a misunderstanding and ambiguity towards the definition of codes.
- The codes are misunderstood as standards, in addition to the specifications of work procedures to execute the tasks.
- The specifications are usually included in the construction contracts.
- Any specified violation is prosecuted by penalty articles in the contract.

5.6.5 Questionnaire One and Two

5.6.5.1 Setting Hypothesis

The major empirical analysis is undertaken to determine how survey participants ranked cause and impact factors. The purpose of the hypothesis testing is to determine which of the following two hypotheses is correct (based on 5% of significance level):

- **Cause factors**

I. H_o ($p > 0.05$): There is no significant difference among Building Officials and Construction professionals for the likelihood of ***cause factors*** occurrences.

II. H_1 ($p < 0.05$): There is a significant difference among Building Officials and Construction professionals for the likelihood of ***cause factors*** occurrences.

- **Public Safety**

i. H0 ($p > 0.05$): There is no significant difference among respondents' rating for the impacts of insufficient Building codes on ***Public Safety*** in Kuwait

ii. H_1 ($p < 0.05$): There is a significant difference among respondents' rating for the impacts of insufficient Building codes on ***Public Safety*** in Kuwait

- **Public Health**

i. H0 ($p > 0.05$): There is no significant difference among respondents' rating for the impacts of insufficient Building codes on ***Public Health*** in Kuwait

ii. Hi ($p < 0.05$) : There is a significant difference between respondents' rating for the impacts of insufficient Building codes on ***Public Health*** in Kuwait

- **Public Welfare**

i. H0 ($p > 0.05$): There is no significant difference among respondents' rating for the impacts of insufficient Building codes on ***Public Welfare*** in Kuwait

ii. Hi ($p < 0.05$) : is no significant difference among respondents' rating for the impacts of insufficient Building codes on ***Public Welfare*** in Kuwait

Refer to Chapter Nine (Sections 9.2.3, 9.3.3, 9.4.3, and 9.5.3) for further details.

5.6.5.2 Statistical Tests

Descriptive statistics and other advanced statistics were used to analyze the responses of the research questions investigated. The data obtained from the questionnaire was analyzed using **(1)** statistical method namely frequency analysis (mean score and coefficient of variation), **(2)** Severity index **(3)** simple tabulation, and graphics such as : pie chart, and bar chart **(4)** analysis within groups using Correlation Coefficient (Pearson Correlation), **(5)** analysis among groups using T-test, and **(6)** correlations between cause and impact using Cross Tabulation.

- **Descriptive statistics**

The frequency analysis was applied to examine the percentage of ratings on different categories of significance for each factor. The mean score analysis has been applied to illustrate the overall responses in terms of significance. Details of the analysis are in Section 6.3 (Analysis and ranking), of chapter 6.

The analysis has been performed using the statistical packages SPSS 13 for Windows (SPSS Ins, 2004), and Microsoft Excel for Windows (Microsoft, 2007).

- **Cronbach's Alpha**

Cronbach's Alpha as a measure of reliability was calculated to check the consistency of the research items and to exclude the extreme responses (SPSS Inc., 2007).

- **Kaiser-Meyer-Olkin (KMO) & Bartlett's Test of Sphericity**

Kaiser-Meyer-Olkin (KMO),another measure of reliability was employed to test the probability of correlation that exists in some of the variables. Bartlett's test of sphericity examines whether the correlation matrix is an identity matrix (SPSS Inc., 2007).

- **Exploratory Factor Analysis**

Exploratory factor analysis was employed to remove redundancy in data and reveal the underlying pattern that may exist between the variables. It is a data reduction technique that was mainly used to reduce the number of questionnaire's questions to a smaller number of variables (dimensions) known as latent variables or constructs. It uses the factor loading as an indicator of the degree of association between a construction and its items (SPSS Inc., 2007). It also provides the percentage of variance explained by each factor, which was calculated by "principle component analysis (Eigenvalues)".

Another exploratory factor analysis that was employed is the correlation matrix (structure). The correlation structure was used to examine the research hypotheses, because it provides a general picture of the association between the dependent variables (effectiveness, extra effort and satisfaction) and the independent variables (dimensions of three leadership styles).

- **Questionnaire One**

In the following three sections, cause factors were presented and tabulated in such a way that the respondent could rate their significance with regard to the decision of the likelihood of cause factors occurrences for building codes and enforcement to minimize the shortcomings of minimum requirements of public health, safety and general welfare in Kuwait:

- **Section 1: Legal & Technical**
- **Section 2: Administrative**
- **Section 3: Social Part**

Respondents were asked to indicate the significance of each factor regarding the insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait.

- **Questionnaire Two**

In the following four sections, factors were presented and tabulated in such a way that respondent could rate their significance with regard to the impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait:

- **Section 1: Legal**
- **Section 2: Administrative**
- **Section 3: Technical**
- **Section 4: Social Part**

Respondents were asked to indicate the significance of each factor with regard to the impact of insufficiencies and infringements in building codes/regulations on public health, safety and general welfare in Kuwait.

5.6.5.3 Rating Scale

Respondents were asked to express their views on 2 kinds of five-point rating scales (see Section 5.4.5.1, and Section 5.4.6.1). Essentially, the numbers in these scales have little physical meaning beyond the fact that the higher score indicates the greater significance of the factors. This type of data is called "ordinal data", because only the order of numbers is meaningful. In the following sections, a number of suitable non-parametric techniques will be used to interpret the results of the survey.

5.7 Research Validity

This research is based on tried and tested research strategies and adopts data collection, and analysis techniques. The implementation of research methods is followed by detailed standards research techniques based on recognized and published researches and text books teaching research. These text books are as follow:

1. *Practical Research Methods: A user-friendly guide to mastering research techniques and projects*
2. *The Essential Guide for Doing a Research*
3. *An Introduction to Research*
4. *Dissertation Research and Writing for Construction Students*
5. *Succeeding your Master's Dissertation: A step-by-step handbook.*
6. *Writing Your Dissertation: How to plan, prepare and present successful work*
7. *Essentials for Research Design and Methodology*
8. *A Guide to Successful Thesis and Dissertation: A Handbook for Students and Faculty.*
9. *Elementary Questionnaire Sampling*
10. *Understanding Hypotheses*
11. *Your research project : a step-by-step guide for the first-time researcher*
12. *The Handbook of Research Synthesis*

5.8 Limitations of the research data

For this study, the problem of scarcity of academic papers for this topic in Kuwait, and the difficulty in accessing sufficient number of building projects was a concern in performing the necessary site inspections to collect the required information. Similar limited access was experienced with the other preferred source of data, such as the files of v Violations' Court Cases of the Building Department at Kuwait Municipality, and Expert Department at Ministry of Justice. Consequently, the information required had to be derived from other sources. To locate and establish an appropriate source of information, unstructured interviews were carried out with people from industrial y, and professionals' domains.

- **Specific Researcher Qualifications**

This research is extremely challenging to execute. I feel many researchers will avoid working in these areas of research. The researcher should have a variety of qualifications. The research has many aspects such as the legislative, social, administrative, and technical aspects. Regulations and administration are very complex issues, and sometimes are beyond the capabilities of an ordinary technical engineer.

The academic and PhD researchers in these areas need the support of politicians and government departments. The researcher needs the skills in how to communicate with officials and many other important personnel. Many building officials don't have the time to participate in research, due to the extensive responsibilities to manage the building works in the country. Researchers need to question the productivity and performance of major government organizations, and sometime may encounter unpleasant debates especially with higher officials.

- **Vast Scope of Regulations and Administrative Information**

The quantity of legal, administrative, and technical regulations and procedures quite enormous, disorganized, and scattered. Knowing the current status of these regulations and procedures in Kuwait and other countries is time and resources consuming. There is a need for government agencies for organizing this information.

- **Sensitive Area of Research**

The researcher needs to look and investigate legal documents, in particular "investigate the occurrence of infringements of building regulations". Some of the infringements practice may cause real-estate companies millions of pounds. Implementing the solutions of this research, would protect buildings and real estate's assets of the country.

Governments make wars to control lands. Building officials are the rulers of buildings and lands in the local government body. Therefore, in many countries they consider the municipality as the local government. Who controls more lands will control more buildings and real-estates. With more buildings and real-estates, people and countries get richer. Taking the mission to put rules and regulations to control the development of lands and buildings is a highly sensitive and a risky job.

- **Nature of Construction Industry**

The construction process challenges standardization. It is hard to imagine a more challenging undertaking project than a construction project. The process is physically complex. It must be designed in such a way that thousands of separate pieces can be fabricated, installed, and connected to create a complete, functioning structure. Unlike the manufacturing process, it is difficult to benefit from rote repetition. Every site is different and every structure, to some extent, is unique. The process is one of ongoing adaptation and innovation. Even the most carefully detailed design can be affected by unanticipated design errors, material deficiencies, the bankruptcy of a key supplier, or changes in the financial markets (Feld, Carper, 1997).

- **Complexity of the Subject of Building Code Regulatory System**

The subject of system is difficult and ambiguous to explore. The Building Codes Regulatory System is quit complex. Even though, I feel I did a lot of efforts to define this issue, I am optimistic that many researches will not have the time or resources to approve or disapprove the contents of the building code regulatory system or main components of the system.

- **Conducting Interviews, Surveys, Small Comparative Studies and Site Inspection**

The data collection was difficult. Understanding and using models of Building Codes Regulatory System of other countries to understand Kuwait frameworks, requires investigation of a lot of information in other countries. Performing interviews, surveys, small comparative studies and site inspection for identification of deficiencies and investigation of Building Codes Regulatory System in Kuwait by expert evaluation needed careful communication skills, and a lot of time for preparation.

5.9 Summary

The research methodology chapter describes **the methods used to implement research, and explains the reasons behind methods choices.** This Chapter explains the research design, methods, style, approach, data collection, data analysis, validity, limitations, and potential problems. The research methods adopted can be categorized as a mix of objective, subjective, an action research, comparative, quantitative, and qualitative. The summary is as follows:

- **Research Methods:** The selected methods for the research are **(1)A questionnaire (2) small comparative Studies, (3) Focus Group, (4) Interviews, and (5) Document Analysis.**.
- **Research Style**: This research style is **objective and subjective**. The conducted surveys are objective research methods, while the literature reviews, interviews are more subjective in nature.*
- **Research Type:** This research is an **action oriented research**. The research activities involve the real project of **BC**, government and societies' studies reports, conferences, workshops, seminars, meetings, and publications of news articles.
- **Research Approach:** This research utilizes more than one approach. The subject of building codes in Kuwait has multiple dimensions including: legal, administrative, technical, and social. Different research methods and approaches where utilized in order to fulfill the research aim. The conducted surveys are quantitative in nature, while literature reviews, interviews, comparative study, and focus group which are more qualitative in nature.

The next chapters present the results of the research.

Chapter Six

Preliminary Analysis of Survey One and Two: Descriptive Statistics and Data Presentation

Chapter Six

Preliminary Analysis of Survey One and Two:

Descriptive Statistics and Data Presentation

6.1 Introduction

In this survey, two questionnaires were developed and distributed among practitioners in different fields of construction professions, involved in building codes and regulations practice. The data obtained were grouped, organized in order to be analyzed and discussed in the next section. Overall findings of the questionnaires are presented in this chapter. This chapter only explains the descriptive statistics of the findings. Further analysis and discussions of the results and the perceptions of the practitioners will be explained in details during the later chapters.

- **Questionnaire One**

The first section of the questionnaire (Section A) includes 2 questions relevant to the respondents' general information .The first question of section A asks the respondents about their background as professionals in terms of areas of expertise such as building official in Municipality/Expert Department, or Construction Professional .The Second question asks the respondents to provide his/her e-mail (to receive a summary report of the survey results), in order to encourage the respondent to have an incentive to answer the questionnaire.

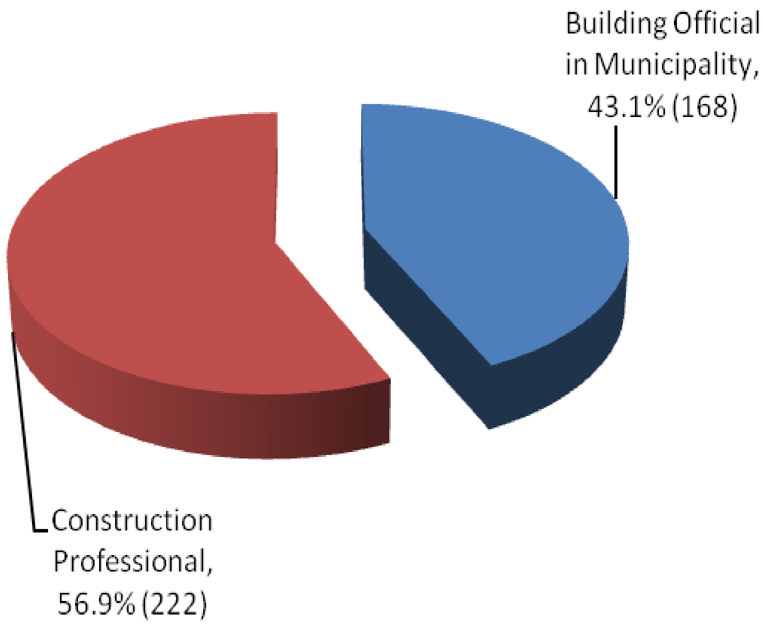

Figure 6.1: Respondents' Area of Expertise

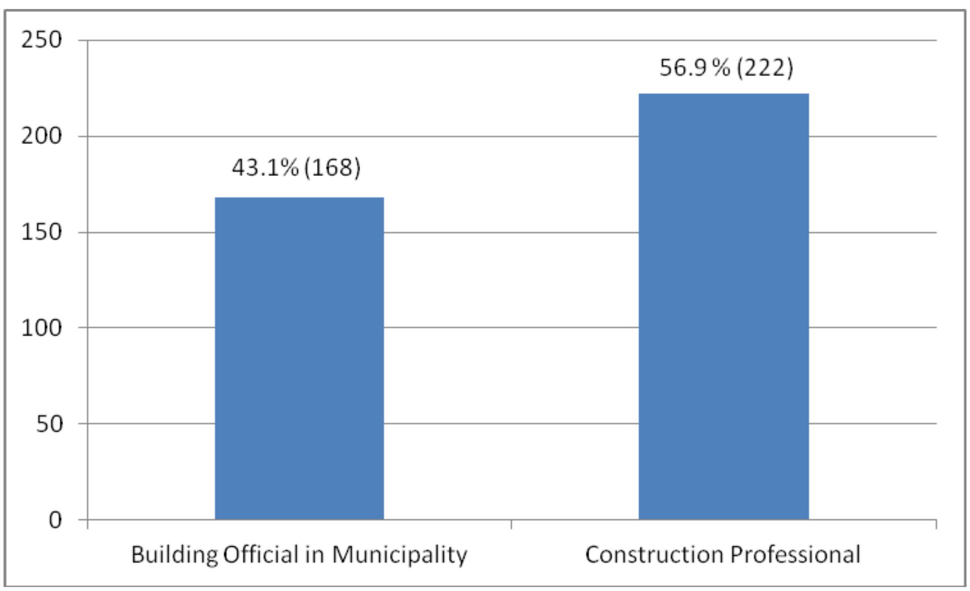

Figure 6.2: Respondents Area of Expertise

The findings showed 168 respondents (43.1%) were Building Officials in Municipality/Expert Department and 222 respondents (56.9%) were Construction Professionals. 180 respondents (46%) were Construction and Site Inspection/Maintenance Professionals.

- **Questionnaire Two**

The first section of the questionnaire (Section A) includes 2 questions relevant to the respondents' general information. The first question of section A asks the respondents' about their background of as professionals in terms of area of expertise such as design or plan review, construction or site inspection, and maintenance. The second question asks the respondent to provide his/her e-mail (to receive a summary report of the survey results), in order to encourage the respondents to have an incentive to answer the questionnaire.

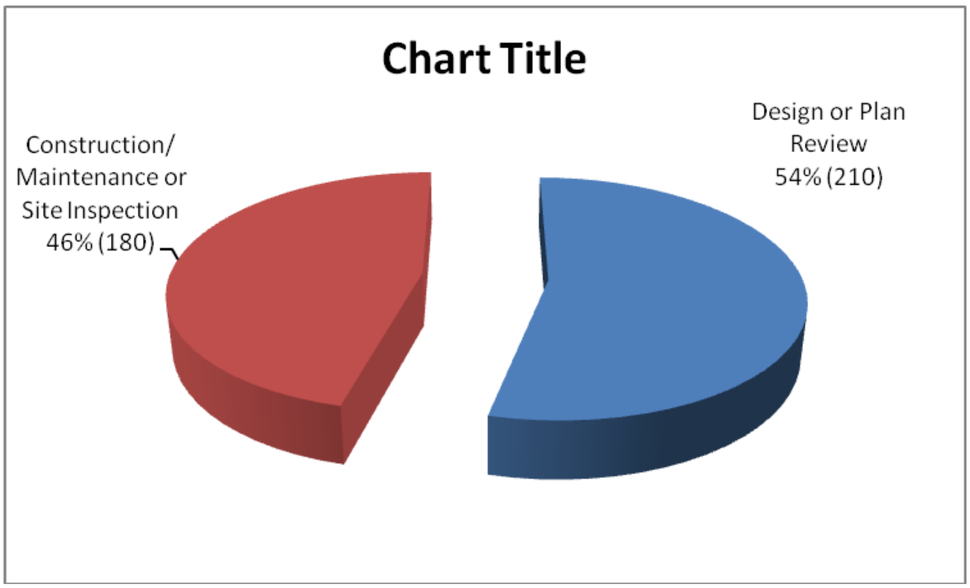

Figure 6.3: Respondents Area of Expertise

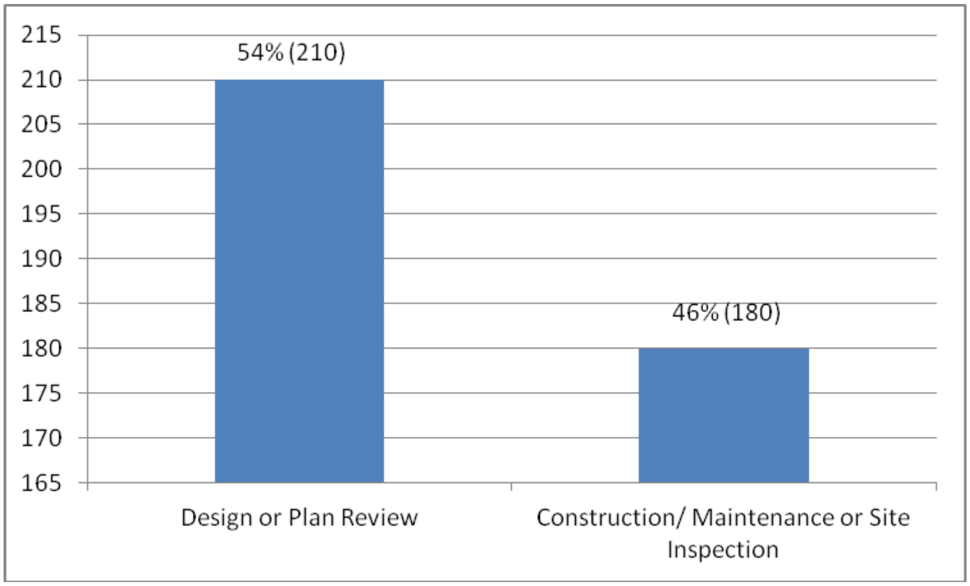

Figure 6.4: Respondents' Area of Expertise

The findings showed 210 respondents (54%) were Design or Plan Review Professionals, 180 respondents (46%) were Construction and Site Inspection/Maintenance Professionals.

6.2 Data Ranking

Ranking is based is on a list of cause and impact factors being ranked on their importance as rated by the respondents. The need for ranking is normally applied when there is a large set of data and a need to find and select similar indicators or common themes and trends for the research.

This chapter examines the statistical techniques used to rank the data obtained from the Questionnaire One, which consists of 55 cause factors within 4 stages, and Questionnaire Two, which consists of 59 impact factors within 4 stages.

In this study, the SPSS and Microsoft Excel software programmes were used for the ranking analysis. The method of evaluation and ranking is based on statistical analysis such as:

- The average weighted means
- Standard deviation
- Coefficient of variation
    - The ratio of standard deviation as a percentage (%) of the mean.
    - For comparing the relative variability of various responses.
    - The lower the variation coefficient, the less is the variability

- Severity index
    - Ranking of the indicators according to their significance.
    - The higher the percentage (%), the more significant is the factor

- **Questionnaire One**

The ranking is based on a questionnaire survey which was commissioned among building codes and regulations practitioners. The questionnaire was designed as a result of literature reviews, previous research works in this area and also a pilot study. The questionnaire consists of 55 cause factors with 4 parts of the building code. Each part has a number of cause factors attributed to it. This is shown in Figure 6.5.

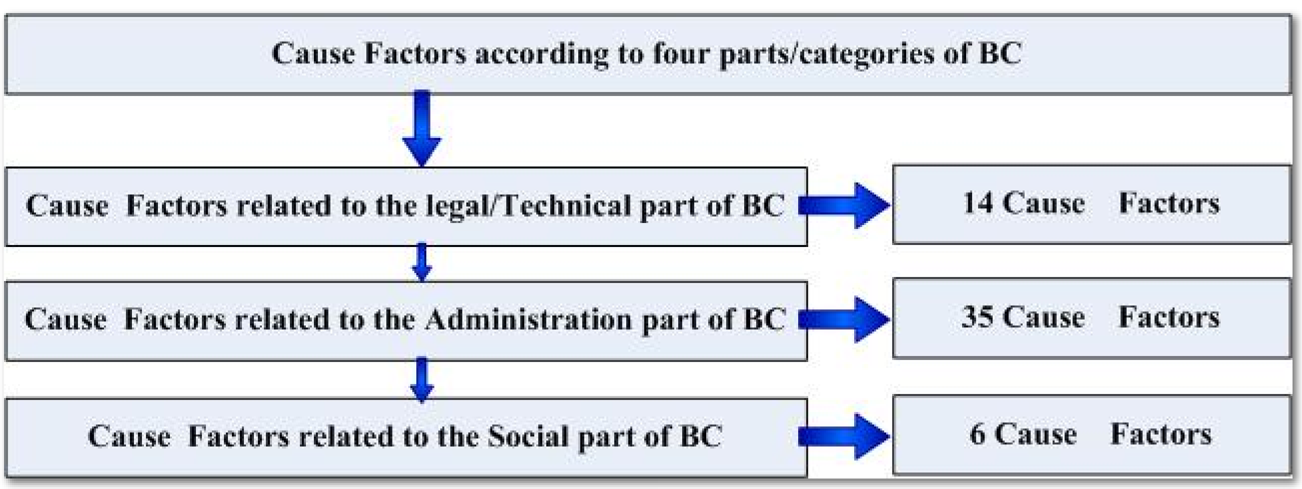

Figure 6.5: Cause Factors Structure

- **Questionnaire Two**

The ranking is based on a questionnaire survey which was commissioned among building codes and regulations practitioners. The questionnaire was designed as a result of literature reviews, previous research works in this area and also a pilot study. The questionnaire consists of 59 impact factors with 4 parts of the building code. Each part has a number of impact factors attributed to it. This is shown in Figure 6.6.

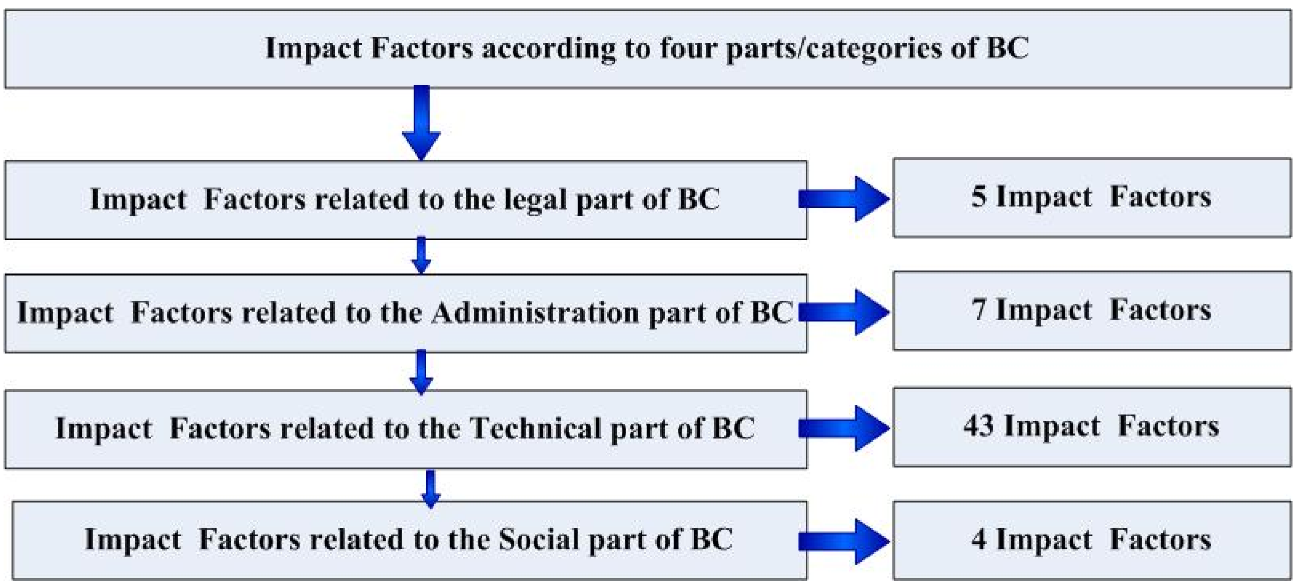

Figure 6.6: Impact Factors Structure

6.3 Analysis and ranking

Details of the analysis are in Section 5.4.5.1, and 5.4.6.1 of Ch.5 (Research Methodology).The mean is the average of all the values in a set of data. The mean is calculated by adding all the values in the group and then dividing by the number of values (Naoum, 2007). The first step in this analysis has been to calculate a mean score for each cause and impact factor based on each respondent's score [detailed calculations are shown in Appendix A and B]. For a cause or impact factor to have some degree of significance, its mean score should be greater than the mean score on the five-point scale, which is 3.

A mean weighted rating for each cause and impact factor is computed to indicate the importance of each indicator, using the equation 6.1 below.

$$\text{Mean weighted rating} = [\sum(R*F)]/n \qquad \textit{Equation 6.1}$$

Where;

R = rating of each cause factor (1,2,3,4,5)

F = frequency of responses

n = total number of responses (n = 390)

The Severity index (S.1) measure is to rank the indicators according to their significance. Each factor has a severity index. The agreement between any two parties can be measured quantitatively using the rank correlation theory (Al-Hammad., Assaf., Al-Shihah, 1997). These indexes were ranked for each group of survey respondent. Equation 6.2 presents how S.I is calculated:-

$$S.I. = \frac{\left(\sum_{i=1}^{i=n} w_i * f_i\right)}{n} * 100\% \qquad \textit{Equation 6.2}$$

Where:

S.I. = severity index

f_i = frequency of responses

w_i = weight of each rating (1/5, 2/5, 3/5, 4/5, 5/5)

n = total number of responses (n = 390)

In order to establish the degree by which respondents agree with each other, **Coefficients of Variations** (C of V) for each cause and impact factor have been calculated. The ratio of standard deviation (SD) as a percentage of the mean is called Coefficient of variation (COV) and is for comparing relative variability of responses. The coefficient of variation is the ratio between the standard deviation and the mean for the same set of data, expressed as a percentage (DeCoursey, (2003). The agreement between the ranking of any two parties was measured using the rank correlation coefficient (Al-Hammad, Assaf, Al-Shihah, 1997). Equation 6.3 presents how COV is calculated:-

$$CofV = \frac{s}{x} * 100\% \qquad \textit{Equation 6.3}$$

Where:

C of V: Coefficients of Variations

S: Standard of Deviation

X: Mean Score of Sample

- **Questionnaire One**

A List of cause factors, derived from the literatures was provided to the respondents who were asked to rate each factor in terms of the likelihood occurrence of the factors using the scale of 1-5 (1- Strongly disagree, 2- disagree, 3- Neutral, 4- Agree, 5-Strongly agree).

- **Questionnaire Two**

List of impact factors, derived from the literatures was provided to the respondents who were asked to rate each factor in terms of the likely magnitude of impact of the factors using the scale of 1-4 (1- no impact, 2- low impact, 3- impact, 4- high impact).

6.4 Rating and Ranking of Likelihood Occurrences of cause factors

For the purpose of this chapter, the full Table 6.1 illustrating the statistical ranking results for all 55 indicators is shown in the Appendix A. In the Table 6.1, the overall ranking, and the ranking of each practitioner for every cause factor are presented.

From the Table 6.1, the average weighted mean for the cause factors varies from 2.63 to 4.29, with the overall mean of 3.60. The severity indices range within 49 % to 87 %. As it can also be seen from Table 6.1, the top 20 ranked cause factors were dominated by the indicators from the Administrative Part and the Social Part, where the highest ranked factor was (AC31-Building Departments are not performing periodical inspection after building occupancy) with a mean of 4.10 and severity indices of 87 %. An overall examination of the first 20 ranked cause factors in Table 6.1 indicates that all first 20 ranked factors have a minimum mean value of 3.66 (which is higher than the overall mean of 3.60) and severity indices of 71.8 %. This means that the first 20 ranked cause factors emerge as important as viewed by the respondents.

The overall ranking for cause factors (AC31-Building Departments are not performing periodical inspection after building occupancy) is the first out of 55, the Building official ranked it the 3rd out of 55. The Construction Professional ranked it 14th out of 55. This factor carries a severity index of 87%, a coefficient of variation of 24.09%, standard deviation of 0.99 and an average weighted mean of 4.10.

6.4.1 Cause Factors of Legal/Technical Part of BC

The Legal/Technical part of BC consists of 14 cause factors. Ranking results in Table 6.5 shows that there are 3 factors (LC8, LC10, LC14) with ranking among the first 20 ranked indicators (Table 6.1 shows ranking results for all indicators is shown in the Appendix A). In Table 6.5, factor LC8 is considered as the highest ranked indicators for the Legal/Technical part of BC, with the mean of 3.99 and severity index of 74%. It has an overall ranking of 7th out of 55, Construction Professional ranked 4 out of 55, and Building Official ranked 7th out of 55.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Building Official in Municipality/Expert Department	Construction Professional			
LC1	3.37	1.253	**48**	**32**	37.21	72	43
LC2	3.56	1.311	**43**	**9**	36.85	72	32
LC3	3.38	1.288	**46**	**33**	38.15	59	42
LC4	3.36	1.281	**50**	**34**	38.10	66	44
LC5	3.20	1.235	**55**	**43**	38.65	68	51
LC6	3.51	1.312	**44**	**20**	37.40	73	36
LC7	3.25	1.165	**26**	**51**	35.88	59	49
LC8	3.99	1.117	**7**	**4**	28.00	74	7
LC9	3.32	1.087	**51**	**41**	32.72	65	46
LC10	3.97	1.085	**21**	**3**	27.33	84	8
LC11	3.38	1.092	**28**	**36**	32.30	69	41
LC12	2.63	1.016	**53**	**55**	38.61	49	55
LC13	3.65	1.096	**36**	**19**	30.04	81	22
LC14	3.71	1.108	**29**	**16**	29.85	76	17

Table 6.5: Mean Average Rating for Cause Factors of Legal/Technical Part of BC

Table [6.5] shows that factors have coefficients of variations ranging from 27.33% to 38.65%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.4.2 Cause Factors of Administrative Part of BC

The Administrative part of BC consists of 35 cause factors. Ranking results in Table 6.6 shows that there are 13 factors (AC34, AC18, AC6, AC31, AC22, AC29, AC26, AC16, AC23, AC2, AC33, AC14, AC28) with ranking among the first 20 ranked indicators. In Table 6.6, factor AC34 is considered as the highest ranked indicators for the Administrative part, with the mean of 4.27 and severity index of 85.33%. It has an overall ranking as the 2nd out of 55; Building Official ranked as the 2nd out of 55; and the Construction Professional ranked as the 6th out of 55.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Building Official in Municipality/Expert Department	Construction Professional			
AC1	3.52	.862	**39**	**26**	24.50	71	35
AC2	3.76	.802	**9**	**30**	21.31	82	15
AC3	3.21	1.177	**47**	**52**	36.65	58	50
AC4	3.58	.966	**30**	**28**	26.94	69	30
AC5	3.28	.912	**32**	**48**	27.83	60	48
AC6	4.17	.866	**1**	**13**	20.77	79	4
AC7	3.52	1.066	**19**	**46**	30.29	65	34
AC8	3.34	.979	**41**	**49**	29.28	68	45
AC9	3.32	1.002	**45**	**50**	30.20	71	47
AC10	3.63	.936	**18**	**23**	25.75	78	24
AC11	3.08	1.243	**37**	**53**	40.34	62	53
AC12	3.64	1.016	**23**	**18**	27.91	79	23
AC13	3.15	1.166	**52**	**47**	37.05	62	52
AC14	3.70	.965	**27**	**15**	26.08	76	19
AC15	3.54	.960	**31**	**27**	27.12	67	33
AC16	3.82	.725	**11**	**25**	18.97	79	13
AC17	3.04	1.368	**54**	**54**	45.05	60	54
AC18	4.21	.790	**8**	**2**	18.78	84	3
AC19	3.60	.847	**14**	**42**	23.53	76	28
AC20	3.60	1.075	**34**	**35**	29.84	71	27
AC21	3.65	1.019	**17**	**31**	27.90	68	21
AC22	3.93	.846	**4**	**37**	21.53	80	9
AC23	3.79	.870	**13**	**24**	22.93	75	14
AC24	3.48	1.028	**35**	**44**	29.57	73	37
AC25	3.59	1.108	**24**	**38**	30.84	79	29
AC26	3.82	1.309	**40**	**5**	34.25	76	12
AC27	3.61	1.072	**49**	**12**	29.68	76	25
AC28	3.66	.948	**33**	**10**	25.88	72	20
AC29	3.83	.975	**16**	**7**	25.48	78	11
AC30	3.45	1.017	**25**	**39**	29.49	68	40

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Building Official in Municipality/Expert Department	Construction Professional			
AC31	4.10	.988	**3**	**14**	24.09	87	5
AC32	3.58	1.186	**42**	**17**	33.10	81	31
AC33	3.71	.767	**10**	**45**	20.68	72	18
AC34	4.27	.776	**2**	**6**	18.18	85	2
AC35	3.48	1.065	**38**	**29**	30.63	68	38

Table 6.6: Mean Average Rating for Cause Factors of Administrative part of BC

Table [6.6] shows that factors have coefficients of variations ranging from 27.12% to 30.63%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.4.3 Cause Factors of Social Part of BC

The Social part of BC consists of 6 cause factors. Ranking results in Table 6.7 shows that there are 4 factors (SC4, SC5, SC3,SC6) with ranking among the first 20 ranked indicators (Table 6.1 shows ranking results for all indicators is shown in the Appendix A). In Table 6.7, factor SC4 is considered as the highest ranked indicators for the Social part, with the mean of 4.29 and severity index of 85%. It has an overall ranking as the 1st out of 55; Building Official ranked the 5th out of 55; and the Construction Professional ranked as the 1st out of 55.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Building Official in Municipality/Expert Department	Construction Professional			
SC1	3.47	1.048	**15**	**40**	30.16	62	39
SC2	3.61	1.232	**20**	**21**	34.13	71	26
SC3	3.91	1.016	**6**	**22**	25.99	85	10
SC4	4.29	.750	**5**	**1**	17.47	85	1
SC5	4.00	1.020	**12**	**11**	25.53	86	6
SC6	3.73	1.214	**22**	**8**	32.56	79	16

Table 6.7: Mean Average Rating for Cause Factors of Social part of BC

Table [6.7] shows that factors have coefficients of variations ranging from 17.47% to 34.13%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.5 The Rating and Ranking Impact of factors on Public Safety

The full Table 6.2 illustrating the statistical ranking results for all 59 indicators is shown in the Appendix B. In the Table 6.2 the overall ranking, and the ranking by each practitioner for every impact factor are presented.

6.5.1 The Legal Part of BC

The Legal part of BC consists of 5 impact factors. For the impact of factors on public safety, the ranking results in Table 6.8 shows that only one factor (IL4) with ranking among the first 20 ranked indicators (Table 6.2 shows ranking results for all indicators is shown in the Appendix B). In Table 6.8, factor IL4 is considered as the highest ranked indicator for the Legal Part of BC, with the mean of 3.76 and a severity index of 76.47%. It has an overall ranking as the 8th out of 59, professionals of Const./ Maintenance or Site Inspection ranked the 4th out of 59, and the professionals of Design or Plan Review ranked as the 18th out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IL1	3.69	0.49	**41**	**7**	13.18	74.12	**18**
IL2	3.47	0.75	**56**	**38**	21.55	71.76	**49**
IL3	3.62	0.71	**52**	**12**	19.57	73.33	**29**
IL4	3.76	0.53	**18**	**4**	14.02	76.47	**8**
IL5	3.61	0.71	**23**	**30**	19.67	72.94	**30**

Table 6.8: Mean Average Rating for the Impact of factors on Public Safety for Legal part of BC

Table [6.8] shows that factors have coefficients of variations ranging from 13.18% to 21.55%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.5.2 The Administrative Part of BC

The Administrative Part of BC consists of 7 impact factors. For the impact of factors on public safety, ranking results in Table 6.9 shows that 5 factors (IA6, IA7, IA1, IA5, IA3) with ranking among the first 20 ranked indicators (Table 6.2 shows ranking results for all indicators is shown in the Appendix B). In Table 6.9, factor IA6 is considered as the highest ranked indicators for the Administrative Part of BC, with the mean of 3.86 and severity index of 77.65%. It has an overall ranking as the 1st out of 59, professionals of Const./ Maintenance or Site Inspection are ranked as the 5th out of 59, and the professionals of Design or Plan Review are ranked as the 2nd out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IA1	3.75	0.52	**35**	**1**	13.93	77.65	**10**
IA2	3.40	0.88	**59**	**47**	25.97	70.59	**53**
IA3	3.69	0.58	**36**	**6**	15.81	75.29	**15**
IA4	3.53	0.72	**54**	**23**	20.28	73.33	**39**
IA5	3.71	0.55	**17**	**16**	14.86	77.33	**14**
IA6	3.86	0.35	**5**	**2**	9.00	77.65	**1**
IA7	3.82	0.41	**2**	**8**	10.83	75.29	**3**

Table 6.9: Mean Average Rating for the Impact of factors on Public Safety for the Administrative Part of BC

Table [6.9] shows that factors have coefficients of variations ranging from 9.00% to 25.97%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.5.3 The Technical Part of BC

The Technical Part of BC consists of 43 impact factors. For the impact of factors on public safety, ranking results in Table 6.10 shows that 10 factors (IT41, IT43, IT42, IT18, IT2, IT31, IT16, IT40, IT13, IT3) with ranking among the first 20 ranked indicators (Table 6.2 shows ranking results for all indicators is shown in the Appendix B). In Table 6.10, factor **IT41** is considered as the highest ranked indicators for the Technical Part of BC, with the mean of 3.83 and severity index of 80%. It has an overall ranking as the 2nd out of 59, professionals of Const./ Maintenance or Site Inspection are ranked as the 3rd out of 59, and the professionals of Design or Plan Review are ranked as the 9th out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IT1	3.49	0.80	**46**	**41**	22.95	74.12	**44**
IT2	3.72	0.63	**24**	**10**	17.01	76.47	**12**
IT3	3.68	0.66	**25**	**18**	17.85	76.47	**20**
IT4	3.60	0.66	**28**	**35**	18.34	75.29	**32**
IT5	3.65	0.69	**12**	**31**	18.79	76.47	**22**
IT6	3.62	0.71	**20**	**26**	19.60	75.29	**28**
IT7	3.63	0.62	**40**	**19**	17.05	72.94	**25**
IT8	3.39	0.89	**57**	**53**	26.38	72.94	**54**
IT9	3.58	0.67	**33**	**34**	18.78	75.29	**35**
IT10	3.42	0.76	**51**	**54**	22.15	74.12	**52**
IT11	3.26	0.89	**55**	**59**	27.15	69.41	**59**
IT12	3.60	0.64	**29**	**28**	17.73	74.12	**33**
IT13	3.69	0.49	**15**	**20**	13.18	75.29	**19**
IT14	3.63	0.63	**19**	**29**	17.32	74.12	**26**
IT15	3.49	0.77	**30**	**50**	22.18	72.94	**42**
IT16	3.69	0.55	**14**	**21**	14.95	76.47	**16**
IT17	3.64	0.61	**37**	**17**	16.70	74.12	**23**
IT18	3.74	0.48	**16**	**11**	12.86	76.47	**11**
IT19	3.49	0.73	**45**	**39**	20.91	72.94	**43**
IT20	3.47	0.74	**42**	**48**	21.41	74.12	**48**
IT21	3.54	0.67	**47**	**32**	18.88	72.94	**38**
IT22	3.50	0.79	**43**	**42**	22.62	74.12	**41**
IT23	3.48	0.69	**49**	**43**	19.71	75.29	**45**
IT24	3.33	0.86	**58**	**55**	25.75	71.76	**58**
IT25	3.37	0.79	**50**	**57**	23.36	70.59	**55**
IT26	3.59	0.65	**32**	**27**	18.13	76.47	**34**
IT27	3.56	0.67	**22**	**40**	18.87	76.47	**36**
IT28	3.63	0.63	**26**	**24**	17.26	77.65	**24**
IT29	3.62	0.62	**13**	**37**	17.12	75.29	**27**
IT30	3.66	0.59	**3**	**36**	16.02	74.12	**21**
IT31	3.71	0.57	**11**	**22**	15.44	78.82	**13**
IT32	3.52	0.78	**31**	**45**	22.11	72.94	**40**
IT33	3.48	0.77	**38**	**49**	22.23	71.76	**46**
IT34	3.46	0.71	**48**	**46**	20.52	75.29	**50**
IT35	3.54	0.74	**21**	**44**	20.87	70.59	**37**
IT36	3.48	0.73	**34**	**51**	21.00	72.94	**47**
IT37	3.35	0.87	**53**	**56**	25.88	69.41	**57**
IT38	3.44	0.78	**44**	**52**	22.54	75.29	**51**
IT39	3.36	0.89	**39**	**58**	26.40	71.76	**56**
IT40	3.69	0.58	**10**	**25**	15.63	77.65	**17**
IT41	3.83	0.46	**9**	**3**	12.01	80.00	**2**
IT42	3.80	0.46	**8**	**9**	12.06	76.47	**6**
IT43	3.81	0.53	**1**	**13**	13.92	77.65	**5**

Table 6.10: Mean Average Rating for the Impact of Factors on Public Safety for the Technical Part of BC

Table [6.10] shows that factors have coefficients of variations ranging from 12.01% to 26.38%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.5.4 Social Part of BC

The Social Part of BC consists of 4 impact factors. The impact of factors on public safety and ranking results in Table 6.11 shows that 3 factors (IS1, IS2, IS3) are with ranking among the first 20 ranked indicators (Table 6.2 shows ranking results for all indicators is shown in the Appendix B). In Table 6.11, factor IS2 is considered as the highest ranked indicators for the Social Part of BC, with the mean of 3.81 and severity index of 76.47%. It has an overall ranking as the 4th out of 59, professionals of Const./ Maintenance or Site Inspection as the 5th out of 59, and the professionals of Design or Plan Review ranked as the 6th out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IS1	3.76	0.53	4	14	14.06	74.12	7
IS2	3.81	0.39	6	5	10.36	76.47	4
IS3	3.76	0.51	7	15	13.49	76.47	9
IS4	3.60	0.69	27	33	19.16	76.47	31

Table 6.11: Mean Average Rating for Impact of factors on Public Safety for Social Part of BC

Table [6.11] shows that factors have coefficients of variations ranging from 10.36% to 19.16%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.6 Rating and Ranking of Impact of factors on Public Health

The full Table 6.3 illustrating the statistical ranking results for all 59 indicators is shown in the Appendix B. In the Table 6.3, the overall ranking, and the ranking of each practitioner for every impact factor are presented.

6.6.1 Legal Part of BC

The Legal part of BC consists of 5 impact factors. For the impact of factors on public health, ranking results in Table 6.12 shows that none of the factors with ranking among the first 20 ranked indicators.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IL1	3.25	.826	55	56	25.40	61.18	55
IL2	3.14	.879	58	59	28.01	61.18	58
IL3	3.17	.968	56	55	30.59	55.29	56
IL4	3.44	.696	45	50	20.20	63.53	45
IL5	3.32	.871	53	53	26.22	65.88	53

Table 6.12: Mean Average Rating for Impact of factors on Public Health for Legal Part of BC

Table [6.12] shows that factors have coefficients of variations ranging from 20.20% to 30.59%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.6.2 The Administrative Part of BC

The Administrative part of BC consists of 7 impact factors .The impact of factors on public health ranking results in Table 6.13 shows that one factor (IA7) with ranking among the first 20 ranked indicators (Table 6.3 shows ranking results for all indicators is shown in the Appendix B). In Table 6.13, factor IA7 is considered as the highest ranked indicator for the Administrative Part of BC, with the mean of 3.64 and severity index of 71.76%. It has an overall ranking of 6th out of 59, the professionals of Const./ Maintenance or Site Inspection ranked as 21 out of 59, and professionals of Design or Plan Review ranked as the 6th out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IA1	3.39	.677	49	44	20.00	62.35	49
IA2	3.03	1.084	59	58	35.80	57.65	59
IA3	3.33	.848	52	54	25.49	60.00	52
IA4	3.14	.950	57	57	30.26	56.47	57
IA5	3.47	.610	38	49	17.56	68.24	38
IA6	3.38	.733	50	51	21.69	66.25	50
IA7	3.64	.516	6	21	14.16	71.76	6

Table 6.13: Mean Average Rating for the Impact of factors on Public Health for the Administrative Part of BC

Table [6.13] shows that factors have coefficients of variations ranging from 56.47% to 71.76%.Therefore, it can be deduced that the variation of responses is relatively above average. This indicates that there is low agreement between the respondents in the significant of the factors.

6.6.3 The Technical Part of BC

The Technical part of BC consists of 43 impact factors. For the impact of factors on public health, ranking results in Table 6.14 shows that 18 factors (IT3, IT43, IT6, IT41, IT31, IT40, IT30, IT29, IT18, IT5, IT42, IT28, IT16, IT32, IT14, IT9, IT25, IT26) with ranking among the first 20 ranked indicators (Table 6.3 shows ranking results for all indicators is shown in the Appendix B). In Table 6.14, factor IT3 is considered as the highest ranked indicator for the Technical Part of BC, with the mean of 3.71 and severity index of 70.59%. It has an overall ranking as the 1st out of 59, professionals of Const./ Maintenance or Site Inspection ranked as the 2nd out of 59, and the professionals of Design or Plan Review ranked as the 1st out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IT1	3.44	.782	46	48	22.76	68.24	46
IT2	3.52	.636	25	33	18.05	67.06	25
IT3	3.71	.554	1	2	14.95	70.59	1
IT4	3.51	.611	28	46	17.42	70.59	28
IT5	3.62	.582	11	47	16.08	75.29	11
IT6	3.69	.496	3	22	13.46	72.94	3
IT7	3.48	.653	36	18	18.75	67.06	36
IT8	3.42	.750	47	42	21.89	67.06	47
IT9	3.55	.567	18	39	15.98	68.24	18
IT10	3.53	.567	21	29	16.05	70.59	21

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IT11	3.32	.683	**54**	**52**	20.58	62.35	**54**
IT12	3.46	.656	**40**	**38**	18.98	67.06	**40**
IT13	3.49	.586	**34**	**43**	16.78	69.41	**34**
IT14	3.56	.551	**17**	**41**	15.48	67.06	**17**
IT15	3.47	.671	**39**	**40**	19.33	67.06	**39**
IT16	3.59	.575	**14**	**11**	16.02	70.59	**14**
IT17	3.45	.654	**43**	**34**	18.96	67.06	**43**
IT18	3.63	.525	**10**	**35**	14.46	71.76	**10**
IT19	3.45	.707	**44**	**24**	20.51	64.71	**44**
IT20	3.45	.756	**42**	**25**	21.92	65.88	**42**
IT21	3.37	.718	**51**	**45**	21.28	62.50	**51**
IT22	3.49	.672	**32**	**6**	19.23	69.41	**32**
IT23	3.51	.694	**27**	**3**	19.76	68.24	**27**
IT24	3.51	.716	**31**	**14**	20.42	69.41	**31**
IT25	3.54	.610	**19**	**12**	17.21	70.59	**19**
IT26	3.54	.567	**20**	**23**	16.03	70.59	**20**
IT27	3.51	.611	**29**	**26**	17.42	67.06	**29**
IT28	3.59	.618	**13**	**17**	17.20	71.76	**13**
IT29	3.63	.563	**9**	**7**	15.50	70.59	**9**
IT30	3.63	.610	**8**	**4**	16.81	72.94	**8**
IT31	3.65	.574	**5**	**5**	15.72	72.94	**5**
IT32	3.58	.639	**15**	**13**	17.82	68.24	**15**
IT33	3.48	.709	**37**	**8**	20.37	71.76	**37**
IT34	3.39	.706	**48**	**37**	20.82	70.00	**48**
IT35	3.49	.656	**33**	**32**	18.79	70.59	**33**
IT36	3.53	.594	**22**	**9**	16.83	71.76	**22**
IT37	3.46	.635	**41**	**36**	18.37	67.06	**41**
IT38	3.52	.636	**26**	**10**	18.06	72.94	**26**
IT39	3.52	.624	**24**	**15**	17.70	71.76	**24**
IT40	3.64	.532	**7**	**16**	14.62	76.47	**7**
IT41	3.67	.538	**4**	**1**	14.68	77.65	**4**
IT42	3.61	.540	**12**	**19**	14.97	74.12	**12**
IT43	3.69	.484	**2**	**20**	13.10	75.29	**2**

Table 6.14: Mean Average Rating for the Impact of factors on Public Health for Technical Part of BC

Table [6.14] shows that factors have coefficients of variations ranging from 13.10% to 21.92%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.6.4 The Social Part of BC

The Social part of BC consists of 4 impact factors. As for the impact of factors on public health, ranking results in Table 6.15 shows that one factor (IS1) with ranking among the first 20 ranked indicators (Table 6.3 shows ranking results for all indicators is shown in the Appendix B). In Table 6.15, factor IS1 is considered as the highest ranked indicator for the Social Part of BC, with the mean of 3.57 and severity index of 64.71%. It has an overall ranking of 16 out of 59, the professionals of Const./ Maintenance or Site Inspection ranked 27 out of 59, and the professionals of Design or Plan Review ranked 16 out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IS1	3.57	.586	**16**	**27**	16.40	64.71	**16**
IS2	3.53	.549	**23**	**28**	15.56	70.59	**23**
IS3	3.51	.644	**30**	**30**	18.35	68.24	**30**
IS4	3.49	.675	**35**	**31**	19.35	72.94	**35**

Table 6.15: Mean Average Rating for the Impact of factors on Public Health for the Social Part of BC

Table [6.15] shows that factors have coefficients of variations ranging from 15.56% to 19.35%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.7 Rating and Ranking Impact of factors on Public Welfare

The full Table 6.4 illustrating the statistical ranking results for all 59 indicators is shown in the Appendix B. In the Table 6.4, the overall ranking, and the ranking of each practitioner for every impact factor are presented.

6.7.1 The Legal Part of BC

The Legal part of BC consists of 5 impact factors. For the impact of factors on public Welfare, ranking results in Table 6.16 shows that only one factor (IL2) with ranking among the first 20 ranked indicators (Table 6.4 shows ranking results for all indicators is shown in the Appendix B). In Table 6.16, factor IL2 is considered as the highest ranked indicator for the Legal Part of BC, with the mean of 3.07 and severity index of 61.18%. It has an overall ranking of 8th out of 59, the professionals of Const./

Maintenance or Site Inspection ranked 22 out of 59, and the professionals of Design or Plan Review ranked 15 out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IL1	2.86	.745	52	46	26.08	50.59	50
IL2	3.07	.752	15	22	24.54	61.18	15
IL3	2.77	.913	54	57	32.96	51.76	57
IL4	2.84	.976	40	56	34.40	51.76	53
IL5	2.76	.933	48	59	33.80	54.12	58

Table 6.16: Mean Average Rating for the Impact of factors on Public Welfare for the Legal part of BC

Table [6.16] shows that factors have coefficients of variations ranging from 50.59% to 61.18%.Therefore, it can be deduced that the variation of responses is relatively above average. This indicates that there is low agreement between the respondents in the significant of the factors.

6.7.2 The Administrative Part of BC

The Administrative Part of BC consists of 7 impact factors. For the impact of factors on public welfare, ranking results in Table 6.17 shows that none of factors with ranking among the first 20 ranked indicators.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IA1	2.84	.883	43	55	31.06	56.47	52
IA2	2.75	.996	51	58	36.15	57.65	59
IA3	2.88	.815	57	25	28.31	55.29	49
IA4	2.85	.850	59	26	29.86	55.29	51
IA5	3.00	.827	44	11	27.58	57.65	31
IA6	2.92	.878	33	53	30.06	52.50	41
IA7	3.00	.887	14	51	29.58	54.12	30

Table 6.17: Mean Average Rating for the Impact of factors on Public Welfare for Administrative Part of BC

Table [6.17] shows that factors have coefficients of variations ranging from 52.50% to 57.65%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.7.3 The Technical Part of BC

The Technical Part of BC consists of 43 impact factors. For the impact of factors on Public Welfare, ranking results in Table 6.18 shows that 19 factors (IT43, IT5, IT9, IT42, IT6, IT38, IT11, IT15, IT29, IT3, IT1, IT10, IT36, IL2, IT24, IT30, IT39, IT34, IT37) with ranking among the first 20 ranked indicators (Table 6.4 shows ranking results for all indicators is shown in the Appendix B). In Table 6.18, factor IT43 is considered as the highest ranked indicator for the Technical Part of BC, with the mean of **3.61** and severity index of 69.41%. It has an overall ranking of 1st out of 59, professionals of Const./ Maintenance or Site Inspection ranked 1st out of 59, and the professionals of Design or Plan Review ranked 1st out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IL1	2.86	.745	52	46	26.08	50.59	50
IL2	3.07	.752	15	22	24.54	61.18	15
IL3	2.77	.913	54	57	32.96	51.76	57
IL4	2.84	.976	40	56	34.40	51.76	53
IL5	2.76	.933	48	59	33.80	54.12	58
IA1	2.84	.883	43	55	31.06	56.47	52
IA2	2.75	.996	51	58	36.15	57.65	59
IA3	2.88	.815	57	25	28.31	55.29	49
IA4	2.85	.850	59	26	29.86	55.29	51
IT1	3.11	.837	13	13	26.96	60.00	11
IT2	2.88	.899	58	16	31.23	51.76	48
IT3	3.11	.770	12	17	24.78	58.82	10
IT4	2.91	.857	50	27	29.46	60.00	43
IT5	3.23	.759	2	7	23.53	64.71	2
IT6	3.17	.748	5	8	23.57	60.00	5
IT7	2.80	.865	55	52	30.87	48.24	55
IT8	3.02	.901	20	31	29.81	55.00	23
IT9	3.22	.735	3	5	22.83	60.00	3
IT10	3.09	.926	6	32	29.92	57.65	12
IT11	3.16	.784	18	3	24.84	62.35	7
IT12	3.01	.770	23	36	25.61	55.00	28
IT13	2.94	.809	41	37	27.53	51.76	39
IT14	2.81	.870	49	54	30.99	48.24	54
IT15	3.13	.772	8	14	24.67	57.65	8
IT16	2.88	.799	53	33	27.76	51.76	47

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IT17	2.80	.896	56	50	32.01	50.59	56
IT18	3.04	.846	7	49	27.84	56.47	21
IT19	2.91	.867	42	41	29.83	52.94	44
IT20	3.01	.868	38	15	28.85	56.47	27
IT21	2.92	.808	47	20	27.70	55.29	42
IT22	2.97	.814	34	28	27.41	57.65	36
IT23	3.02	.821	22	29	27.21	56.47	25
IT24	3.06	.822	17	24	26.89	57.65	16
IT25	2.93	.767	39	47	26.19	54.12	40
IT26	2.96	.783	28	48	26.44	56.47	38
IT27	3.02	.734	21	34	24.32	58.82	24
IT28	2.98	.795	30	35	26.64	58.82	33
IT29	3.12	.805	9	18	25.78	61.18	9
IT30	3.05	.813	19	21	26.64	60.00	17
IT31	2.96	.849	27	42	28.67	57.65	37
IT32	2.98	.860	24	43	28.87	57.65	34
IT33	2.91	.822	45	38	28.26	58.82	45
IT34	3.04	.802	11	45	26.35	57.65	19
IT35	2.89	.886	46	39	30.64	60.00	46
IT36	3.07	.805	26	9	26.26	62.35	14
IT37	3.04	.788	35	10	25.90	62.35	20
IT38	3.16	.856	16	4	27.07	64.71	6
IT39	3.04	.899	10	44	29.53	60.00	18
IT40	2.97	1.068	32	40	35.91	57.65	35
IT41	3.01	1.063	29	19	35.33	61.18	26
IT42	3.20	.855	4	6	26.73	62.35	4
IT43	3.61	.635	1	1	17.58	69.41	1

Table 6.18: Mean Average Rating for the Impact of factors on Public Welfare for Technical Part of BC

Table [6.18] shows that factors have coefficients of variations ranging from 17.58% to 36.15%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is reasonable agreement between the respondents in the significant of the factors.

6.7.4 The Social part of BC

The Social Part of BC consists of 4 impact factors. For the impact of factors on Public Welfare, ranking results in Table 6.19 shows that one factor (IS4) with ranking among the first 20 ranked indicators (Table 6.4 shows ranking results for all indicators is shown in the Appendix B). In Table 6.19, factor IS4 is considered as the highest ranked indicator for the Social Part of BC, with the mean of 3.09 and severity index of 63.53%. It has an overall ranking of 4th out of 59, the professionals of Const./

Maintenance or Site Inspection ranked it as the 2nd out of 59, and the professionals of Design or Plan Review ranked 36 out of 59.

Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
			Design or Plan Review	Const./ Maintenance or Site Inspection			
IS1	3.00	.774	25	**30**	25.78	54.12	**29**
IS2	2.99	.825	37	**23**	27.63	58.82	**32**
IS3	3.03	.866	31	**12**	28.57	61.18	**22**
IS4	3.09	.901	36	**2**	29.16	63.53	**13**

Table 6.19: Mean Average Rating for Impact of factors on Public Welfare for Social part of BC

Table [6.19] shows that factors have coefficients of variations ranging from 54.12% to 63.53%.Therefore, it can be deduced that the variation of responses is relatively above average. This indicates that there is low agreement between the respondents in the significant of the factors.

6.8 Summary

In accordance with research objective no. 5 (Indentify insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait), this chapter discovers insufficiencies and infringements impact factors and investigates building codes, regulations and their enforcement by four aspects.

Ranking helps researchers to indicate which cause and impact factors are more important. Coefficients of variations used to have some indication about the variation of responses, and to assess the agreement between the respondents in the significant of the factors. However, there are more advance statistical methods to assess the agreement between the respondents. ***Therefore, T-Test was computed to perform the advance analysis. Moreover, Pearson correlation coefficient was computed to assess the relationship between cause factors, and Factor analysis is used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of variables as reported in Chapters 8 and 9.***

In this chapter, ranking based on severity index, average weighted mean and standard deviation of each cause and impact factor were used in order to determine the degree of significance on cause and impact factors in the context of insufficiencies and infringements in building codes/regulations which cause shortcomings in the minimum requirements of public health, safety and general welfare in Kuwait. This will be discusses in greater details in the next few chapters.

Chapter Seven

Practitioners Perceptions on Likelihood Occurrence of Cause and Impact Factors

Chapter Seven

Practitioners' Perceptions on Likelihood Occurrence of Cause and Impact Factors

7.1 Introduction

While building regulations, authorities and professionals invest substantial time, resources and effort on building codes development, administration, and controlling the insufficiencies associated with building codes practice is crucial and critical to the area of concern [(Black, 2004), (Building Research Establishment, 2008), (McDonald., Smith, Mehta, 1996), (Kubba, 2008), (Lyubashevskii, Martenson, 1990), (Udoeyo,1995), (Compliance Task Force, 2008), (Fang, Okada, 1999), (Burby, Peter ,1999), (McPherson, 2008), (Thiruppugazh, 2008), (Rousseau, 2000), (JSCQB, 2002), (Residential and Civil Construction Alliance of Ontario, 2008)]. Most of the previous studies are undertaken to explore the relationship between insufficiencies with the overall building regulations practice and correlate these issues within the perspectives of the building officials**,** professionals**,** users and BC organizations as a whole**.** Little has been done, however, to explain the perceptions among different building officials and professionals within the building codes development and administration of the likelihood occurrence of these insufficiencies and their impact on the public health, safety and general welfare in Kuwait in each part of the building code framework (legal, administrative, technical, & social).

Building regulations implementations can often be beyond control and result in not meeting BC objectives (public health, safety and general welfare) and not performed in the way expected. Many examples of practices of building codes in the world are eventually unsuccessful or significantly adjusted without delivering the intended performance. Because of the strategic importance of BC objectives and the large amount of tasks and responsibilities involved, it is very crucial to be able to manage the risks of insufficiencies and the negligence.

This chapter examines the mindset of building officials and professionals dealing with Building codes and to show their value and perception for each insufficiencies factors and their likelihood occurrence in each part of the building code framework. Due to the large amount of tasks and responsibilities involved in building codes development, administration, and controlling, comparisons were also made about the impact of these insufficiencies on the BC objectives (public health, safety and general welfare).

The four parts of the building code framework are explained in Section 1.2.1 of Research Scope in Chapter One. **The Legal part is** concerned with the legal status of BC. **The Administrative part is** concerned with BC organizations, issuing permits, reviewing plan, and conducting inspection. **The Technical part is** concerned with building requirements. **The Social part is** concerned with effects of buildings and built environment on the human relationship.

The results of this analysis should be valuable for the building officials and the professionals of the building codes field to understand the importance of insufficiencies occurrence in each part of the building code framework (legal, administrative, technical, & social), and crucially, be able to identify and manage the insufficiencies that have significant impact on the BC objectives.

7.2 Experiences

7.2.1 Questionnaire One

Table 7.l below shows the background experience of the respondents:

Respondents	Years of experience in construction		
	1-10 yrs	More than 10 yrs	Number of respondents
Building Official in Municipality	117	105	222
Construction Professional	108	72	180
Total	225	177	402
%	55.97	44.03	

Table 7.1 Experiences of` respondents in construction (in Years)

It can be seen that 55.97% of respondents had less than 10 years of experience, and 44.03% of respondents had more than 10 years of experience. From Table 7.1, it can be said that the respondents overall have sufficiently good working knowledge and insights of construction projects and building regulations processes, in terms of years of experiences. The richness of experiences among the respondents was very relevant and significant in justifying the responses that were given in the questionnaires. This gives support for the arguments in this study.

7.2.2 Questionnaire Two

Table 7.2 below shows the background experience of the respondents:

Respondents	**Years of experience in construction**		
	1-10 yrs	**More than 10 yrs**	**Number of respondents**
Design or Plan Review	**206**	**4**	**210**
Construction/ Maintenance or Site Inspection	**23**	**157**	**180**
Total	**229**	**161**	**390**
%	**58.72**	**41.28**	

Table 7.2 Experiences of` respondents in construction (in Years)

It can be seen that 58.72% of respondents had less than 10 years of experience, and 41.28% of respondents had more than 10 years of experience. From Table 7.2, it can be said that the respondents have sufficiently good working knowledge and insights of construction projects and building regulations' processes, in terms of years of experiences. The richness of experiences among the respondents was very relevant and significant in justifying the responses that were given in the questionnaires. This may give a reasonable support for the arguments in this study.

7.2 Findings of cause Factors: Questionnaire One

7.2.1 Overall Observation

The overall perspectives of the average rating for the parts of the building code framework (legal, administrative, technical, & social) are shown in Fig. 7.1. In general, for the likelihood of occurrence in Fig. 7.1, Construction Professionals rated the cause factors in all parts of the building code, higher than the rating by Building Officials. The overall rating showed that the social part (mean average: 3.84) was ranked top of other parts of BC framework, followed by the legal/technical part (3.45) and administrative part (2.59). The social part is associated with the effects of buildings and built environment on the human relationships. Based on these results, both groups of respondents agreed that the social and legal/technical parts of the building code were the most important parts that have higher cause factors occurrence. All respondents rated the cause factors in the social part of the building code, higher than the factors in the legal/technical parts of the building code. Both Construction Professionals and Building Officials moderately rated the occurrence of cause factors in administrative part.

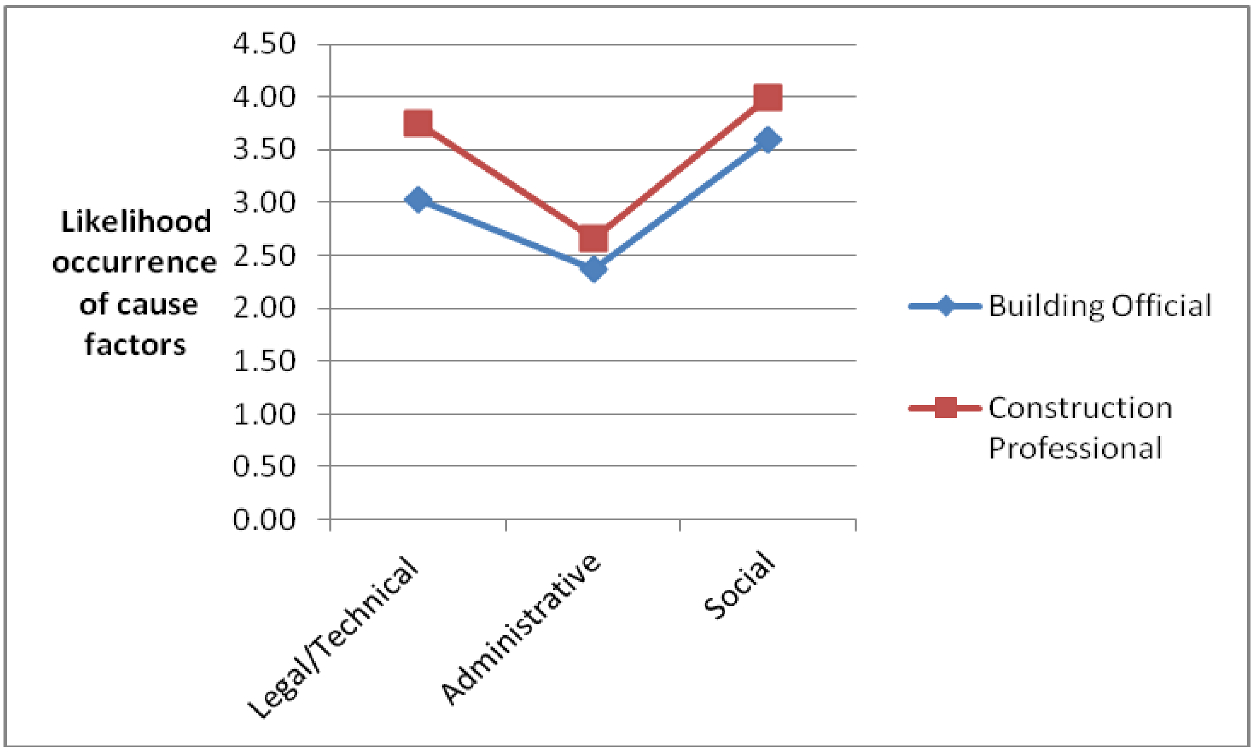

Fig. 7.1: The average rating for the occurrence of cause factors

7.2.2 Highest 20 ranking

For the purpose of this chapter and more manageable analysis and discussion, the cause factors rated by the respondents were ranked and the top 20 ranked cause factors by each category of professionals were shown in Table 7.3. The full rankings of the cause factors were already highlighted the previous Chapter 6 (Preliminary Analysis of Survey One & Two).

For the likelihood of occurrences, the cause factors in the Administration and Social parts of the building code dominate the top end of the ranking. Most of the respondents' views are more significant towards the work environment and the nature of their tasks. As a result, the construction professionals found out that the preserving quality of building construction works by insurance companies (Factor: LC2), testing and certification system for trades (Factor:LC6), and other similar factors are more significant than other factors.

The other Social and Technical factors were also rated high in the rank. The cause factors including documents and records of building projects at Kuwait Municipality are easily lost and damaged (AC6), Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy (AC31), and lack of power through the law in enforcing correction decisions of violations (SC5), have an average rating of a maximum of 4.23 and a minimum of 3.68.

Sometimes building officials are not willing to recognize the weakness and inefficiency of their work performance. As a result, they have a lawful agreement that design and supervision engineers from engineering offices usually get licenses from Municipality, but they are not tested technically to know their abilities (Factor:AC14).

Parts of BC	Cause Factors	Ref.	Building official		Construction professional		Overall	
			Mean	SD	Mean	SD	Mean	SD
Legal/Technical	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	LC2	2.95	1.437	4.15	.920	3.56	1.31
	Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	LC6	2.93	1.442	3.87	.870	3.51	1.31
	Not taking into account the changes in building technology in current law	LC8	3.89	1.194	4.28	.979	3.99	1.12
	Unavailable laws to prevent the monopoly of lands, which led to increase of land price and misuse of lands and real estates	LC10	3.29	1.050	4.33	.869	3.97	1.08
	Weak regulations by Municipality Council	LC13	3.07	1.129	3.90	.831	3.65	1.10
	Weak regulations from National Parliament	LC14	3.15	1.154	3.96	.889	3.71	1.11
Administrative	Documents and records of building projects at Kuwait Municipality are easily lost and damaged	AC6	4.23	.909	4.00	.833	4.17	0.87
	Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible of direct communication with citizens	AC7	3.33	1.049	3.46	.946	3.52	1.07
	Many participating organizations in administration of building process	AC10	3.33	1.066	3.83	.637	3.63	0.94
	Procedures of following and monitoring of building and construction works at Municipality are not clear and not with satisfying performance	AC12	3.27	1.064	3.91	.784	3.64	1.02
	Design and supervision engineers from engineering offices usually get licenses by Municipality, but they are not tested technically to know their abilities	AC14	3.16	.999	4.00	.606	3.70	0.97
	Many construction problems are due to unclear professional practice and workmanship standards	AC16	3.75	.787	3.81	.742	3.82	0.72
	Small contractors usually get licenses by Municipality, but they are not tested technically resulting in engineering problems	AC18	3.88	.806	4.36	.722	4.21	0.79

Parts of BC	Cause Factors	Ref.	Building official		Construction professional		Overall	
			Mean	SD	Mean	SD	Mean	SD
	Unsuitable qualification of workforce at Municipality departments	AC19	3.45	.972	3.57	.690	3.60	0.85
	Assigning many additional tasks for engineers of the technical department	AC2	3.84	.892	3.70	.662	3.76	0.80
	Weak legal departments at Municipality branches at governorates	AC21	3.34	.972	3.70	.882	3.65	1.02
	Weak reimbursements for workers at Municipality	AC22	4.02	.984	3.67	.727	3.93	0.85
	Weak technical and financial capabilities at Municipality branches at governorates	AC23	3.46	.928	3.81	.702	3.79	0.87
	It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control	AC26	3.04	1.528	4.26	.678	3.82	1.31
	Kuwait Municipality don't perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labors, and labor	AC27	2.87	1.100	4.02	.566	3.61	1.07
	Many owners and investors have no trust in the supervision capabilities of the engineering offices	AC28	3.13	1.039	4.13	.516	3.66	0.95
	Neglecting of testing of building materials and concrete by certified testing centres during projects execution	AC29	3.36	1.071	4.20	.728	3.83	0.98
	Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy	AC31	4.09	1.008	4.00	.890	4.10	0.99
	Unclear and inadequate procedures of review of building plans at Municipality	AC32	2.98	1.206	3.93	.887	3.58	1.19
	There is no government controlled inspection on building at construction sites	AC33	3.75	.787	3.52	.614	3.71	0.77
	To reduce the cost of construction and to finish work quickly, many private projects are not executed as per professional standards and proper workmanship	AC34	4.20	.768	4.21	.776	4.27	0.78
Social	Absence of community awareness in building regulations and nature tasks of Municipality	SC1	3.39	.619	3.59	1.158	3.47	1.05
	Delay of issuing and enforcing legal court rules based on violation cases	SC2	3.30	1.037	3.85	1.106	3.61	1.23
	Low monetary value of penalty by Municipality law (max. 500 k.d. = 1000 £)	SC3	3.93	.964	3.83	1.042	3.91	1.02
	No deterrent punishments for violators	SC4	3.98	.899	4.48	.504	4.29	0.75
	Weak of power of law in enforcing correction decisions of violations	SC5	3.68	1.023	4.07	.887	4.00	1.02
	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	SC6	3.29	1.389	4.17	.818	3.73	1.21

Table 7.3 The mean average rating and standard deviation (SD) for likelihood occurrence of cause factors

7.3 Findings of Impact Factors: Questionnaire Two

For the purpose of this chapter and more manageable discussions, the impact factors rated by the respondents were ranked and the top 20 ranked impact factors by each category of professionals were shown in Tables 7.4, 7.5 and Table 7.6. The full ranked of the impact factors were already highlighted in the previous Chapter 6 (Preliminary Analysis of Survey One & Two: Descriptive Statistics and Data Presentation**)**.

7.3.1 The Impact of factors on Public Safety

7.3.1.1 Overall Observation

With regard to the impact of these factors on the BC objective (public safety), the average rating for the parts of the building code framework (legal, administrative, technical, & social) is shown in Fig. 7.2. The overall rating showed that the technical part (mean average: 3.73) was ranked top, followed by the administrative part (3.68), the legal part (3.63), and the social part (3.55). Based on these results, both groups of respondents agreed that the technical and the administrative parts of the building code were the most important parts that have a higher cause factors occurrence.

In general, for the likelihood of occurrence in Fig. 7.2,the professionals of construction/maintenance or site inspection rated the impact of factors in administrative and legal parts of the building code, higher than the rating by professionals of design or plan review, and the professionals of design or plan review rated the impact of factors in technical and social parts of the building code, higher than the rating by professionals of construction/maintenance or site inspection.

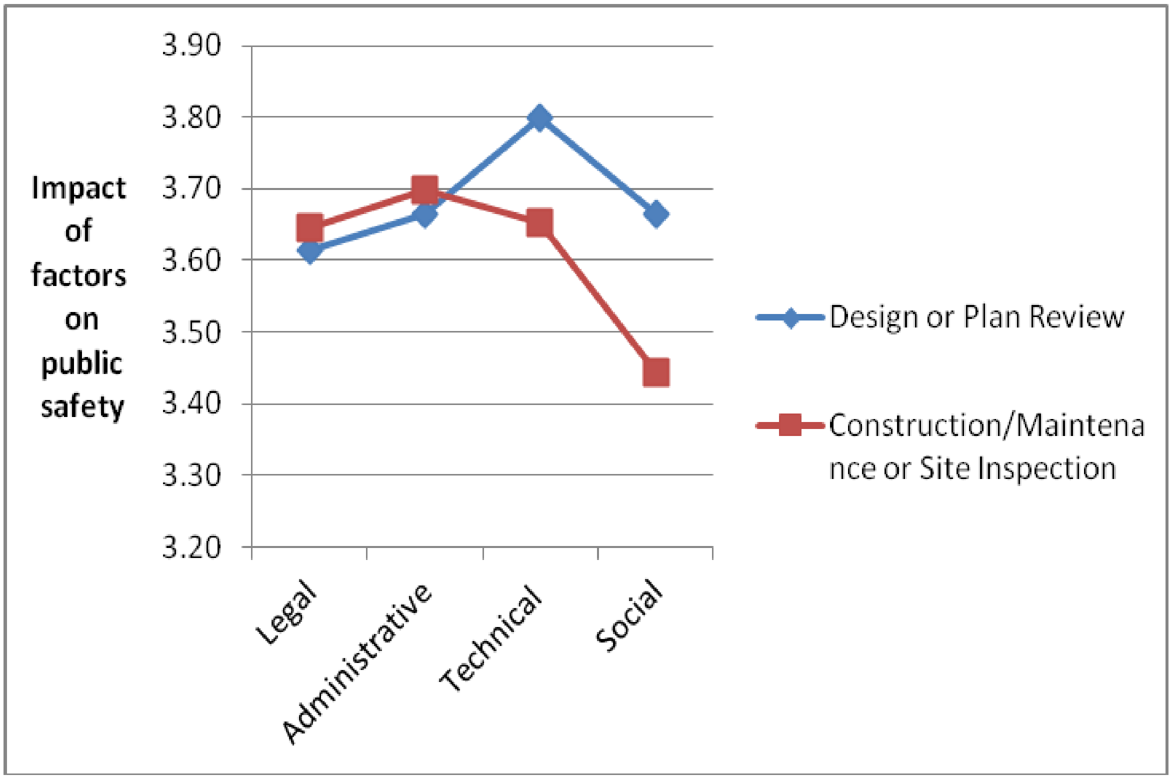

Fig. 7.2: The average rating for the impact of factors on public safety

7.3.1.2 Highest 20 ranking

When it comes to the impact of these factors on public safety of building codes implementation, they neglect the testing of building materials and concrete by certified testing centers during projects execution (IA6), type of construction (IT41), and Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy (IA7 dominates the top 3 rated factors with an average rating of 3.74 to 3.84.

This showed the importance of these impact factors and the disapproving of the Administration and the Technical parts of building codes. Other Social and Technical factors were also rated high in the rank. The impact factors such as weak power of law in the amendment decisions for violations (IS2), wood (IT43), and weather condition such as humidity, dust and wind (IT42), have an average rating to a maximum of 3.80 and a minimum of 3.81.

Parts of BC	The Impact of factors on Public Safety	Ref.	Design or Plan Review		Const./Maintenance or Site Inspection		Overall	
			Mean	SD	Mean	SD	Mean	SD
Legal	Inexistence of many of BC requirements (because of the law)	IL1	3.61	.527	3.78	.417	3.69	0.49
	Inexistence of professional code practice for engineering offices, contractors, and skilled labours (because of the law)	IL3	3.53	.810	3.72	.560	3.62	0.71
	Inexistence of building materials testing system (because of the law)	IL4	3.74	.520	3.78	.534	3.76	0.53
Administrative	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	IA1	3.62	.624	3.89	.315	3.75	0.52
	Improper capabilities in both technical and managerial side of municipality to follow up and control building and construction works	IA3	3.62	.689	3.78	.417	3.69	0.58
	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following up local construction works	IA5	3.74	.523	3.67	.579	3.71	0.55
	Neglecting the testing of building materials and concrete by certified testing centres during projects' execution	IA6	3.83	.372	3.89	.315	3.86	0.35
	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	IA7	3.85	.408	3.78	.417	3.82	0.41
Social	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	IS1	3.84	.468	3.67	.579	3.76	0.53
	The Weak power of law in enforcing correction decisions for violations	IS2	3.83	.374	3.78	.417	3.81	0.39
	No deterrent punishments for violators	IS3	3.83	.422	3.67	.579	3.76	0.51
Technical	Gas piping installations	IT13	3.75	.475	3.61	.489	3.69	0.49
	Glass and glazing	IT14	3.73	.549	3.50	.689	3.63	0.63
	The Increase number of persons occupying housing units	IT16	3.77	.506	3.61	.592	3.69	0.55
	Interior environment	IT17	3.62	.632	3.67	.579	3.64	0.61
	Interior finishes	IT18	3.75	.507	3.72	.449	3.74	0.48
	Aluminium	IT2	3.71	.689	3.72	.560	3.72	0.63
	Sewage disposal	IT29	3.78	.511	3.44	.687	3.62	0.62
	Boilers/water heaters	IT3	3.70	.634	3.65	.683	3.68	0.66
	Sheds and Car metal sheds	IT30	3.84	.402	3.44	.687	3.66	0.59
	Signs	IT31	3.80	.446	3.61	.680	3.71	0.57
	Swimming pools	IT40	3.80	.432	3.56	.687	3.69	0.58
	Type of construction	IT41	3.82	.421	3.83	.501	3.83	0.46
	Weather condition such as humidity , dust and wind	IT42	3.83	.381	3.78	.534	3.80	0.46
	Wood	IT43	3.88	.384	3.72	.652	3.81	0.53
	Construction equipments	IT5	3.78	.491	3.50	.836	3.65	0.69
	Demolition of buildings and facilities	IT6	3.72	.562	3.50	.836	3.62	0.71
	Electrical works	IT7	3.61	.641	3.65	.590	3.63	0.62

Table 7.4: The mean average rating and standard deviation (SD) for impact of factors on public safety

7.3.2 The Impact of factors on Public Health

7.3.2.1 Overall Observation

With regard to the impact of these factors on the BC objective (public health), the average rating for the parts of the building code framework (legal, administrative, technical, & social) is shown in Fig. 7.3. The overall rating showed that the social part (mean average: 3.59) was ranked at the top, followed by the technical part (3.57), the administrative part (3.34), and the legal part (3.24). Based on these results, both groups of respondents agreed that the social and the technical parts of the building code were the most important parts that have a higher cause factors occurrence.

In general, for the likelihood of occurrence in Fig. 7.3, professionals of construction/maintenance or site inspection rated the impact of factors in administrative and technical parts of the building code, higher than the rating by professionals of design or plan review, and the professionals of design or plan review rated the impact of factors in legal part of the building code, higher than the rating by professionals of construction/maintenance or site inspection.

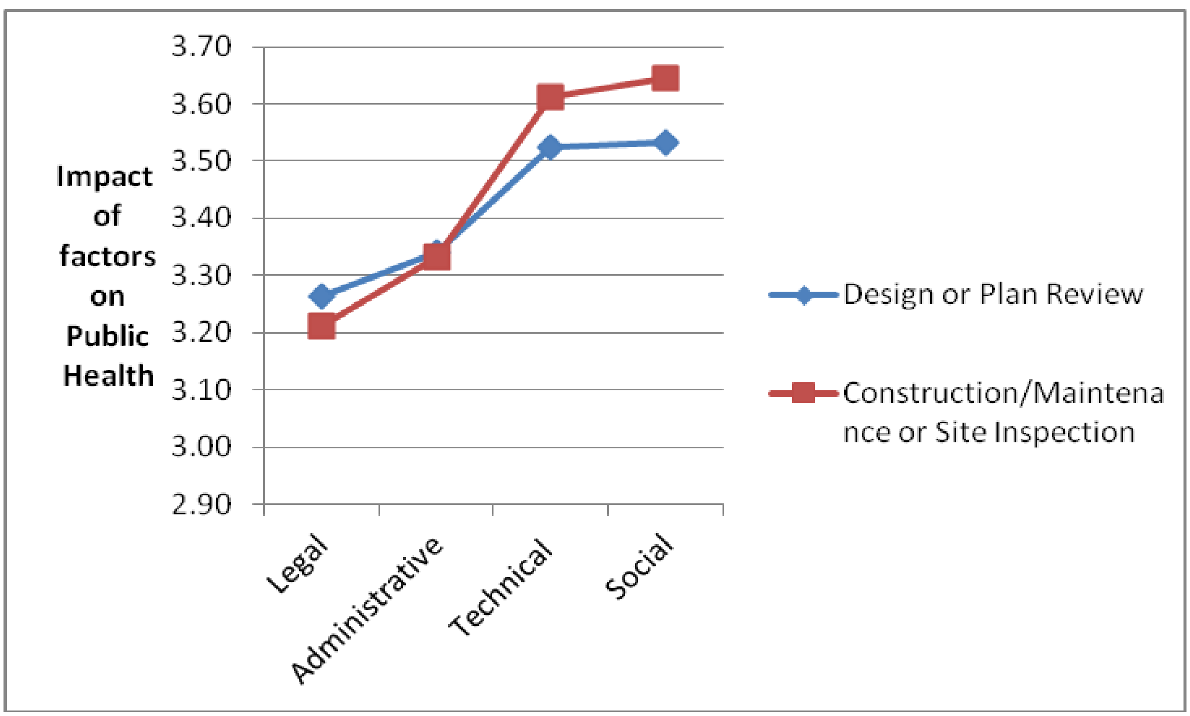

Fig. 7.3: The average rating for Impact of factors on Public Health

7.3.2.2 Highest 20 ranking

For the likelihood of occurrence, the impact factors in the Technical part of the building code dominate the top end of the ranking. As for the impact of these factors on public health of building codes implementation, the impact of technical factors including boilers/water heaters (IT3), wood (IT43), and demolition of buildings and facilities (IT6) dominates the top 3 rated factors with an average rating of 3.69 to 3.71. This shows the importance of these factors and the disapproving of the technical part of the building code.

Other Technical and Administration factors were also rated high in the rank. The impact factors including the type of construction(IT31), signs(IT41), municipality, and fire-fighting and electricity are not performing periodical inspection after linking electricity and building occupancy (IA7), these have an average rating a maximum of 3.64 and a minimum of 3.67.

Parts of BC	Impact of factors on Public Health	Ref.	Design or Plan Review		Const./Maintenance or Site Inspection		Overall	
			Mean	SD	Mean	SD	Mean	SD
Administrative	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	IA5	3.50	.619	3.44	.600	3.47	.610
	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	IA7	3.62	.551	3.67	.473	3.64	.516
Social	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	IS1	3.54	.657	3.61	.489	3.57	.586
Technical	Concrete and reinforce concrete works	IT4	3.52	.620	3.50	.603	3.51	.611
	Construction equipments	IT5	3.72	.545	3.50	.603	3.62	.582
	Demolition of buildings and facilities	IT6	3.70	.516	3.67	.473	3.69	.496
	Electrical works	IT7	3.32	.742	3.67	.473	3.48	.653
	Encroachments into public right of way	IT9	3.54	.622	3.56	.498	3.55	.567
	Energy conservation	IT10	3.47	.620	3.61	.489	3.53	.567
	Glass and glazing	IT14	3.56	.594	3.56	.498	3.56	.551
	The Increase number of persons occupying housing unit	IT16	3.47	.643	3.72	.449	3.59	.575
	Interior finishes	IT18	3.64	.554	3.61	.489	3.63	.525
	Parkings	IT22	3.30	.763	3.72	.449	3.49	.672
	Plastic	IT23	3.29	.797	3.78	.417	3.51	.694
	Plumbing systems	IT24	3.32	.783	3.72	.560	3.51	.716
	Poor electric and lighting works during alteration, movement, and repairing	IT25	3.39	.685	3.72	.449	3.54	.610
	Sanitation of exterior property areas	IT28	3.48	.713	3.72	.449	3.59	.618
	Sewage disposals	IT29	3.55	.634	3.72	.449	3.63	.563
	Boilers/water heaters	IT3	3.64	.644	3.78	.417	3.71	.554
	Sheds and Car metal sheds	IT30	3.50	.714	3.78	.417	3.63	.610
	Signs	IT31	3.55	.664	3.78	.417	3.65	.574
	Site preparation	IT32	3.47	.679	3.72	.560	3.58	.639
	Smoke detectors for houses	IT33	3.27	.817	3.72	.449	3.48	.709
	Sound transmissions	IT36	3.36	.651	3.72	.449	3.53	.594
	Structural designs	IT38	3.35	.718	3.72	.449	3.52	.636
	Structural tests and inspections	IT39	3.35	.698	3.72	.449	3.52	.624
	Swimming pools	IT40	3.57	.585	3.72	.449	3.64	.532
	Type of construction	IT41	3.57	.524	3.78	.534	3.67	.538
	Weather condition including humidity , dust and wind condition	IT42	3.55	.588	3.67	.473	3.61	.540
	Wood	IT43	3.71	.493	3.67	.473	3.69	.484

Table 7.5: The mean average rating and standard deviation (SD) for the impact of factors on public health

7.3.3 Impact of factors on Public Welfare

7.3.3.1 Overall Observation

The impact of these factors on the BC objective (public welfare), the average rating for the parts of the building code framework (legal, administrative, technical, & social) is shown in Fig. 7.4. The overall rating showed that The technical part (mean average: 3.03) was ranked at the top, followed by the social part (3.02),the administrative part (2.89), and the legal part (2.85). Based on these results, all these 2 groups of respondents agreed that the technical and the social parts of the building codes were the most important parts that have a higher cause factors occurrence.

In general, for the likelihood of occurrence in Fig. 7.4, professionals of construction/maintenance or site inspection rated the impact of factors in technical part of the building code, higher than the rating by professionals of design or plan review, and the professionals of design or plan review rated the impact of factors in social and legal parts of the building code, higher than the rating by professionals of construction/maintenance or site inspection.

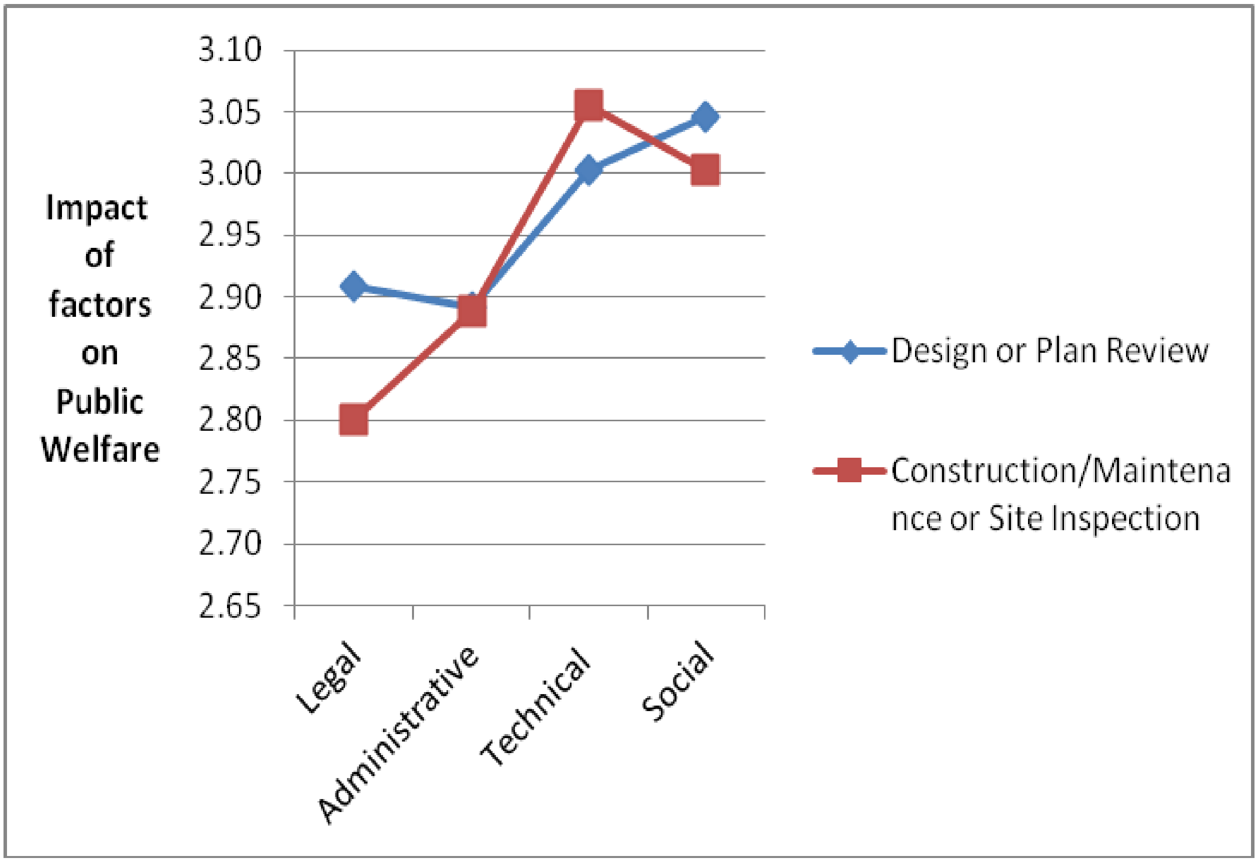

Fig. 7.4: The average rating for the Impact of factors on Public Welfare

7.3.3.2 Highest 20 ranking

For the likelihood of occurrence, the impact factors in the Technical part of the building code dominate the top end of the ranking. As for the impact of these factors on public welfare of building codes implementation, the impact of technical factors including wood (IT43), construction equipment (IT5), and encroachments into public right of way (IT9) dominates the top 3 rated factors with an average rating of 3.22 to 3.61. This showed the importance of these factors and the disapproving of the technical part of the building code.

Other Technical factors were also rated high in the rank. The impact factors including weather condition such as humidity, dust and wind condition (IT42), demolition of buildings and facilities (IT6), and structural design (IT38) , have an average rating a maximum of 3.99 and a minimum of 3.84.

Parts of BC	Impact of factors on Public Welfare	Ref.	Design or Plan Review		Const./ Maintenance. or Site Inspection		Overall	
			Mean	SD	Mean	SD	Mean	SD
Legal	Not taking into account the changes in building technology in current law	IL2	3.12	.754	3.00	.747	3.07	.752
Administrative	Improper capability of technical and managerial part of municipality to follow up and control building and construction works	IA3	2.77	.910	3.00	.669	2.88	.815
	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	IA5	2.90	.888	3.11	.739	3.00	.827
	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	IA7	3.14	.852	2.83	.900	3.00	.887
Socia	Absence of community awareness in building regulations and nature tasks of Municipality	IS4	2.98	.975	3.22	.788	3.09	.901
	No deterrent punishments for violators	IS3	3.01	.983	3.06	.707	3.03	.866
Technical	Accessibility	IT1	3.15	.882	3.06	.782	3.11	.837
	Construction equipments	IT5	3.32	.764	3.11	.739	3.23	.759
	Demolition of buildings and facilities	IT6	3.22	.753	3.11	.739	3.17	.748
	Elevators and conveying systems	IT8	3.09	.887	2.94	.914	3.02	.901
	Encroachments into public right of way	IT9	3.26	.705	3.17	.766	3.22	.735
	Energy conservations	IT10	3.22	.808	2.94	1.029	3.09	.926
	Existing structures	IT11	3.10	.839	3.22	.713	3.16	.784
	Existing structures	IT11	3.10	.839	3.22	.713	3.16	.784
	Gypsum board and plasters	IT15	3.19	.820	3.06	.707	3.13	.772
	Interior finishes	IT18	3.21	.817	2.83	.836	3.04	.846
	Aluminium	IT2	2.72	1.012	3.06	.707	2.88	.899
	Masonry	IT20	2.97	.935	3.06	.782	3.01	.868
	Plumbing systems	IT24	3.10	.880	3.00	.747	3.06	.822
	Sewage disposals	IT29	3.18	.822	3.06	.782	3.12	.805
	Boilers/water heaters	IT3	3.15	.820	3.06	.707	3.11	.770
	Sheds and Car metal sheds	IT30	3.10	.864	3.00	.747	3.05	.813
	Soil and foundations	IT34	3.17	.831	2.89	.739	3.04	.802
	Sound transmissions	IT36	3.03	.858	3.11	.739	3.07	.805
	Steel	IT37	2.98	.824	3.11	.739	3.04	.788
	Structural designs	IT38	3.11	.854	3.22	.856	3.16	.856
	Structural tests and inspections	IT40	3.18	.843	2.89	.939	3.04	.899
	Weather condition including humidity , dust and wind conditions	IT42	3.23	.753	3.17	.960	3.20	.855
	Wood	IT43	3.51	.746	3.72	.449	3.61	.635

Table 7.6: The mean average rating and standard deviation (SD) for the impact of factors on public welfare

7.4 Discussion

7.5.1 Common agreements

From Tables 7.3, 7.4, 7.5 and Table 7.6, there were common agreements among the practitioners with factors such as no deterrent punishments for violators (SC4), projects not executed as per professional standards and proper workmanship (AC34), small contractors not tested technically (AC18), building officials are not performing periodical inspection after building occupancy (AC6), and weak power of law in enforcing correct decisions for violations (AC31). These 5 factors interchange in the top 20 rankings among the practitioners. For the likelihood occurrence of cause factors, these 5 factors were rated with a minimum average rating of 4.00 and a maximum average rating of 4.29, which is likely high to occur. Both building officials and construction professionals have an agreement on the previous cause factors.

Table [7.3] shows that factors have coefficients of variations ranging from 17.47% to 24.09%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is a reasonable agreement between the respondents in the significance of factors.

Whereas the rating impact of most of these cause factors on public safety, the minimum average rating was 3.76 and the maximum average rating was 3.81, which shows a high impact on public safety. Table [7.4] shows that factors have coefficients of variations ranging from 9.00% to 14.02%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is a reasonable agreement between the respondents in the significance of factors.

According to Al-Harris (2000, 2003), the deterrent punishments due to weak power of law for violators is not the reason for spreading violations, and some violations are saved from punishments. There are many incidences for infringements in building regulations, and building officials are not preventing violators (Kuwait Municipality, 2009), (Al-Masaoudi, 2009). Code officials have the authority to stop construction works until code violations or other threats to public safety are resolved (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987). In Australia, officials found that the major cause of poor quality of buildings was due to building code violations where principal certifiers were not properly performing their functions (JSCQB, 2002). Building officials should perform periodical inspection during and after building occupancy, and should insure that the projects are conducted according to professional standards and proper workmanship.

There are many problems of demolition projects which threaten public safety (T. ALGhatani, 2008). Government regulations require certification of contractors, tradesmen based on their technical qualifications but this is absent (Al-Ali, 1997). Moreover, Building Regulations of 1985 and International Building Code ordered the use of registered engineers to perform the designing and implementing any demolitions. However, neither Building Regulations of 1985, or International Building Code gave more details, specifications, methodology procedures, standards, or professional certifications in how to perform demolition.

The pressure under which many building officials must function, leads to a better knowledge of the impact of both direct and indirect cause factors and will help them focus effort on building project areas that are likely to cause failures. Moreover, building code frameworks (legal, administrative, technical, and social) in many official departments may also be stacked against the building officials, making it difficult to convince the senior management to accept realistic amendments and rehabilitation of the current framework. During a workshop in Municipality, the manger of Building Department requests the use of comprehensive plan review and inspection checklists, however, the senior officials have different perspectives (AL-Teram, 2010).

7.5.2 Building Official's Perspectives

As for Building Officials, most of them agreed that, documents and records of building projects at Kuwait Municipality are easily lost and damaged (AC6) It is very likely to occur during the administration of building regulations. The Building Officials rated this factor with a high average of 4.23. This problem is a serious fault in administration system, it would cause lost of rights, many financial resources, and lost of trust in the Municipality activities and responsibilities. Article 104.7 of International Building Code states that the Building Officials shall keep official records of applications received, permits and certificates, issued fees collected, reports of inspections, and notices and orders issued (ICC, 2000). This cause factor may result in the lack of proper management support and commitment. A better management support and commitment could mean better documents keeping.

7.5.3 Areas of disagreement

As seen in Table 7.3, there are few factors that stand out in a way to the Construction Professionals perceived in the likelihood occurrence of causes, compared to building officials. There were (4) factors that the Construction Professionals rated quite high, that none of the Building Officials consider rating them in the top 20, and these (4) cause factors did not even ranked in the top 20 of the overall rating for the likelihood occurrences :

(1) It is incorrect to award all engineering supervision and inspection tasks of consultant offices without Municipality control (AC26)
(2) Insurance companies in Kuwait have no effective role in insuring and preserving quality of building construction works (because of the law (LC2)
(3) Many owners and investors have no trust in the supervision capabilities of the engineering offices (AC28)
(4) Kuwait Municipality doesn't perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labours. (AC27)

This shows that the engineering offices are not satisfied with the responsibilities to adhere code enforcement without the sufficient contribution of the Municipality, and they would like to share more encouraging participation by the Municipality while it raises some of the responsibilities, especially in the engineering errors and legal troubles. Group of researchers in Kuwait (Amin, 2002; Hamed, 2004; Al-Haider, 2003) show that faults in the design, supervision and execution led to building failures. Rsearchers in other countries found that inspections by designers seemed inadequate (Rousseau, 2000; Olubodun, Mole, 1999; BRE, 1983).

Engineering offices would also like to enhance the effectiveness of insurance companies to hold the responsibilities of the errors in design and construction. It is obvious that the view of engineering offices about the Municipality did not properly license workers in the engineering offices, which indicates to multiple nuisances of some engineering offices operating in the construction market. In the end, the accumulation of huge responsibility rests the engineering offices but, led owners and investors to low confidence in the capabilities of some engineering offices. As for the impact of these factors [(AC26), (LC2), (AC28), and (AC27)] on the BC objectives, both respondents (Construction Professionals and building officials) their views were almost the same.

7.5.4 Technical Impact Factors

Technical impact factor related to **Public Safety** such as type of construction (IT41) was deemed very important to these practitioners. Fire safety considerations are the most important requirements for construction Type (ICC, 2009). There are fire safety problems such as deaths and injuries resulted by fires in Kuwait. The major cause of fire is insufficient fire safety regulations (KFSD, 2002), (Al-Babtain, 2005), (Al-Masaoudi, 2009).

Table [7.4] shows that factors have coefficients of variation of 12.01%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is a reasonable agreement between the respondents in the significance of the factor.

Technical impact factor related to **Public Health** such as boilers/water heaters (IT3) was deemed very important to these practitioners. An article in Canada Consumer Product Safety Act states that: “Whereas the Parliament of Canada recognizes that a lack of full scientific certainty is not to be used as a reason for postponing measures that prevent adverse effects on human health if those effects could be serious or irreversible", (Canada Consumer Product Safety Act, 2008). For that reason, it is not surprising that professionals link the important of boilers/water heaters as requirements of **Public Health.**

Table [7.5] shows that factors have coefficients of variation of 14.95%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is a reasonable agreement between the respondents in the significance of the factor.

Technical impact factor related to **Public Welfare** such as encroachments into public right of way (IT9) was deemed very important to these practitioners. Public welfare is related to happiness (Oxford University, 2006), and pedestrian walkways is a requirement of public right of way in international codes (ICC, 2009). Therefore, when pedestrians are free to move and to use proper walkways in suburbs and cities, he or she will be in a condition of happiness, and take pleasure from the country welfare.

Table [7.6] shows that factors have coefficients of variation of 22.83%.Therefore, it can be deduced that the variation of responses is relatively low. This indicates that there is a reasonable agreement between the respondents in the significance of the factor.

7.6 Summary

Ranking helps researchers to indicate which cause and impact factors are more important. Coefficients of variations used to have some indication about the variation of responses, and to assess the agreement between the respondents in the significant of the factors. However, there are more advanced statistical methods to assess the agreement between the respondents. Therefore, T-Test was computed to perform the advanced analysis. Moreover, Pearson correlation coefficient was computed to assess the relationship between cause factors, and factors analysis that are used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of variables as reported in Chapters 8 and 9.

From the study, it is clear that professionals viewed the cause factors in the social part as the most important part of building code framework followed by legal/technical part, and administrative part. Factors such as :" No deterrent punishments for violators" shows that many projects are not executed according to professional standards and proper workmanship, Whereas improper small contractors' certification were deemed very important issues in dealing with causes in codes of building projects.

For impact factors on public safety, professionals viewed the technical part is the most important part of building code framework, followed by the administrative part, then by the legal part and social part. As for the impact of these factors on public safety of building codes, the impact factors such as:(neglecting the testing of building materials and concrete by certified testing centers during projects execution ,type of construction, and Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy) dominate the top 3 rated factors.

For impact factors on public health, professionals viewed the social part as the most important part of the building code framework, followed by the technical part, then by the administrative part and legal part. As for the impact of these factors on public health of building codes, the impact of technical factors such as Boilers/water heaters, wood, and demolition of buildings and facilities dominates the top 3 rated factors.

For impact factors on public welfare, professionals viewed the technical part as the most important part of building code framework, followed by the social part, then by the administrative part and legal part. As for the impact of these factors on public welfare of building codes implementation, the impact of technical factors such as wood, construction equipment, and encroachments into public right of way dominate the top 3 rated factors.

Chapter Eight

Factors Analysis of cause factors and their impact on Public Health, Safety and General Welfare in Kuwait

Chapter Eight

Factors Analysis of cause factors and their impact on Public Health, Safety and General Welfare in Kuwait

8.1 Introduction

Insufficiencies and infringements in building codes/regulations are widely documented in academic research literatures [(Kartam, Flood and Koushki, 2000), (Mahgoub, 2002), (Amin, 2002) and, (Hamed, 2004), (Ministry of Planning, 1995-1997), (Amin, 2002), (Hamed, 2004), (Al-Haider, 2003), (Sadek, 2001), (Al-Bendari, 2003), and (Al-Qabas, 2004, 2005)]. A lot of problems have essential relations with legal, administration, technical requirements, and social issues of building codes as well. In Kuwait and in many other countries as mentioned in Chapter 3 and 4, building and construction projects are often difficult to be in compliance and agreement with building regulations and codes, and be enforced properly. Some under standard violated troubled projects are causing sever problems to people and properties because of improper development and enforcement of building codes/regulations or even failure to produce anticipated benefits.

Many studies have proven that a proper compliance with building regulation and codes causes affects to the success or failure of a project. [(Sadeq, 2001), (Al-Fahad, 1998), (MOP, 1997), (Haque, 2003), (Al-Sayed, 2002), (Fereig, Younis, 1985), (Al-Ragom, Omar, 2002), (Al-Temeemi, 1994), (Al-Feel, 1988), (Bofah, 1991), (Al-Azmi, 1997)].. Identified the legal, administrative, technical, and social causes that negatively affect the building codes performance that should be well controlled in order to improve the building and construction projects' performance. Failure to understand, identify and administrate these causes is often cited as a contributing factor in building and construction projects failures.

The purpose of this chapter is to undertake factor analysis and data reduction process from results of surveys. Based on factors' relationship and correlations, the outcome of data reduction is presented in few components that consist of most important cause and impact factors of the original large group cause and impact factors. At the end of the day, a more clearly and manageable understanding of new cluster or most important list of **cause and impact** factors and their implications will be instrumental in the influence of the **cause and impact** factors on the building codes development and implementation.

8.2 Factor analysis

Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of variables (SPSS Inc., 2007). Having many variables often make it difficult to understand the data. It is used to determine the number of common factors needed to adequately describe the correlations between the observed variables, and estimating how each factor is related to each observed variable (i.e., estimating the factor loadings). The analysis helps to simplify the initial solution by the process known as factor rotation (Landa, Everitt, 2004). Factor analysis, is an attempt to explain a set of data in terms of a smaller number of dimensions than one begins with (SPSS Inc., 2007).

8.3 Factor analysis process

For undertaking Factor analysis of the data, Statistical Package (SPSS) and Microsoft Excel were used. In SPSS, the principal components method is used to extract the hidden components and variables. Components are a set of matrices that present the correlations between different variables.

There are steps to perform the analysis. First ,there is a need to collect measurements, by measuring survey variables on the same (or matched) experimental units. Second, there is a need to obtain the correlation matrix, or covariance between each of the variables. Third, the process of selecting a number of factors for inclusion to account for as much of the covariance in the data with few factors as possible. There are a number of methods to determine the optimal number of factors by examining the data. Kaiser criterion shows that a number of factors are equal to the number of Eigen values of the Scree matrix that are greater than one . The Scree test requires to plot the Eigen values of the correlation matrix in descending order, and then to use a number of factors equal to the number of Eigen values that occur prior to the last major drop in Eigen value magnitude .Fourth ,there is a need to extract the initial set of factors, and submit the correlations or covariances into SPSS program to extract the factors. There are a number of different extraction methods, including maximum likelihood, principal component, and principal axis extraction (DeCoster, 1998). Fifth, there is a need to rotate the factors to reach final solution .Sixth, there is the interpreting of factor structure. Each measure will be linearly related to each of the other factors. The strength of this relationship is contained in the respective factor loading, produced by the rotation. This loading can be explained as a standardized regression coefficient, regressing the factor on the measures. Seventh, there a is need to construct factor scores for additional analysis. The score for a certain factor is a linear combination of the measures, weighted by the matching factor loading (DeCoster, 1998).

The existence of 54 cause factors and 59 impact factors in this survey makes it difficult to handle the analysis, therefore, factor analysis and data reduction are considered as an important process to reduce the number of cause and impact factors in order to handle the task more successfully. This goal was achieved through the application of SPSS software and as a result the redundant data is removed from the list of questions in order to obtain a manageable subset of the cause and impact factors that represent the majority of them. The process of the analysis is shown in Figure 8.1. The figure shows that through the use of data reduction in SPSS, 54 cause factors and 59 impact factors in 4 parts of the building code framework are analysed to few components. The correlations and interactions of factors with each other are computed. The SPSS program assists to analyse the factors, and categorise the factors according to their relationship and correlations to each other. The process, findings and discussions of the data analysis are presented in the following sections.

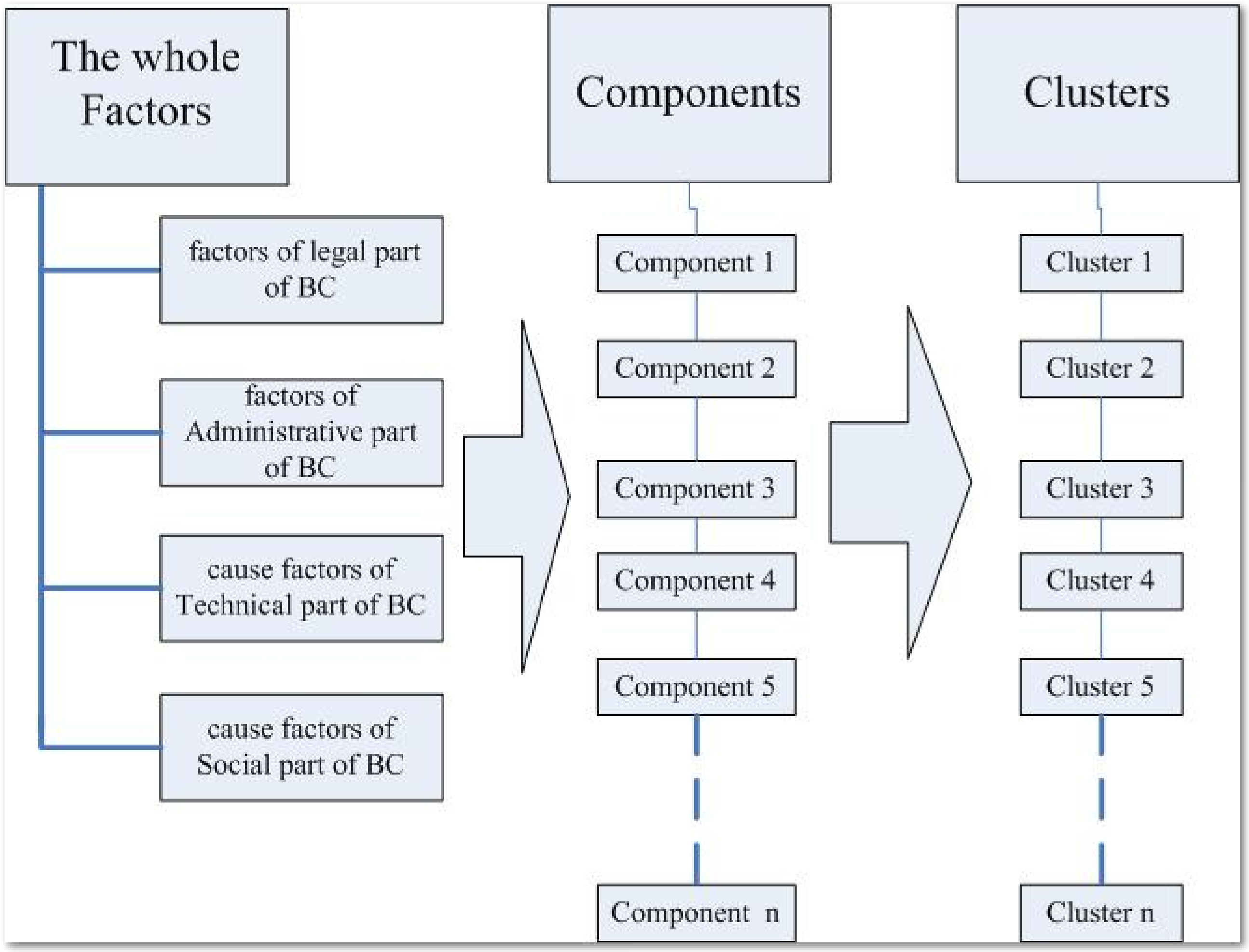

Figure 8.1: The process of data reduction and factor analysis

Prior to conducting factor analysis of the research, reliability analysis was conducted.

8.4 Analysis of the Findings for Cause factors

8.4.1 Reliability Analysis

Reliability analysis has been included as part of substantive validation because it checks whether the items from the same scale measure the same construct, therefore, validating the item sampling procedure. A scale with low reliability signifies that the items that make up the scale do not correlate strongly enough, thus they might not be tapping the same construct domain. Therefore, reliability tests are tests of substantive validity.

In order to determine the factorability of the “Inter correlation Matrix”, the researcher has employed two reliability tests: Cronbach Alpha (α), and Kaiser-Meyer-Olkin (KMO) & Bartlett’s test of sphericity.

8.4.2 Cronbach Alpha

Cronbach Alpha (α) is one of the commonly used tests for reliability, which is based on the rationale that items measuring the same construct will highly correlate (SPSS Inc., 2007). Acceptable values of the Cronbach Alpha for a scale to be considered reliable depend on the purpose of the study. For exploratory studies, as is the case of this study, a value of (α = 60%) is considered acceptable. However, variable SC1 (Absence of community awareness in building regulations and nature tasks of Municipality) had to be removed in the following calculation and further data analysis, because SC1 is not consistent with its group, and it will effect on other variables in the group reliability and internal consistency.

In this study, the reliability (i.e. Cronbach Alpha) of all other 54-items of MLQ instrument was 83.5%, reflecting that the questions were correlated and addressing the research problem (Table 8.1).

Part of BC	Cronpach Alpha (%)	# of Variable
Cause Factors of Legal/Technical	**89.5**	**14**
Cause Factors of Administrative	**93.7**	**35**
Cause Factors of Social	**67.3**	**5**
ALL Items	**83.5%**	**54**

Table 8.1: Results of Cronbach Alpha (α) test of reliability

8.4.3 Kaiser-Meyer-Olkin (KMO) & Bartlett’s Test of Sphericity

The Kaiser-Meyer-Olkin measures of sampling adequacy tests whether the partial correlations among variables are small (SPSS Inc., 2007). It is used to examine the appropriateness of factor analysis. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) measure should be greater than 0.70

indicates factor analysis is appropriate, and is inappropriate if less than 0.50. The KMO test tells whether enough items are predicted by each factor or not.

The difference between Cronbach Alpha and Kaiser-Meyer-Olkin (KMO) tests is that the
first is used to test the consistency of the measurements of each factor, while the second is measuring the probability of which correlations exist between some of the variables. The result of reliability test by using SPSS software for the whole questionnaire is 0.947, which is more than the minimum level (0.7), (SPSS Inc., 2007). It means a scale with high reliability signifies that items that make up the scale correlate strongly enough (have significantly high internal consistency).

- **Cause Factors of Legal/Technical**

KMO is 0.76 which is greater than 0.50 indicating sufficient items for each factor (Table 8.2). Bartlett's Test of Sphericity tests whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. The Bartlett's test should be significant (i.e., a significance value less than 0.05); this means that the variables are correlated higher enough to provide a reasonable basis for factor analysis (SPSS Inc., 2007).

Kaiser-Meyer-Olkin Measures of Sampling Adequacy.		**0.76**
Bartlett's Test of Sphericity	**Approx. Chi-Square**	**3912.81**
	df	**91.00**
	Sig.	**0.00**

Table 8.2: KMO and Bartlett's Test for Cause Factors of Legal/Technical Part of BC

- **Cause Factors of Administrative Part**

KMO is 0.623 which is greater than 0.50 indicates sufficient items for each factor (Table 8.3). Bartlett's Test of Sphericity tests whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. The Bartlett's test should be significant (i.e., a significance value less than 0.05); this means that the variables are correlated higher enough to provide a reasonable basis for factor analysis (SPSS Inc., 2007).

Kaiser-Meyer-Olkin Measures of Sampling Adequacy.		.623
Bartlett's Test of Sphericity	Approx. Chi-Square	14365.855
	df	595
	Sig.	0.00

Table 8.3: KMO and Bartlett's Test for Cause Factors of Administrative Part of BC

- **Cause Factors of Social**

KMO is 0.604 which is greater than 0.50 indicates sufficient items for each factor. The Bartlett's test should be significant (i.e., a significance value less than 0.05); this means that the variables are correlated higher enough to provide a reasonable basis for factor analysis (SPSS Inc., 2007), (Table 8.4).

Kaiser-Meyer-Olkin Measures of Sampling Adequacy.		0.605
Bartlett's Test of Sphericity	Approx. Chi-Square	402.576
	df	10
	Sig.	**0.00**

Table 8.4: KMO and Bartlett's Test for Cause Factors of Social Part of BC

8.4.4 Overall Likelihood Occurrences of cause factors of legal/technical parts of BC

In Table 8.5, each component is set according to a series of correlations between different cause factors. Thus, it shows how a correlated cause factor could be correlated to other factors. The first column of the three sections in Table 8.5, are labelled as Initial Eigen values related to Eigen value of the correlation matrix and indicates which components of the table remain in the analysis. To carry out the factor analysis, only components with Eigen values of more than one are selected and those Eigen values of less than one are excluded (SPSS Inc., 2007). In the current context, an Eigen value is the amount of the total test variance that is accounted for by a particular factor (SPSS Inc., 2007).

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1.00	6.22	44.39	44.39	6.22	44.39	44.39	3.91	27.95	27.95
2.00	2.22	15.87	60.26	2.22	15.87	60.26	3.71	26.47	54.42
3.00	1.59	11.35	71.61	1.59	11.35	71.61	2.41	17.19	71.61
4.00	0.95	6.77	78.38						
5.00	0.75	5.34	83.72						
6.00	0.54	3.83	87.55						
7.00	0.44	3.16	90.71						
8.00	0.38	2.68	93.40						
9.00	0.29	2.07	95.47						
10.00	0.20	1.42	96.88						
11.00	0.16	1.14	98.02						
12.00	0.13	0.91	98.94						
13.00	0.08	0.59	99.53						
14.00	0.07	0.47	100.00						

Table 8.5: Overall Likelihood occurrences - cause factors of legal/technical parts of BC

As shown in the three rows of the second column, Eigen values refer to the variance explained or accounted for (Table 8.5). The initial and rotated Eigen values were used to confirm the variation explained by each extracted cause component. Lower values of Eigen values indicate that the contribution to the explanation of the variances in the set of our cause survey attributes is minimal.

The initial and rotated Eigen values were used to confirm the variation explained by each extracted cause component. Lower values indicate that the contribution to the explanation of the variances in the set of our cause survey attributes is minimal. For example, the initial Eigen value of the first factor in Table 8.5 is **6.22**. Hence, the proportion of the total test variance accounted for by the first factor is **27.95**% (the given figure in % of variance column). In this analysis for the Overall likelihood of occurrences, just three components carry Eigen values of one and more, and account for 71.61% of the variance as shown in the cumulative % column. This means that the selected three components presents

71.61% of the whole variance. Therefore, the three components can be considered as the representative of fourteen legal/technical factors employed in this study. This means that less than 29% of the existing information is compromised (the outcome of the data reduction is presented as a few components that consist of the most important factors from the original large group of factors). Another way of presenting the most important factors of a study can be obtained through the presentation of a Scree plot of data as shown in Figure 8.2.

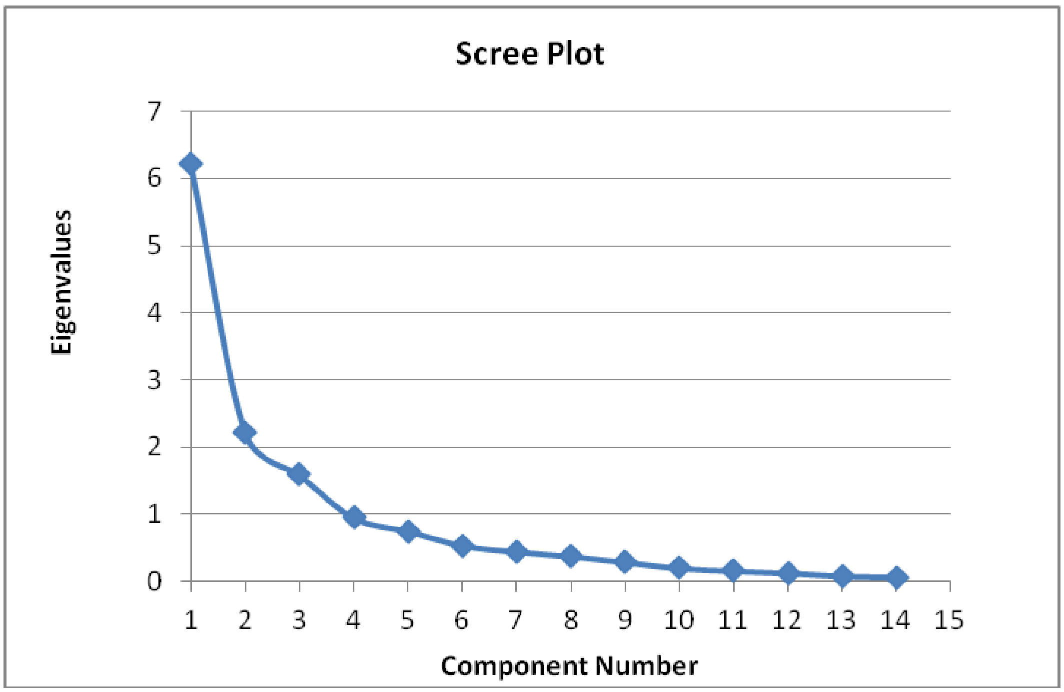

Figure 8.2: Scree plot of cause factors on legal/technical parts of BC for Overall likelihood occurrences

The purpose of a Scree plot is to provide a graphical picture of the Eigen value for each component extracted in SPSS. The Scree plot graphs the eigenvalue against the component number. As it is shown in the Figure 8.2, the slope of Scree is reducing, while moving towards components with Eigen value less than 1. The point of interest is defined between components three and four, where the figure curve connects to the points, starting to flatten out and be horizontal. Therefore, in a Scree plot, the place where a sharp change in angle (point of interest) occurs can be considered as the exact point that Eigen values of less than one are placed (SPSS Inc., 2007). On the sharp slope of curve, the Eigen values which are bigger than one are located, while in the flatten part of the curve, the Eigen Values which are smaller than one are plotted.

From principal component analysis three components which have more than one in Eigen Value are selected. The next phase is the extraction of rotated component matrix for finding out which cause factors are contributing the highest level of influence on the objectives of BC. This level of influence is shown in Table 8.5. The Matrix loading score presented in Table 8.5 shows the degree of influence of each cause factor in the fourteen legal/technical factors employed in the survey, and the cause factors with the highest rate of influence can be distinguished.

This factor loading tells us about the relative contribution that a variable makes to a factor. Most variables have high loadings on the most important factors, and fewer loadings on other factors. It is recommended to interpret factor loadings with an absolute value greater than 0.4 (ignoring the +ve or -ve sign), (SPSS Inc., 2007). In Table 8.6, only the degree of influence 0.4 and above are shown. However, for the purpose of interpreting how to extract the cause factors based on the factor loading, the factor loading of the components for some of cause factors were shown in Table 8.6.

The shaded values in Table 8.6, show the items cluster into these three groups defined by high loadings. From Table 8.6, the cause factor (LC7; 0.89) has got greater influence on component three compared to other components. Whereas, the cause factor (LC10; 0.83) has got more influence on component one in relation to other components, and (LC2; 0.78) has got more influence on component two in relation to other components. This same method is used for the rest of the cause factors and components to extract the most effective cause factors for each component. The cause factors with high scores and correlation values are chosen for each component.

	Rotated Component Matrix			
		Component		
Ref.		**1.00**	**2.00**	**3.00**
LC1	Inexistence of law to prepare and enforce Building Codes to safeguard minimum requirement of public health, safety and general welfare	**0.54**	**0.67**	**-0.28**
LC2	Insurance companies in Kuwait have no effective role in insuring and preserving quality of building construction works (because of the law)	**0.21**	**0.78**	**0.38**
LC3	Major obstacles to approve building materials testing system for Kuwait is the non existence of country/Municipality laws	**0.44**	**0.76**	**0.13**
LC4	Major obstacles to approve standard building specifications for Kuwait is the none existence of related articles in Municipality laws	**0.61**	**0.66**	**0.07**
LC5	Major obstacles to approve system of building methods for Kuwait is the none existence of related articles in Municipality laws	**0.57**	**0.38**	**0.47**
LC6	Major obstacle to approve testing and certification systems for building engineers, contractors, and skilled labours for Kuwait is the non existence of country Municipality laws	**0.71**	**0.56**	**-0.11**
LC7	More laws and codes and the resulting conflict among them	**0.11**	**-0.02**	**0.89**
LC8	Proper clauses should be developed to take into account the changes in building technology and regulations	**-0.14**	**0.76**	**-0.28**
LC9	There is a considerable deficiency in building laws and regulations to cover many aspects of building constructions especially at Kuwait Municipality	**0.43**	**0.34**	**0.45**
LC10	Unavailable laws to prevent the monopoly of lands, which led to the increase of land prices and misuse of lands and real estates	**0.83**	**0.11**	**0.15**
LC11	Unclear regulations texts	**-0.03**	**0.69**	**0.41**
LC12	Unconstitutional decisions to collect fees	**0.15**	**0.01**	**0.77**
LC13	Weak regulations by Municipality Council	**0.82**	**0.06**	**0.17**
LC14	Weak regulations from National Parliament	**0.78**	**0.01**	**0.21**

Table 8.6: Matrix loading score for Overall Likelihood occurrences

8.4.5 Overall Likelihood occurrences of cause factors in Administrative Part of BC

In Table 8.7, each component is set according to a series of correlations between different cause factors. As the interpretation of Eigen Values correlation matrix to the factor analysis already being explained in the previous section (Section 8.4.4), the next few sections will explain only the most relevant data for the cause factors in Administrative Part of BC.

Total Variance Explained									
	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.127	34.648	34.648	12.127	34.648	34.648	6.032	17.236	17.236
2	3.549	10.140	44.788	3.549	10.140	44.788	4.312	12.319	29.555
3	3.263	9.322	54.110	3.263	9.322	54.110	3.824	10.926	40.481
4	2.255	6.441	60.552	2.255	6.441	60.552	3.538	10.109	50.591
5	1.772	5.064	65.616	1.772	5.064	65.616	3.107	8.877	59.468
6	1.612	4.604	70.220	1.612	4.604	70.220	2.180	6.229	65.697
7	1.267	3.620	73.840	1.267	3.620	73.840	2.050	5.856	71.553
8	1.137	3.248	77.088	1.137	3.248	77.088	1.547	4.419	75.972
9	1.069	3.055	80.144	1.069	3.055	80.144	1.460	4.171	80.144
10	.889	2.541	82.685						
11	.864	2.468	85.153						
12	.747	2.135	87.288						
13	.571	1.630	88.919						
14	.524	1.498	90.416						
15	.488	1.394	91.810						
16	.431	1.232	93.042						
17	.339	.967	94.010						
18	.317	.906	94.916						
19	.288	.823	95.738						
20	.230	.657	96.395						
21	.215	.613	97.008						
22	.203	.581	97.589						
23	.159	.454	98.043						
24	.150	.430	98.473						
25	.106	.302	98.775						
26	.082	.236	99.010						
27	.075	.214	99.224						
28	.068	.195	99.419						
29	.053	.153	99.572						
30	.048	.137	99.708						
31	.037	.105	99.813						
32	.024	.068	99.881						
33	.021	.059	99.941						
34	.013	.037	99.978						
35	.008	.022	100.000						

Table 8.7: Total Variance Explained - Cause Factors of Administrative Part of BC

For cause factors of Administrative part of BC, the Eigen Value of the first factor in Table 8.7 is 12.127. Hence, the proportion of the total test variance accounted by the first factor is 34.648% (the figure given in % of variance column). In this analysis for cause factors of Administrative Part of BC, just nine components carry Eigen Values of one and more, and account for **80.144**% of the variance as shown in the cumulative percent (%) column. This means that the selected nine components presents **80.144**% of the whole variance for the cause factors of Administrative Part of BC and less than 20% of original data is compromised.

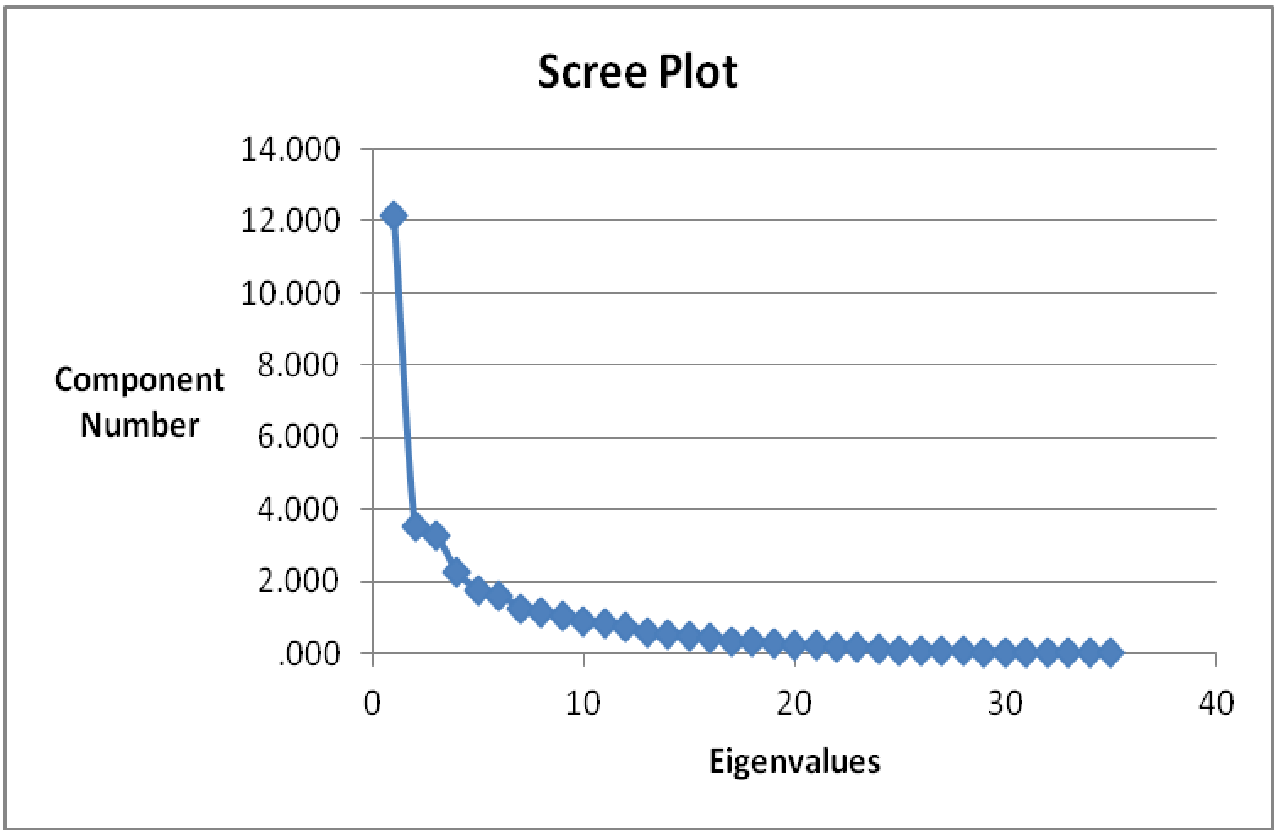

Figure 8.3: Scree plot of cause factors in Administrative part of BC for Overall likelihood occurrences

The scree plot graphs the eigenvalue against the component number. You can see these values in the first column of the table immediately above. From the third component on, you can see that the line is almost flat, meaning the each successive component is accounting for smaller and smaller amounts of the total variance. The point of interest in the scree plot in Figure 8.3 for cause factors of

Administrative part of BC is defined between components 9 and 10, where the figure curve connects to the points, starting to flatten out and be horizontal. Therefore, in a scree plot, the place where a sharp change in angle (point of interest) occurs can be considered as the exact point that Eigen values of less than one are placed (SPSS Inc., 2007), (For details for the interpretation of Scree Plot refer to Section 8.4.4).

The presented Table 8.8 shows the degree of influence of each cause factor in the survey, and the cause factors with the highest rate of influence and high loading matrix can be distinguished. The shaded values in Table 8.8, show the items cluster into these two groups defined by high loadings. The same method and concept of factor loading score used previously with the likelihood occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the cause factors in extracting the most important cause factors.

	Rotated Component Matrix[a]									
		Component								
		1	2	3	4	5	6	7	8	9
AC1	Administrative procedures at Municipality are the main obstacles to implement and enforce regulations and laws	**.758**	**.285**	**.275**	**.139**	**.193**	**.119**	**-.102**	**-.027**	**-.148**
AC2	Assigning many additional tasks for engineers of the technical department	**-.176**	**.009**	**-.077**	**.870**	**.101**	**.033**	**.229**	**.049**	**.068**
AC3	Building decisions and regulations were created without proper study which affect the investors	**.645**	**.219**	**.530**	**.018**	**.146**	**.025**	**.015**	**.099**	**.096**
AC4	Conflict in issuing the licenses among Ministry of Trade and Municipality	**.505**	**.505**	**.251**	**.163**	**.260**	**.150**	**.266**	**.266**	**.137**
AC5	Difficulty in implementing some matters	**.096**	**.137**	**.702**	**.225**	**.233**	**.201**	**.199**	**.120**	**-.044**
AC6	lose and damage of documents and records of building projects at Kuwait Municipality	**.054**	**.197**	**.230**	**.258**	**.401**	**.726**	**-.053**	**.052**	**-.133**
AC7	Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible for direct communications with citizens	**-.053**	**-.109**	**.201**	**.111**	**.454**	**.006**	**.743**	**.175**	**.130**
AC8	It is hard to obtain specific information from Municipality, Kuwait Fire Department, Ministry of Electricity and Ministry of Public Work	**.847**	**-.088**	**.153**	**.047**	**.284**	**-.090**	**-.042**	**-.003**	**.108**
AC9	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	**.337**	**.743**	**.213**	**.259**	**.121**	**-.017**	**-.012**	**-.014**	**-.154**
AC10	Many participating organizations in administration of building process	**.053**	**.167**	**-.040**	**.240**	**-.117**	**-.097**	**.811**	**.070**	**.035**

	Rotated Component Matrix[a]									
		Component								
		1	2	3	4	5	6	7	8	9
AC11	None of the government organizations performed their tasks of updating the construction requirements related to the use of latest construction materials or methods	.282	-.197	.611	-.011	-.243	.129	.414	-.215	.025
AC12	Procedures of following and monitoring of buildings and construction works at Municipality are not clear and not with satisfying performance	.060	.714	.128	.357	-.096	.221	.056	-.234	.099
AC13	Conflict and unclear area of expertise of organizations participated in administration of building process	.552	-.111	.431	-.208	.044	.238	.377	-.087	-.161
AC14	Design and supervision engineers from engineering offices usually get licenses by Municipality, but they are not tested technically to know their abilities	.692	.165	.288	.004	.032	.340	-.020	.231	.081
AC15	Improper capabilities in technical and managerial sides of Municipality to follow up and control building and construction works	.528	.305	.020	-.054	.205	.000	.220	-.510	.340
AC16	Many construction problems are due to unclear professional practice and workmanship standards	-.111	-.194	.062	.159	.024	-.040	.098	.131	.809
AC17	Municipality Council members don't have the necessary technical education or qualifications in preparing the building regulations	.327	.169	.779	.083	.235	-.031	-.020	.016	.086
AC18	Small contractors usually get licenses by Municipality, but they are not tested technically resulting in engineering problems	.393	.281	-.171	.101	.161	.723	-.017	-.016	.079
AC19	Unsuitable qualification of workforce at Municipality departments	.223	.171	.193	.795	.160	.084	.076	.069	.172
AC20	Weak workforce at Municipality departments	.482	.449	-.022	.015	.643	-.036	.052	-.109	.129
AC21	Weakness in legal departments at Municipality branches at governorates	.237	.038	.375	.153	.731	.155	.245	-.111	-.096
AC22	Weak reimbursements for workers at Municipality	.091	-.128	.122	.228	-.083	-.010	.225	.772	.245
AC23	Weakness in technical and financial capabilities at Municipality branches at governorates	.071	.229	.085	.211	.800	.130	.027	-.031	.177
AC24	Building Departments, Inspection Departments, and Safety Departments at Kuwait Municipality don’t perform their responsibilities properly in controlling and following up local construction works	.141	.774	-.162	.060	.276	.044	.085	.067	-.216
AC25	Difficulties facing Municipality's technical workforce in acquiring correct data and information to implement and check what have been done on the site with issued licenses	.319	.184	.428	.687	.058	-.041	.139	.161	.060

	Rotated Component Matrix[a]									
		Component								
		1	2	3	4	5	6	7	8	9
AC26	It is incorrect to award all engineering supervisions and inspection tasks of consultant offices without Municipality control	.653	.205	.257	.127	-.087	.250	.086	.462	.012
AC27	Kuwait Municipality doesn't perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labours	.680	.387	.127	.009	.184	-.069	.089	-.203	-.111
AC28	Many owners and investors have no trust in the supervision capabilities of the engineering offices	.436	.431	.458	.112	-.149	.357	-.008	-.144	-.067
AC29	Neglect the testing of building materials and concrete by certified testing centres during projects execution	.784	.150	.061	.169	-.020	.215	.036	-.004	-.221
AC30	Most owners and investors don't care to fulfil the demands of energy conservation in buildings because due to the low cost of electricity, and weakness of regulations and enforcements	.176	.140	.732	.022	.008	-.092	-.083	.125	.090
AC31	Municipality, Fire-fighting and Electricity departments are not performing periodical inspections after linking electricity and building occupancy	.092	.319	-.066	.762	.194	.242	-.035	.091	-.071
AC32	Unclear and inadequate procedures to review building plans at Municipality	.477	.622	.190	.402	-.070	.224	-.096	-.098	.082
AC33	There is no government controlled inspection on building at construction sites	.206	-.001	-.048	.163	.627	.381	-.322	-.034	-.211
AC34	To reduce the cost of construction and to finish work quickly, many private projects are not executed as per professional standards and proper workmanship	.068	.211	.220	.456	.115	.423	-.029	.064	.421
AC35	Workers at Kuwait Municipality don't care to use comprehensive checklists to review plans, and monitor projects to faithfully fulfil their work requirements	.096	.747	.332	.040	.180	.243	-.047	-.016	-.013

Table 8.8: Matrix loading score for Overall Likelihood occurrence

8.4.6 Overall Likelihood of occurrence of cause factors of Social part of BC

As the interpretation of the Eigen values correlation matrix to the factor analysis already being explained in the previous section (Section 8.4.4), these next few sections will explain only the most relevant data for the cause factors of Social part of BC.

Total Variance Explained									
	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.230	44.609	44.609	2.230	44.609	44.609	1.729	34.579	34.579
2	1.049	20.987	65.597	1.049	20.987	65.597	1.551	31.017	65.597
3	.865	17.309	82.906						
4	.519	10.382	93.288						
5	.336	6.712	100.000						

Table 8.9: Total Variance Explained - cause factors of Social Part of BC

For cause factors of Social Part of BC, the Eigen Value of the first factor in Table 8.9, is 2.230. Hence, the proportion of the total test variance accounted by the first factor is 44.609% (the figure is given in % of variance column). In this analysis for cause factors of Social part of BC, just two components carry Eigen values of one and more, and accounts for 65.597% of the variance as shown in the cumulative percent (%) column. This means that the selected two components present 65.597% of the whole variance for the cause factors of Social part of BC and less than 35% of original data are compromised.

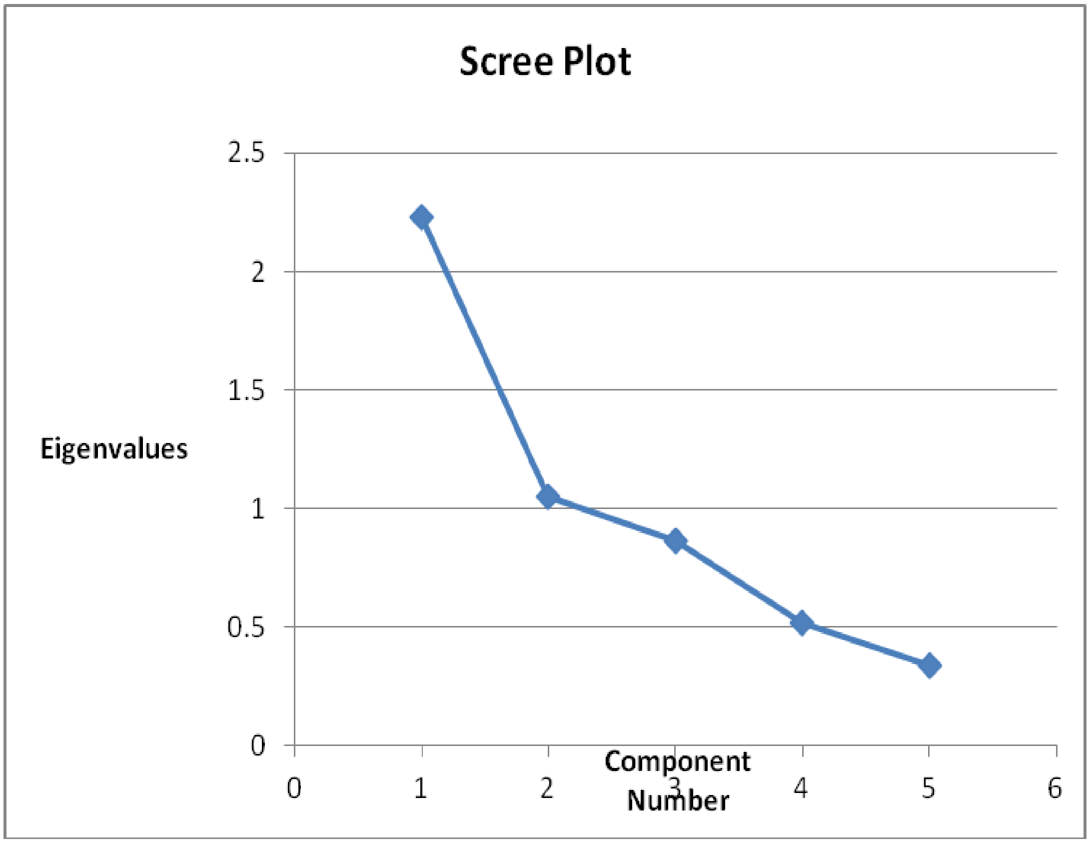

Figure 8.4: Scree plot of cause factors of Social part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.4 for cause factors of Social part of BC is defined between components two and three, where the figure curve connects to the points, starting to flatten out and is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

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The presented Table 8.10 shows the degree of influence of each cause factor in the survey, and the cause factors with the highest rate of influence and high loading matrix can be distinguished. The shaded values in Table 8.10, show the items cluster into these two groups defined by high loadings. The same method and concept of factor loading score used previously with the likelihood of occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the cause factors in extracting the most important cause factors.

	Rotated Component Matrix[a]		
		Component	
		1	2
SC2	Delay of issuing and enforcing legal court rules based on violation cases	**.898**	**-.088**
SC3	Low monetary values of penalty by Municipality law (max. 500 kd. = 1000 £)	**.101**	**.836**
SC4	No deterrent punishments for violators	**.129**	**.751**
SC5	Weak power of law in enforcing correction decisions for violations	**.802**	**.353**
SC6	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	**.503**	**.395**

Table 8.10: Matrix loading score for Overall Likelihood occurrences

8.4.7 Components for the overall likelihood occurrences of cause factors

In Table 8.11, each component is set according to a series of correlations between different cause factors. The most important and influential cause factors of each component is extracted to form a reduced list of cause factors, which are highly manageable without losing a large amount of data. Factor analysis helps to analyse the factors, and categorises the factors according to their relationships and correlations to each other in this survey. By applying factor analysis and data reduction in this survey, the questionnaire 54 cause factors are reduced to fourteen factors/components (3 components for cause factors of legal/technical parts of BC, 8 components for cause factors of administrative, 2 components for cause factors of social), which are shown in Tables 8.11, 8.12, and 8.13 below. The percentages of variance of each component in Tables 8.11, 8.12, and 8.13 are extracted from Tables 8.8, 8.9, and 8.10. Common themes of the components were identified and each component was given new terms for reference.

Cause component	Extracted Eigen value	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Cause factors aggregated to component following rotation	
				Factor loading score	Factor details
Component 1 Weak building regulations, methods, and certification of professionals	**6.22**	**44.39**	**27.95**	**0.57** **0.71** **0.83** **0.82** **0.78**	**LC5**: Major obstacles to approve system of building methods for Kuwait is the none existence of related articles in Municipality laws **LC6**: Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law) **LC10**:Unavailable laws to prevent the monopoly of lands, which led to the increase of land prices and misuse of lands and real estates **LC13**: Weak regulations by Municipality Council **LC14**: Weak regulations of National Parliament
Component 2 Inexistence of law to prepare and enforce codes, materials testing, specifications, and effective insurance for building	**2.22**	**15.87**	**26.47**	**0.67** **0.78** **0.76** **0.66** **0.76** **0.69**	**LC1:**Inexistence of law to prepare and enforce Building Codes to safeguard minimum requirements of public health, safety and general welfare **LC2:** Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law) **LC3:** Inexistence of building materials testing systems (because of the law) **LC4:**Major obstacle to approve standard building specifications for Kuwait is the none existence of related articles in Municipality laws **LC8:** Not taking into account the changes in building technology in current law **LC11:**Unclear regulations texts
Component 3 Problems in technical requirements, conflict, collect fees in building regulations	**1.59**	**11.35**	**17.19**	**0.89** **0.45** **0.77**	**LC7:**More laws and codes and the resulting conflict among them **LC9:** Lack many of the technical requirements in building regulations in Kuwait **LC12:**Unconstitutional decisions to collect fees

Table 8.11: Components of the overall likelihood occurrence for Cause Factors of Legal/Technical Parts of BC

Cause component	Extracted Eigen value	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Cause factors aggregated to component following rotation	
				Factor loading score	Factor details
Component 1 Improper procedures to prepare and enforce codes, proper workforce capabilities, testing of building materials, and system to provide information	**12.127**	**34.648**	**17.236**	**.758** **.645** **.505** **.847** **.552** **.692** **.528** **.482** **.653** **.680** **.784**	**AC1:** Administrative procedures at Municipality are the main obstacles to implement and enforce regulations and laws **AC3:** Building decisions and regulations were created without proper study which affect the investors **AC4:** Conflict in issuing the licenses among Ministry of Trade and Municipality **AC8:** It is hard to obtain specific information from Municipality, Kuwait Fire Department, Ministry of Electricity and Ministry of Public Work **AC13:** Conflict and unclear area of expertise of organizations participated in administration of building process **AC14:** Design and supervision engineers from engineering offices usually get licenses from Municipality, but they are not tested technically to know their abilities **AC15:** Improper capabilities of Municipality in technical and managerial sides to follow up and control building and construction works **AC20:** Weak workforce at Municipality departments **AC26:** It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control **AC27:** Kuwait Municipality doesn't perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labours **AC29:** Neglecting the testing of building materials and concrete by certified testing centres during projects execution
Component 2 Improper Municipality procedures for plan review and inspection	**3.549**	**10.140**	**12.319**	**.702** **.611** **.779** **.458** **.732**	**AC9:** Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects **AC12:** Procedures of following and monitoring of building and construction works at Municipality are not clear and not with satisfying performance **AC24:** Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform its responsibilities properly in controlling and following local construction works **AC32:** Unclear and inadequate procedures of review of building plans at Municipality **AC35:** Workers at Kuwait Municipality don't care to use comprehensive checklists to review plans, and monitor projects to faithfully fulfil their work requirements
Component 3 Problems in enforcement and updating building regulation and consultant supervision capabilities	**3.263**	**9.322**	**10.926**	**.702** **.611** **.779** **.458** **.732**	**AC5:** Difficulty in implementing some matters **AC11:** None of the government organizations perform their tasks of updating the construction requirements related to the use of latest construction materials or methods **AC17:** Municipality Council members don't have the necessary technical education or qualifications in preparing the building regulations **AC28:** Many owners and investors have no trust in the supervision capabilities of the engineering offices **AC30:** Most owners and investors don't care to fulfil the demands of energy conservation in buildings because of the low cost of electricity, and weakness of regulations and enforcement

Cause component	Extracted Eigen value	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Cause factors aggregated to component following rotation	
				Factor loading score	**Factor details**
Component 4 Problems in qualification, tasks, knowledge of officials and professionals, and performing periodical inspection	**2.255**	**6.441**	**10.109**	**.870** **.795** **.687** **.762** **.456**	**AC2:** Assigning many additional tasks for engineers of the technical department **AC19:** Unsuitable qualifications of workforce at Municipality departments **AC25:** Difficulties facing Municipality's technical workforce in acquiring correct data and information to implement and check what have been done on the site of issued licenses **AC31:** Municipality, Fire-fighting and Electricity departments are not performing periodical inspections after linking electricity and building occupancy **AC34:** To reduce the cost of construction and to finish work quickly, many private projects are not executed as per professional standards and proper workmanship
Component 5 Weak technical, legal, and financial capabilities of officials workforce and government inspection	**1.772**	**5.064**	**8.877**	**.643** **.731** **.800** **.627**	**AC20:** Weak workforce at Municipality departments **AC21:** Weak legal departments at Municipality branches at governorates **AC23:** Weak technical and financial capabilities at Municipality branches at governorates **AC33:** There is no government controlled inspection on building at construction sites
Component 6 Problems with records of building projects and certification of small contractors	**1.612**	**4.604**	**6.229**	**.726** **.723**	**AC6:** lose and damage of documents and records of building projects at Kuwait Municipality **AC18:** Small contractors usually get licenses from Municipality, but they are not tested technically resulting in engineering problems
Component 7 Problems with corporation of government organizations in administration of building process	**1.267**	**3.620**	**5.856**	**.743** **.811**	**AC7:** Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible of direct communications with citizens **AC10:** Many participating organizations in administration of building process
Component 8 Improper inspection and supervision of consultant and reimbursements for workers at Municipality	**1.137**	**3.248**	**4.419**	**.772** **.462**	**AC22:** Weak reimbursements for workers at Municipality **AC26:** It is incorrect to award all engineering supervisions and inspection tasks to consultant offices without Municipality control

Table 8.12: Components of the overall likelihood occurrence for Cause Factors of Administrative Part of BC

Cause components	Extracted Eigen value	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Cause factors aggregated to component following rotation	
				Factor loading score	Factor details
Component 1 Ineffective inspection, and weak and delay in enforcing correction decisions of violations	**2.230**	**44.609**	**34.579**	**.898** **.802** **.503**	**SC2:**Delay of issuing and enforcing legal court rules based on violation cases **SC5:**Weak of power of law in enforcing correction decisions of violations **SC6:** Ineffective engineering supervision and inspection tasks to prevent violations or cheatings
Component 2 No deterrent punishments for violators and Low monetary value of penalty	**1.049**	**20.987**	**31.017**	**.836** **.751**	**SC3:**Low monetary value of penalty by Municipality law (max. 500 KD = 1000 £) **SC4:**No deterrent punishments for violators

Table 8.13: Components of the overall likelihood occurrence for Cause Factors of Social Part of BC

8.5 Analysis of the Findings in Impact factors

8.5.1 Reliability Analysis

As the interpretation of the Eigen values correlation matrix to the factor analysis already being explained in the previous section (8.4 Analysis of the Findings of Cause factors), the next few sections will explain only the most relevant data for the impact of cause factors on the BC objective.

8.5.2 Cronbach Alpha

In this study, the reliability (i.e. Cronbach Alpha) of all other 58-items of MLQ instrument was 97.4% for Public Safety, 97.3% for Public Health, and 98.5% for Public Welfare, reflecting that the questions were correlated and addressing the research problem (Table 8.14).

Parts of BC	**Cronpach Alpha** **(%)** Public Safety	**Cronpach Alpha** **(%)** Public Health	**Cronpach Alpha** **(%)** Public Welfare	**# of Variable**
Legal Impact Factors	**75.4**	**88.9**	**90.6**	**5**
Administrative Impact Factors	**73.5**	**85.7**	**93.4**	**7**
Technical Impact Factors	**70.7**	**76.5**	**87.2**	**3**
Social Impact Factors	**97.3**	**97.3**	**98.5**	**43**
ALL Items	**97.4**	**97.3**	**98.5**	**58**

Table 8.14: Results of Cronbach Alpha (α) test of reliability

8.5.3 Kaiser-Meyer-Olkin (KMO) & Bartlett's Test of Sphericity

Section 8.4.3 gives more details and explanations for this section. The result of reliability test by using SPSS software for the whole questionnaire is 0.974 for public safety, 0.973 for public health, 0.985 for public welfare, which is more than the minimum level (0.7), (Table 8.14), (SPSS Inc., 2007).

- **Legal Cause Factors**

KMO values are 0.607, 0.855, and 0.839 which is greater than 0.50 indicates sufficient items for each factor. The Bartlett's test should be significant (i.e., a significance value less than 0.05); this means that the variables are correlated high enough to provide a reasonable basis for factor analysis (SPSS Inc., 2007), (Table 8.15).

		Public Safety	**Public Health**	**Public Welfare**
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.607**	**.855**	**.839**
Bartlett's Test of Sphericity	**Approx. Chi-Square**	**568.184**	**1139.781**	**1363.422**
	df	**10**	**10**	**10**
	Sig.	**.000**	**.000**	**.000**

Table 8.15: KMO and Bartlett's Test for Impact Factors of Legal Part of BC

Impact Factors of Administrative

KMO values are 0.510, 0.800, and 0.890 which is greater than 0.50 indicates sufficient items for each factor (Table 8.16).

		Public Safety	Public Health	Public Welfare
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.510	.800	.890
Bartlett's Test of Sphericity	**Approx. Chi-Square**	744.531	1443.924	2262.277
	df	21	21	21
	Sig.	**.000**	**.000**	**.000**

Table 8.16: KMO and Bartlett's Test for Cause Impact Factors of Administrative Part of BC

Technical Impact Factors

KMO values are 0.597, 0.669, and 0.715 which is greater than 0.50 indicates sufficient items for each factor (Table 8.17).

		Public Safety	Public Health	Public Welfare
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.597	.669	.715
Bartlett's Test of Sphericity	**Approx. Chi-Square**	33375.569	24846.372	29739.861
	df	903	903	903
	Sig.	**.000**	**.000**	**.000**

Table 8.17: KMO and Bartlett's Test for Impact Factors of Technical Part of BC

Social Impact Factors

KMO values are 0.643, 0.722, and 0.810 which is greater than 0.50 indicates sufficient items for each factor (Table 8.18).

		Public Safety	Public Health	Public Welfare
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.643	.722	.810
Bartlett's Test of Sphericity	**Approx. Chi-Square**	351.244	495.737	780.177
	df	6	6	6
	Sig.	**.000**	**.000**	**.000**

Table 8.18: KMO and Bartlett's Test for Impact Factors on Social Part of BC

8.5.4 Overall Likelihood occurrence of impact factors on Public Safety

As the interpretation of the Eigen values correlation matrix to the factor analysis already being explained in the previous section (Section 8.4.4), these next few sections will explain only the most relevant data for the impact factors on Public Safety.

8.5.4.1 Impact Factors of Legal Part of BC

Total Variance Explained						
Components	**Initial Eigen values**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	**2.592**	**51.843**	**51.843**	**2.592**	**51.843**	**51.843**
2	**.938**	**18.766**	**70.609**			
3	**.716**	**14.320**	**84.929**			
4	**.503**	**10.066**	**94.995**			
5	**.250**	**5.005**	**100.000**			

Table 8.19: Total Variance Explained - impact factors of legal part of BC

In Table 8.19, each component is set according to a series of correlations between different impact factors. For impact factors of legal part of BC, the Eigen value of the first factor in Table 8.19, is **2.592**. Hence, the proportion of the total test variance accounted by the first factor is **51.843**% (the figure given in % of variance column). In this analysis of cause factors in legal part of BC, just one component carry Eigen values of one and more, and account for **51.843**% of the variance as shown in the cumulative % column. This means that the selected one components presents **51.843**% of the whole variance for the impact factors of legal part of BC and less than 49% of original data is compromised.

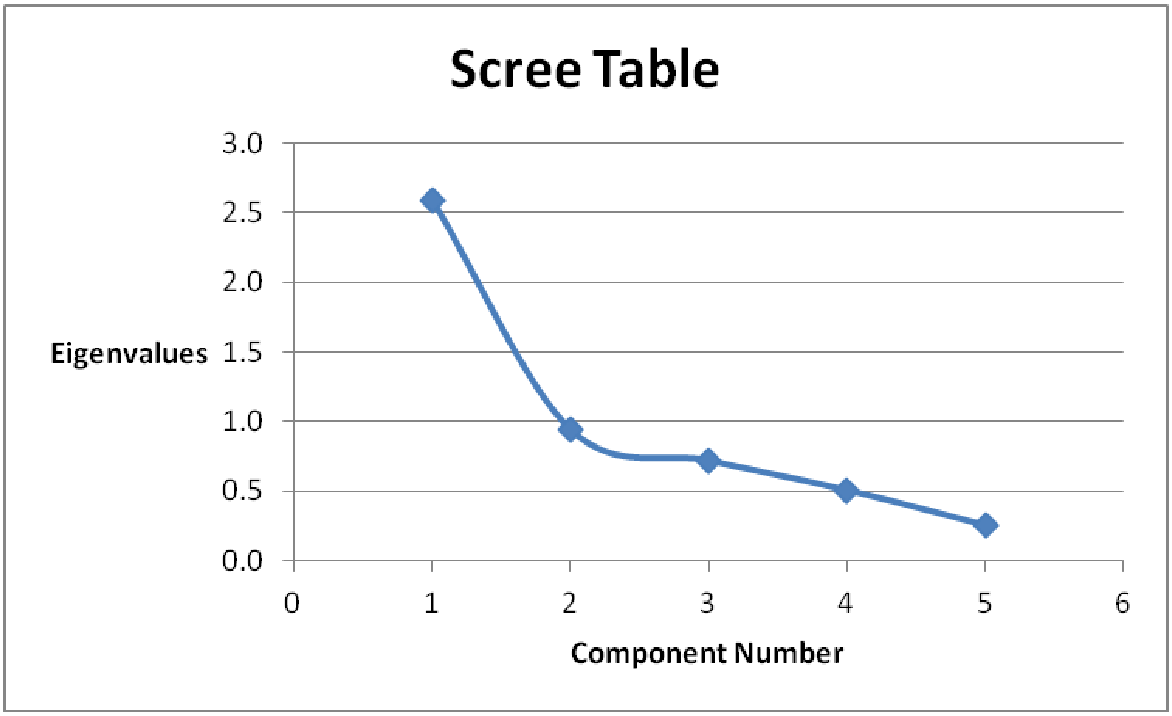

Figure 8.5: Scree plot of impact factors on legal part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.5 for impact factors of legal part of BC is defined between components one and two, where the figure curve connects to the points, starting to flatten out and become horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

The presented Table 8.20 shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rate of influence and high loading matrix which can be distinguished. The same method and concept of factor loading score used previously with the likelihood of occurrence of cause factors in legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important cause factors.

	Component Matrix[a]	
		Component
		1
IL1	Lacks many of the technical requirements in building regulations in Kuwait	.711
IL2	Not taking into account the changes in building technology in current law	.698
IL3	Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	.665
IL4	Inexistence of building materials testing system (because of the law)	.764
IL5	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	.757

Table 8.20: Matrix loading score for Overall Likelihood occurrences

8.5.4.2 Impact Factors of Administrative Part of BC

Total Variance Explained									
Components	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.779	39.698	39.698	2.779	39.698	39.698	2.029	28.990	28.990
2	1.199	17.124	56.822	1.199	17.124	56.822	1.650	23.577	52.566
3	1.088	15.536	72.358	1.088	15.536	72.358	1.385	19.792	72.358
4	.750	10.718	83.076						
5	.538	7.680	90.755						
6	.453	6.472	97.227						
7	.194	2.773	100.000						

Table 8.21: Total Variance Explained - impact factors of Administrative part of BC

For impact factors of Administrative Part of BC, the Eigen value of the first factor in Table 8.21, is **2.779**. Hence, the proportion of the total test variance accounted by the first factor is **39.698**% (the figure given in percentage of variance column). In this analysis for cause factors of Administrative part of BC, just three components carry Eigen values of one and more, and account for **72.358**% of the variance as shown in the cumulative percentage column. This means that the selected three components present 72.358% of the whole variance of the impact factors of Administrative part of BC and less than 28% of original data is compromised.

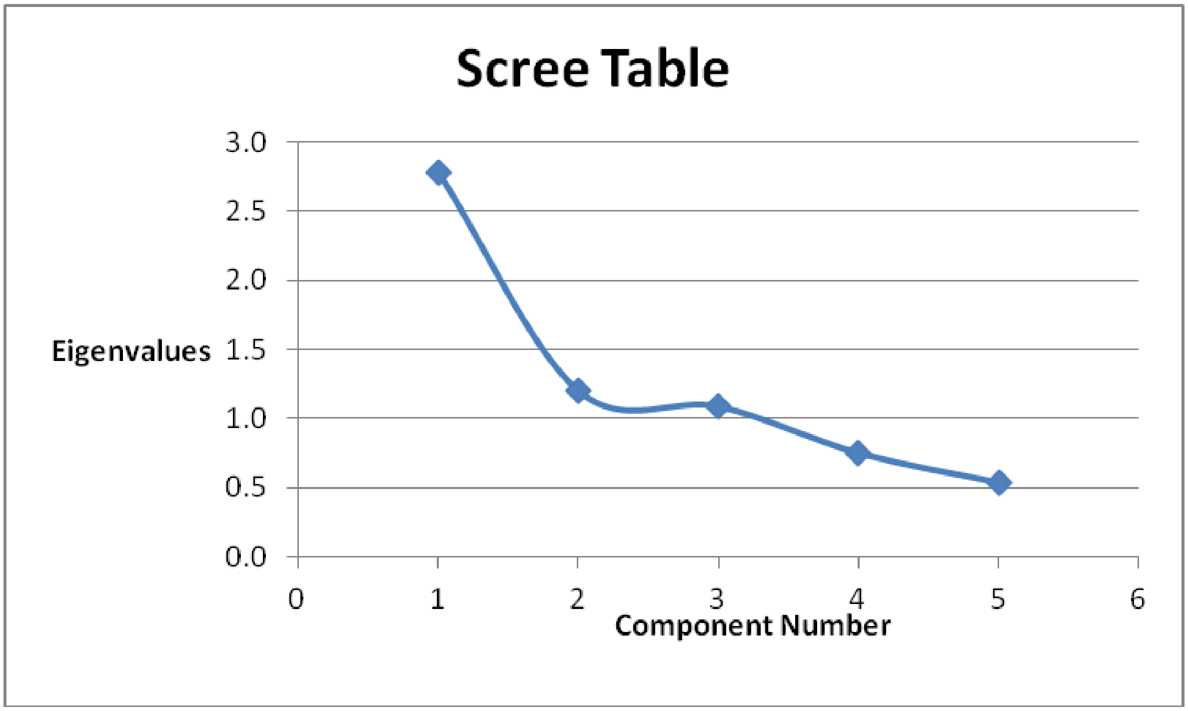

Figure 8.6: Scree plot of impact factors of Administrative part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.6 for impact factors of Administrative part of BC is defined between components three and four, where the figure curve connects to the points, starting to flatten out and be horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.22 presented here shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rate of influence and high loading matrix can be distinguished. The shaded values in Table 8.22, show the items cluster into these three groups defined by high loadings. The same method and concept of factor loading score is used previously with the likelihood of occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important impact factors.

	Rotated Component Matrix[a]			
		Component		
		1	2	3
IA1	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	.816	.115	-.006
IA2	lose and damage of documents and records of building projects at Kuwait Municipality	.418	.673	.130
IA3	Improper capabilities in technical and managerial sides of Municipality to follow up and control building and construction works	.704	.125	.284
IA4	Unclear and inadequate procedures of review of building plans at Municipality	.693	.468	-.071
IA5	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	.084	.885	.067
IA6	Neglecting the testing of building materials and concrete by certified testing centres during projects execution	.434	-.200	.727
IA7	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	-.134	.354	.866

Table 8.22: Matrix loading score for Overall Likelihood occurrence

8.5.4.3 Impact Factors of Technical Part of BC

Total Variance Explained									
Components	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.541	47.770	47.770	20.541	47.770	47.770	11.363	26.426	26.426
2	3.604	8.381	56.151	3.604	8.381	56.151	5.196	12.084	38.511
3	3.054	7.103	63.254	3.054	7.103	63.254	4.028	9.367	47.877
4	2.138	4.973	68.227	2.138	4.973	68.227	3.493	8.123	56.000
5	2.093	4.868	73.094	2.093	4.868	73.094	2.976	6.921	62.921
6	1.736	4.036	77.130	1.736	4.036	77.130	2.831	6.584	69.505
7	1.405	3.268	80.398	1.405	3.268	80.398	2.557	5.946	75.451
8	1.254	2.917	83.315	1.254	2.917	83.315	2.356	5.479	80.930
9	1.045	2.430	85.745	1.045	2.430	85.745	2.070	4.815	85.745
10	.828	1.926	87.671						
11	.721	1.678	89.348						

Total Variance Explained									
Components	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
12	.583	1.357	90.705						
13	.530	1.232	91.937						
14	.427	.994	92.931						
15	.405	.943	93.874						
16	.374	.871	94.745						
17	.321	.746	95.491						
18	.292	.678	96.169						
19	.261	.607	96.776						
20	.211	.492	97.267						
21	.186	.432	97.699						
22	.180	.418	98.117						
23	.116	.269	98.387						
24	.113	.263	98.650						
25	.094	.219	98.868						
26	.081	.189	99.057						
27	.079	.183	99.240						
28	.059	.137	99.377						
29	.055	.129	99.506						
30	.045	.104	99.609						
31	.043	.101	99.711						
32	.040	.092	99.803						
33	.029	.067	99.870						
34	.022	.050	99.921						
35	.015	.035	99.955						
36	.008	.019	99.974						
37	.006	.014	99.988						
38	.002	.004	99.992						
39	.002	.004	99.996						
40	.001	.002	99.998						
41	.000	.001	99.999						
42	.000	.001	100.000						
43	.000	.000	100.000						

Table 8.23: Total Variance Explained - impact factors of technical part of BC

For impact factors of technical part of BC, the Eigen value of the first factor in Table 8.23, is **20.541**. Hence, the proportion of the total test variance accounted by the first factor is **47.770**% (the figure given in % of variance column). In this analysis for cause factors of technical part of BC, just nine components carry Eigen values of one and more, and account for **85.745**% of the variance as shown in the cumulative % column. This means that the selected nine components present **85.745**.The percentage of the whole variance for the impact factors of technical part of BC and less than 15% of original data is compromised.

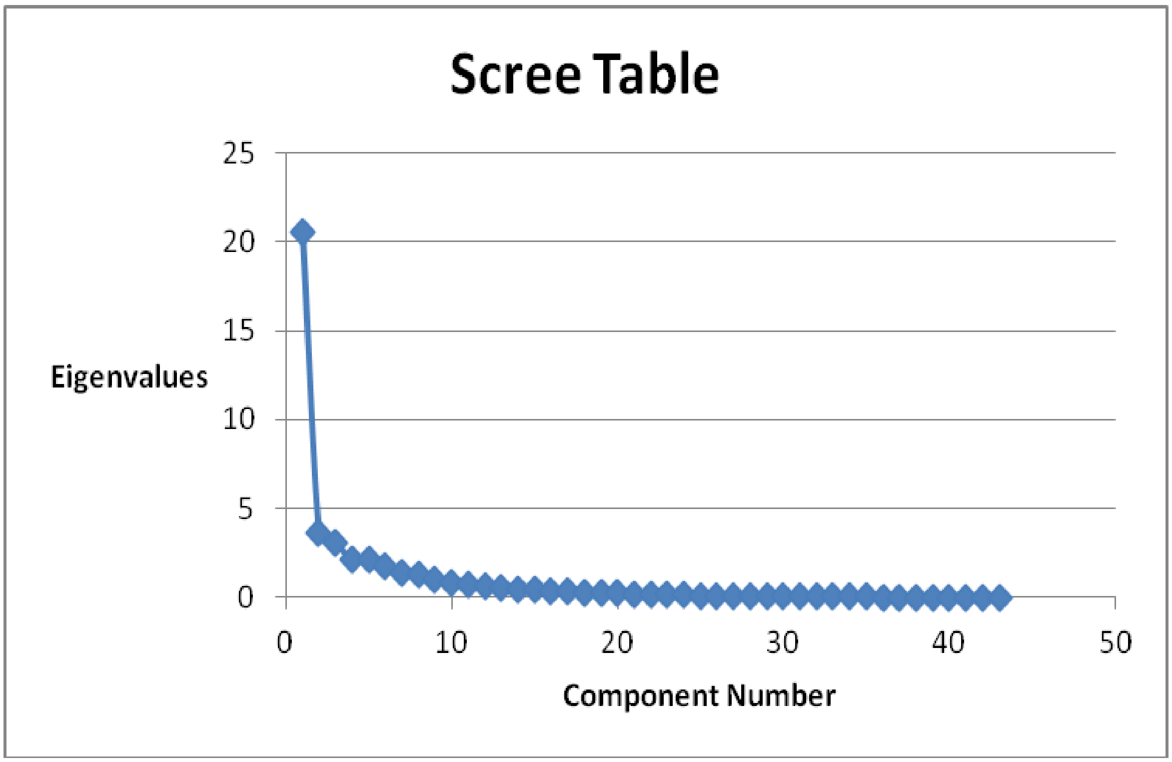

Figure 8.7: Scree plot of impact factors of technical part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.7 for impact factors of technical part of BC is defined between components nine and ten, where the figure curve connects to the points, starting to flatten out and is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.24 presented shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rate of influence and high loading matrix can be distinguished. The shaded values in Table 8.24 show the items cluster into these nine groups defined by high loadings. The same method and concept of factor loading score used previously with the likelihood of occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important impact factors.

	Rotated Component Matrix[a]									
		Component								
		1	2	3	4	5	6	7	8	9
IT1	Accessibility	.490	-.008	.163	.359	-.265	.064	.019	.461	.394
IT2	Aluminium	.111	.112	.362	.456	.048	.612	.251	.125	-.045
IT3	Boilers/water heaters	.354	.048	.771	.235	.190	.161	.161	.040	.003
IT4	Concrete and reinforce concrete works	.036	.611	.274	.043	.416	.177	-.016	.297	.360
IT5	Construction equipment	.362	-.007	.456	.168	.667	.055	.017	.119	.204
IT6	Demolition of buildings and facilities	.397	.134	.682	.021	.215	.229	.060	-.050	.341
IT7	Electrical works	.171	.448	.151	.671	-.011	.185	.125	-.054	.052
IT8	Elevators and conveying systems	.328	.231	.495	.323	-.001	-.055	.164	.150	.601
IT9	Encroachments into public right of way	.333	.178	.174	-.033	.363	-.008	.593	.091	.458
IT10	Energy conservation	.648	.330	-.027	.129	.099	-.057	.108	.099	.555
IT11	Existing structures	.650	.321	.021	.247	.244	-.150	.262	.148	.380
IT12	Exterior walls	.444	.163	.067	.324	.117	.091	.713	.012	.068
IT13	Gas piping installations	.105	.564	.062	.091	.392	.244	.511	.116	-.108
IT14	Glass and glazing	.106	.367	.113	.067	.790	.135	.213	-.025	.011
IT15	Gypsum board and plaster	.695	.282	.307	-.009	.005	.172	.187	.142	.246
IT16	Increase number of persons occupying housing unit	.188	.479	.396	-.050	-.074	.396	.303	-.202	.186
IT17	Interior environment	.068	.803	.180	.089	.116	.158	.227	-.145	.105
IT18	Interior finishes	.208	.161	.226	.656	.487	.191	.085	-.074	-.111
IT19	Maintenance of drinking water cooler sets	.802	.063	.340	.314	.087	-.020	.084	.124	-.006
IT20	Masonry	.847	.072	.281	.302	.107	.092	.122	.071	.071
IT21	Mechanical systems	.201	.465	.579	.384	.026	.196	.045	.189	.071
IT22	Parking	.347	.034	.481	.168	-.077	-.004	.604	.392	.093
IT23	Plastic	.815	.090	.166	.145	.098	.237	.295	.096	.035
IT24	Plumbing systems	.782	.079	.336	.164	-.040	-.048	.323	.200	.089
IT25	Poor electric and lighting works during alteration, movement, and repairing	.748	.242	.231	.199	.025	-.010	.264	.264	.179
IT26	Property maintenance	.670	.151	-.024	.001	.358	.447	.048	.074	.193
IT27	Safeguards during construction	.741	.290	.209	-.173	.261	.186	.130	.032	.141
IT28	Sanitation of exterior property areas	.772	.093	.173	.191	.160	.346	-.110	-.080	.040

	Rotated Component Matrix[a]									
		Component								
		1	2	3	4	5	6	7	8	9
IT29	Sewage disposal	.826	.379	-.077	.056	.161	-.106	.036	.014	.067
IT30	Sheds and Car metal shed	.290	.513	.538	.189	.304	.060	.054	.098	-.148
IT31	Signs	.612	.148	-.153	.009	.509	.484	-.094	.036	.017
IT32	Site preparation	.366	.711	.086	-.132	.201	.155	.195	.056	.406
IT33	Smoke detectors for houses	.693	.395	.132	.163	-.130	.077	.000	.261	-.018
IT34	Soil and foundations	.551	.038	.015	.211	.069	.062	.253	.650	-.025
IT35	Solar systems	.400	.833	-.090	.116	.056	-.092	-.074	.118	-.052
IT36	Sound transmission	.512	.604	.141	.112	.157	.213	-.152	.340	.112
IT37	Steel	.636	-.022	.291	-.115	.055	.031	.306	.429	.221
IT38	Structural designs	.497	.258	.187	.121	.250	.291	.053	.604	.220
IT39	Structural tests and inspections	.729	.111	.428	.152	.159	.052	.217	.336	.020
IT40	Swimming pools	.403	.398	-.270	.045	-.113	.552	-.039	.416	.114
IT41	Type of construction	.041	.124	.207	.045	.169	.838	.021	.051	-.043
IT42	Weather condition such as humidity , dust and wind	.135	.053	.229	.667	.282	-.196	-.042	.159	-.001
IT43	Wood	.153	-.104	-.027	.841	-.125	.110	.131	.122	.163

Table 8.24: Matrix loading score for Overall Likelihood occurrences

8.5.4.4 Impact Factors of Social Part of BC

Total Variance Explained						
Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.149	53.721	53.721	2.149	53.721	53.721
2	.880	22.009	75.729			
3	.635	15.879	91.608			
4	.336	8.392	100.000			

Table 8.25: Total Variance Explained - impact factors of social part of BC

In Favour of impact factors of social part of BC, the Eigen value of the first factor in Table 8.25 is **2.149**. Hence, the proportion of the total test variance accounted by the first factor is **53.721**% (the figure given in percentage of variance column). In this analysis for cause factors of social part of BC, just one component carry Eigen values of one and more, and account for **53.721**% of the variance as shown in the cumulative percentage column. This means that the selected one component presents **53.721**% of the whole variance for the impact factors of social part of BC and less than 47% of original data is compromised.

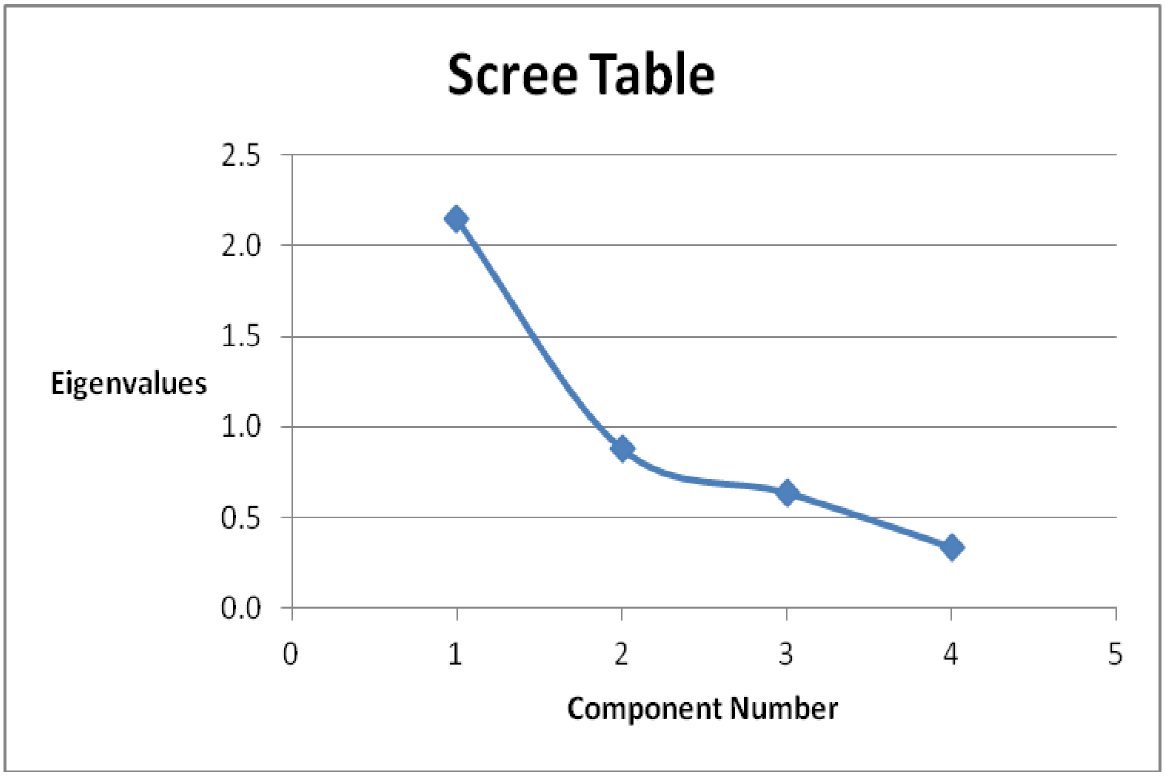

Figure 8.8: Scree plot of impact factors of technical part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.8 for impact factors of technical part of BC is defined between components one and two, where the figure curve connects to the points, starting to flatten out and be horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.26 presented shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rate of influence and high loading matrix can be distinguished. The same method and concept of factor loading score used previously with the likelihood occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important ones.

	Component Matrix a	
		Component
		1
IS2	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	.536
IS3	Weak power of law in enforcing correction decisions for violations	.751
IS4	No deterrent punishments for violators	.887
IS5	Absence of community awareness in building regulations and nature tasks of Municipality	.715

Table 8.26: Matrix loading score for Overall Likelihood occurrences

8.5.4.5 Components for the overall likelihood occurrence of impact factors on Public Safety

By applying factor analysis and data reduction in this survey, the questionnaire 59 impact factors are reduced to fourteen factors/components (one component for impact factors of legal part of BC, three components for impact factors of administrative, seven components for technical impact factors, one components for social impact factors), which are shown in Table 8.27 below. The percentages of variance of each component in Table 8.27 are extracted from Table 8.3. Common themes of the components were identified and each component was given new terms for reference.

Impact component	Extracted eigenvalue	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Impact factors aggregated to component following rotation	
				Factor loading score	Factor details
Component 1	**2.592**	**51.843**	**-**	**.711 .698 .665 .764 .757**	**IL1: Lack many of the technical requirements in building regulations in Kuwait** **IL2: Not taking into account the changes in building technology in current law** **IL3: Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)** **IL4: Inexistence of building materials testing system (because of the law)** **IL5: Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)**
Component 2	**2.779**	**39.698**	**28.990**	.816 .704 .693	**IA1:** Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects **IA3:** Improper Municipality technical and managerial capabilities to follow up and control building and construction works **IA4:** Unclear and inadequate procedures of review of building plans at Municipality
Component 3	**1.199**	**17.124**	**23.577**	.673 .885	**IA2:** lose and damage of documents and records of building projects at Kuwait Municipality **IA5:** Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform its responsibilities properly in controlling and following local construction works
Component 4	**1.088**	**15.536**	**19.792**	3.000 .727 .866	**IA6:** Neglecting of testing of building materials and concrete by certified testing centers during projects execution **IA7:** Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy
Component 5	**20.541**	**47.770**	**26.426**	0.49 0.65 0.65 0.69 0.80 0.85 0.82 0.78 0.75 0.67 0.74 0.77 0.83 0.64 0.73	IT1: Accessibility IT10: Energy conservation IT11: Existing structures IT15: Gypsum board and plaster IT19: Maintenance of drinking water cooler sets IT20: Masonry IT23: Plastic IT24: Plumbing systems IT25: Poor electric and lighting works during alteration, movement, and repairing IT26: Property maintenance IT27: Safeguards during construction IT28: Sanitation of exterior property areas IT29: Sewage disposal **IT37:** Steel **IT39:** Structural tests and inspections

Impact component	Extracted eigenvalue	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Impact factors aggregated to component following rotation	
				Factor loading score	**Factor details**
Component 6	**3.604**	**8.381**	**12.084**	611 .564 .479 .803 .711 .833 .604	**IT4:** Concrete and reinforce concrete works **IT13:** Gas piping installations **IT16:** Increase number of persons occupying housing unit **IT17:** Interior environment **IT32:** Site preparation **IT35:** Solar systems **IT36:** Sound transmission
Component 7	**3.054**	**7.103**	**9.367**	.771 .682 .579 .538	**IT3:** Boilers/water heaters **IT6:** Demolition of buildings and facilities **IT21:** Mechanical systems **IT30:** Sheds and Car metal shed
Component 8	**2.138**	**4.973**	**8.123**	.671 .656 .667 .841	**IT7:** Electrical works **IT18:** Interior finishes **IT42:** Weather condition such humidity , dust and wind condition **IT43:** Wood
Component 9	**2.093**	**4.868**	**6.921**	.667 .790 .509	**IT5:** Construction equipment **IT14:** Glass and glazing **IT31:** Signs
Component 10	**1.736**	**4.036**	**6.584**	.612 .552 .838	**IT2:** Aluminium **IT40:** Swimming pools **IT41:** Type of construction
Component 11	**1.405**	**3.268**	**5.946**	.593 .713 .511 .604	**IT9:** Encroachments into public right of way **IT12:** Exterior walls **IT13:** Gas piping installations **IT22:** Parking
Component 12	**2.149**	**53.721**	**-**	.536 .751 .887 .715	**IS2:** Ineffective engineering supervision and inspection tasks to prevent violations or cheatings **IS3:** Weak of power of law in enforcing correction decisions of violations **IS4:** No deterrent punishments for violators **IS5:** Absence of community awareness in building regulations and nature tasks of Municipality

Table 8.27: Components for the overall likelihood occurrences of impact factors on Public Safety

8.5.5 Overall Likelihood of occurrence of impact factors on Public Health

As the interpretation of the Eigen values correlation matrix of the factor analysis already being explained in the previous section (Section 8.4.4), the next few sections will explain only the most relevant data for impact factors on Public Health.

8.5.5.1 Impact Factors of Legal Part of BC

Total Variance Explained						
	Initial Eigen values			Extraction Sums of Squared Loadings		
Components	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.481	69.621	69.621	3.481	69.621	69.621
2	.685	13.697	83.318			
3	.359	7.186	90.504			
4	.253	5.065	95.569			
5	.222	4.431	100.000			

Table 8.28: Total Variance Explained - impact factors of legal part of BC

Regarding the impact factors of legal part of BC, the Eigen value of the first factor in Table 8.28, is **3.481**. Hence, the proportion of the total test variance accounted by the first factor is **69.621**% (the figure given in percentage of variance column). In this analysis for cause factors of legal part of BC, just one component carry Eigen values of one and more, and accounts for **69.621**% of the variance as shown in the cumulative percentage column. This means that the selected one components present **69.621**% of the whole variance for the impact factors of legal part of BC and less than 31% of original data is compromised.

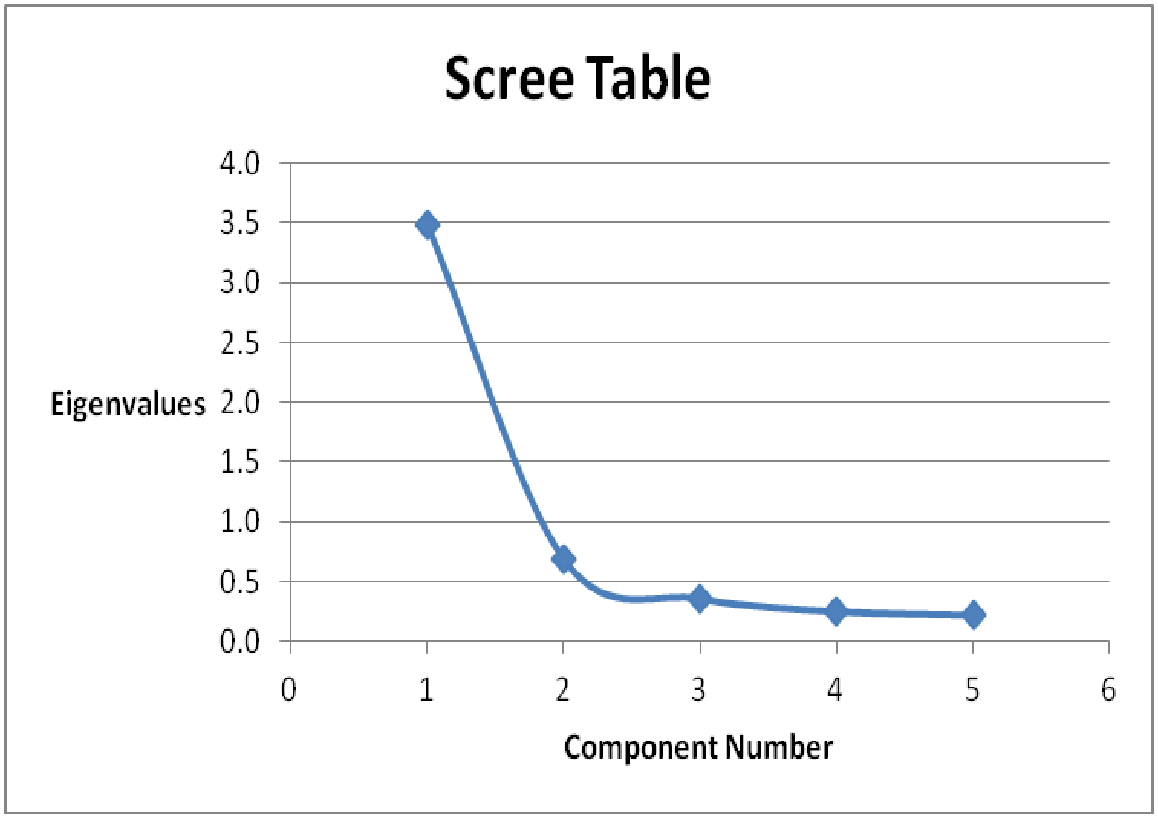

Figure 8.9: Scree plot of impact factors of legal part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.9 for impact factors of legal part of BC is defined between components 1 and 2, where the figure curve connects to the points, starting to flatten out and is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.29 presented, shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rate of influence and high loading matrix can be distinguished. The same method and concept of factor loading score used previously with the likelihood occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important impact factors.

	Component Matrix[a]	
		Component
		1
IL1	Lacks many technical requirements in building regulations in Kuwait	.867
IL2	Not taking into account the changes in building technology in current law	.868
IL3	Inexistence of testing and certification system building engineers, contractors, and skilled labours (because of the law)	.849
IL4	Inexistence of building materials testing for system (because of the law)	.658
IL5	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	.907

Table 8.29: Matrix loading score for Overall Likelihood occurrences

8.5.5.2 Impact Factors of Administrative Part of BC

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.862	55.168	55.168	3.862	55.168	55.168	3.308	47.253	47.253
2	1.210	17.283	72.451	1.210	17.283	72.451	1.764	25.198	72.451
3	.750	10.720	83.171						
4	.416	5.936	89.107						
5	.349	4.988	94.095						
6	.281	4.017	98.113						
7	.132	1.887	100.000						

Table 8.30: Total Variance Explained - impact factors of Administrative Part of BC

In relation to impact factors of Administrative Part of BC, the Eigen value of the first factor in Table 8.30, is **3.481**. Hence, the proportion of the total test variance accounted by the first factor is **69.621**% (the figure given in percentage of variance column). In this analysis for cause factors of Administrative Part of BC, just two components carry Eigen values of one and more, and account for **69.621**% of the variance as shown in the cumulative percentage column. This means that the selected two components present 69.621% of the whole variance for the impact factors of Administrative Part of BC and less than 31% of original data is compromised.

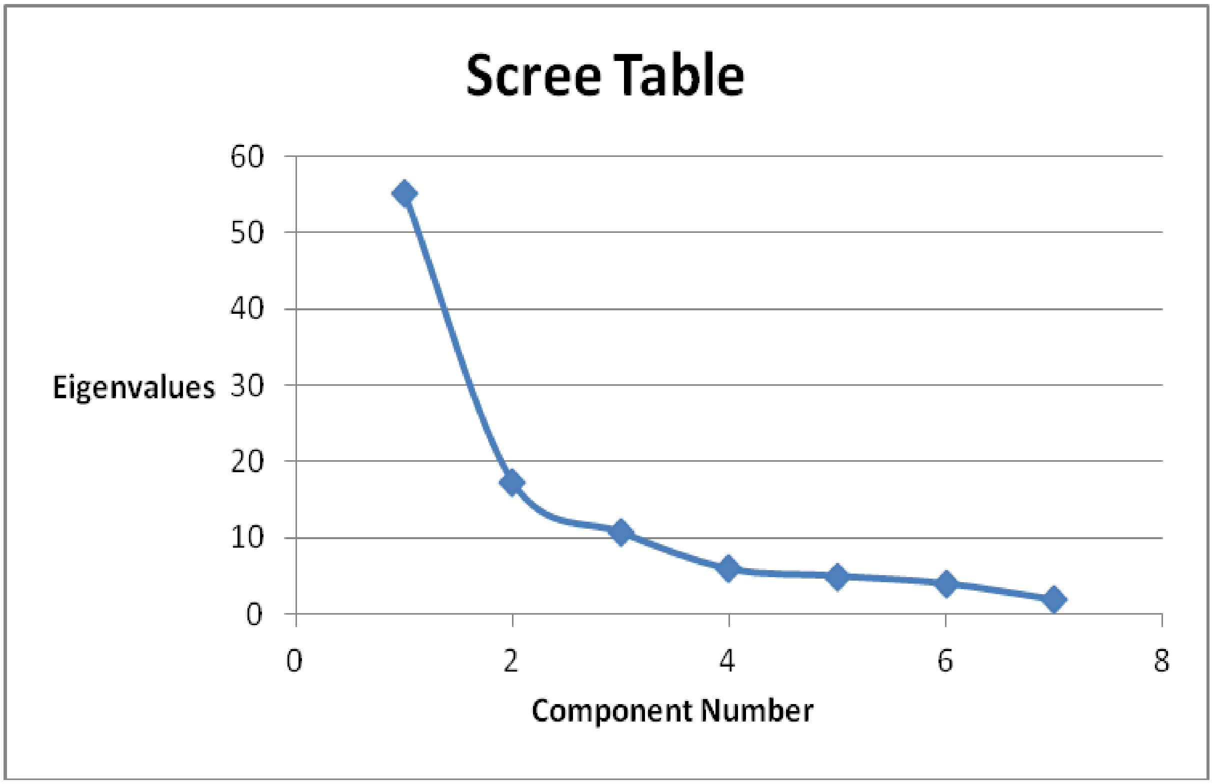

Figure 8.10: Scree plot of impact factors of Administrative Part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.10 for impact factors of Administrative Part of BC is defined between components two and three, where as the figure curve connects to the points, starting to flatten out and be horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.31 presented, shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rate of influence and high loading matrix can be distinguished. The shaded values in Table 8.31, show the items cluster into these two groups defined by high loadings.

The same method and concept of factor loading score used previously with the likelihood occurrence of legal/ technical cause factors (Section 8.4.4), is also used for the impact factors in extracting the most important impact factors.

	Rotated Component Matrix[a]		
		Component	
		1	2
IA1	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	.597	.211
IA2	lose and damage of documents and records of building projects at Kuwait Municipality	.897	.003
IA3	Improper capabilities of Municipality in technical and managerial sides to follow up and control building and construction works	.835	.268
IA4	Unclear and inadequate procedures of review of building plans at Municipality	.927	.121
IA5	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	.566	.604
IA6	Neglecting of testing of building materials and concrete by certified testing centres during projects execution	.515	.642
IA7	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	-.065	.925

Table 8.31: Matrix loading score for Overall Likelihood occurrences

8.5.5.3 Impact Factors of Technical Part of BC

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.348	47.320	47.320	20.348	47.320	47.320	6.825	15.871	15.871
2	3.529	8.206	55.526	3.529	8.206	55.526	6.277	14.597	30.469
3	2.337	5.434	60.960	2.337	5.434	60.960	5.053	11.751	42.220
4	1.887	4.388	65.349	1.887	4.388	65.349	3.849	8.951	51.171
5	1.713	3.983	69.332	1.713	3.983	69.332	3.832	8.912	60.083
6	1.482	3.447	72.779	1.482	3.447	72.779	3.272	7.609	67.692
7	1.284	2.985	75.764	1.284	2.985	75.764	2.536	5.897	73.589
8	1.215	2.826	78.590	1.215	2.826	78.590	2.150	5.001	78.590
9	.997	2.319	80.909						
10	.956	2.223	83.133						

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
11	.926	2.154	85.286						
12	.722	1.680	86.966						
13	.692	1.610	88.576						
14	.598	1.390	89.967						
15	.562	1.307	91.274						
16	.472	1.097	92.370						
17	.441	1.026	93.396						
18	.365	.849	94.245						
19	.309	.718	94.963						
20	.269	.626	95.589						
21	.236	.549	96.137						
22	.227	.528	96.665						
23	.204	.475	97.140						
24	.156	.363	97.503						
25	.149	.347	97.850						
26	.136	.317	98.167						
27	.127	.294	98.461						
28	.113	.262	98.724						
29	.098	.227	98.951						
30	.079	.184	99.135						
31	.071	.165	99.300						
32	.061	.141	99.442						
33	.051	.120	99.561						
34	.044	.102	99.663						
35	.041	.096	99.759						
36	.030	.069	99.828						
37	.022	.051	99.879						
38	.016	.038	99.916						
39	.014	.032	99.949						
40	.011	.027	99.975						
41	.005	.012	99.987						
42	.004	.009	99.996						
43	.002	.004	100.000						

Table 8.32: Total Variance Explained - impact factors of legal part of BC

Regarding the impact factors of technical part of BC, the Eigen value of the first factor in Table 8.32, is **20.348**. Hence, the proportion of the total test variance accounted by the first factor is **47.32**% (the figure given in percentage of variance column). In this analysis for cause factors of technical part of BC, just eight components carry Eigen values of one and more, and account for **78.590**% of the variance as shown in the cumulative percentage column. This means that the selected eight components presents **78.590**% of the whole variance for the impact factors of technical part of BC and less than 22% of original data is compromised.

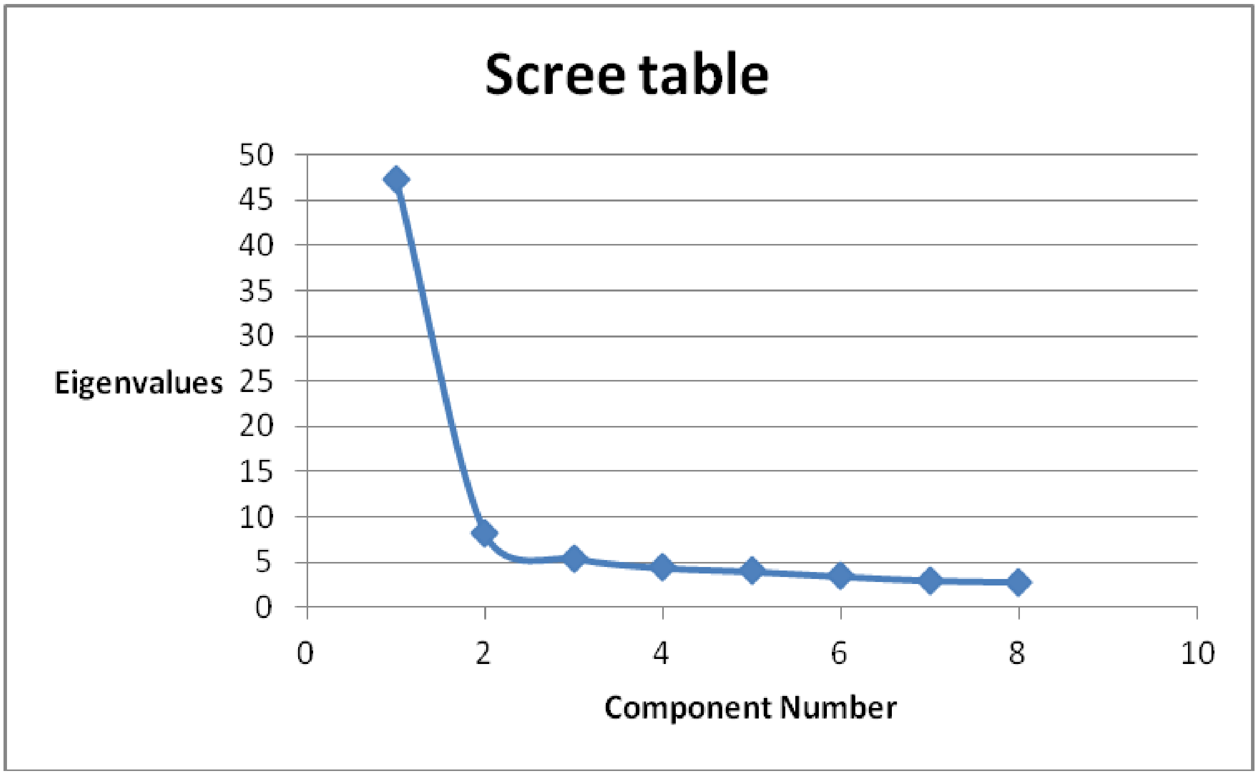

Figure 8.11: Scree plot of impact factors on technical part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.11 for impact factors on technical part of BC is defined between components 8 and 9, where the figure curve connects to the points, starting to flatten out and be horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.33 presented, shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rates of influence and high loading matrix which can be distinguished. The shaded values in Table 8.33, show the items cluster into these eight groups defined by high loadings. The same method and concept of factor loading score used previously with the likelihood occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important ones.

	Rotated Component Matrix[a]								
		Component							
		1	2	3	4	5	6	7	8
IT1	Accessibility	.128	.013	.632	-.061	.405	.334	-.003	
IT2	Aluminium	.253	.175	.421	.563	.154	.031	.200	.271
IT3	Boilers/water heaters	.135	.096	.100	.093	.066	.168	.073	.786
IT4	Concrete and reinforce concrete works	.304	.032	.120	.043	.619	.418	.328	
IT5	Construction equipment	-.042	-.075	.463	.204	.244	.491	.377	.108
IT6	Demolition of buildings and facilities	.006	.178	.229	.174	.119	-.054	.766	.081
IT7	Electrical works	.429	.162	.329	.218	.433	.084	.285	
IT8	Elevators and conveying systems	.200	.124	.500	.369	.560	.303	-.020	
IT9	Encroachments into public right of way	.281	.050	.324	.609	-.006	.280	.296	.133
IT10	Energy conservation	.146	.010	.572	.488	.114	.275	.317	
IT11	Existing structures	.058	.260	.423	.606	.248	-.021	.345	
IT12	Exterior walls	.497	.213	.190	.353	.183	-.062	.453	
IT13	Gas piping installations	.523	.053	.105	.213	.044	.195	.603	.227
IT14	Glass and glazing	.536	.173	-.078	.151	.338	.158	.481	.292
IT15	Gypsum board and Plaster	.332	.317	.156	.663	.161	.214	.149	.112
IT16	Increase number of persons occupying housing unit	.797	.301	.100	.234	.207	.193	.064	.095
IT17	Interior environment	.711	.217	.178	.372	.165	.067	.184	
IT18	Interior finishes	.103	.216	.645	.062	.118	.048	.202	.480
IT19	Maintenance of drinking water cooler sets	.526	.333	.234	.356	.392	-.050	-.044	.207
IT20	Masonry	.370	.421	.183	.233	.533	-.022	-.003	.299
IT21	Mechanical systems	.258	.375	.164	.081	.690	.146	.279	.099
IT22	Parking	.435	.379	.086	.449	.488	.147	.117	.119
IT23	Plastic	.464	.327	.059	.356	.571	.077	.032	.199
IT24	Plumbing systems	.629	.298	.215	.325	.353	.181	-.072	.173
IT25	Poor electric and lighting works during alteration, movement, and repairing	.778	.347	.125	.012	.117	.163	.066	.053
IT26	Property maintenance	.585	.444	.319	-.041	.282	.278	.015	.032

	Rotated Component Matrix[a]								
		Component							
		1	2	3	4	5	6	7	8
IT27	Safeguards during construction	.636	.458	.060	.174	.312	.000	.228	.182
IT28	Sanitation of exterior property areas	.622	.248	.320	.018	-.081	.199	.150	.471
IT29	Sewage disposal	.271	.802	.243	.218	.089	.044	-.001	.187
IT30	Sheds and Cars' metal sheds	.336	.767	.130	.249	-.034	.217	.046	
IT31	Signs	.561	.624	.268	.091	.089	.034	-.072	.098
IT32	Site preparation	.191	.781	-.009	.176	.226	.016	.214	.042
IT33	Smoke detectors for houses	.392	.766	.074	.098	.127	.168	.055	.010
IT34	Soil and foundations	-.029	.664	.162	.166	.431	.387	.118	.040
IT35	Solar systems	.302	.701	.120	-.060	.222	.130	.238	.297
IT36	Sound transmission	.257	.423	.218	.011	.055	.695	-.039	.038
IT37	Steel	.117	.326	-.107	.456	.302	.522	-.003	.263
IT38	Structural design	.142	.112	.274	.264	.241	.734	-.003	.191
IT39	Structural tests and inspections	.423	.251	.222	.453	.217	.424	.067	.081
IT40	Swimming pools	.184	.216	.648	-.005	-.019	.442	.038	.231
IT41	Type of construction	.269	.414	.463	.077	-.114	.383	.185	.223
IT42	Weather condition such as humidity , dust and wind	.138	.104	.792	.277	.097	.107	.100	.045
IT43	Wood	.164	.164	.805	.212	.064	-.027	.076	.079

Table 8.33: Matrix loading score for Overall Likelihood occurrences

8.5.5.4 Impact Factors of Social Part of BC

Total Variance Explained						
Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.415	60.380	60.380	2.415	60.380	60.380
2	.830	20.751	81.131			
3	.440	11.003	92.134			
4	.315	7.866	100.000			

Table 8.34: Total Variance Explained - impact factors on Legal part of BC

In relation to the impact factors of social part of BC, the Eigen value of the first factor in Table 8.34, is **2.415**. Hence, the proportion of the total test variance accounted by the first factor is **60.38**% (the figure given in percentage of variance column). In this analysis for cause factors of social part of BC, just one components carries Eigen values of one and more, and account for **60.38**% of the variance as shown in the cumulative percentage column. This means that the selected one component presents **60.380**% of the whole variance for the impact factors of social part of BC and less than 40% of original data is compromised.

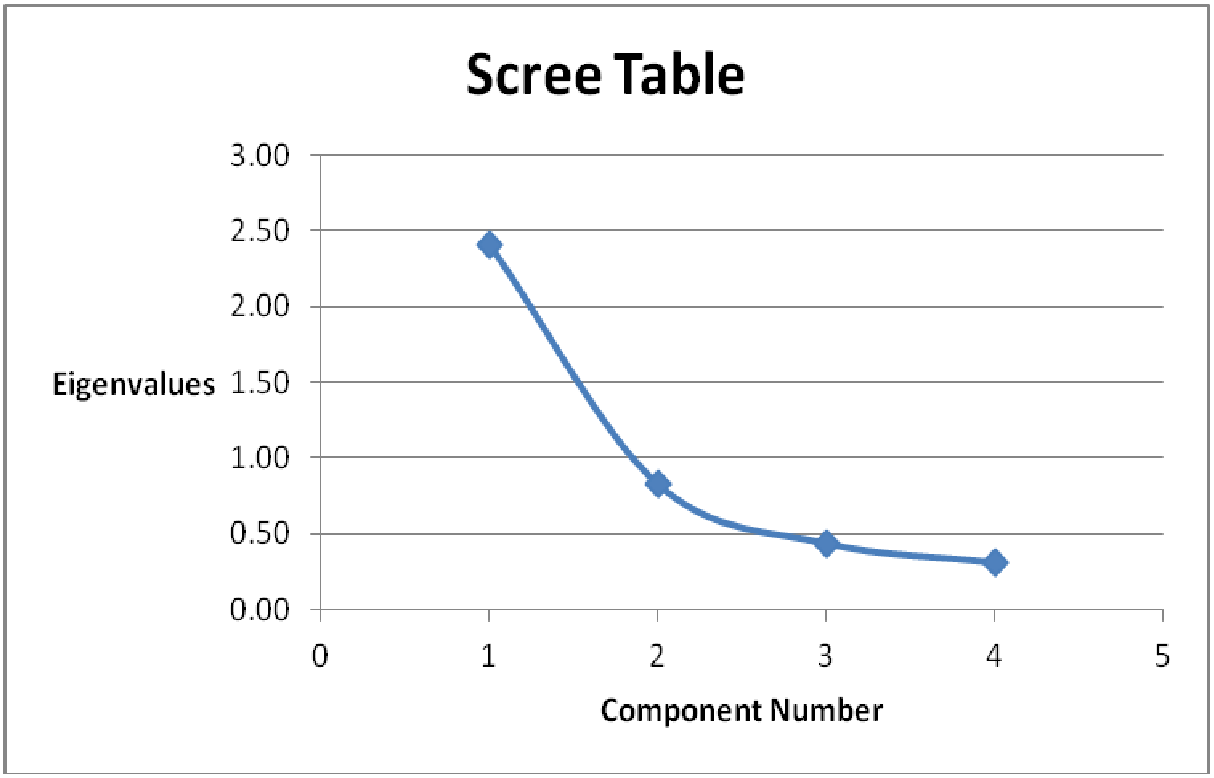

Figure 8.12: Scree plot of impact factors on Social part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.12 for impact factors of Social part of BC is defined between components one and two, where the figure curve connects to the points is starting to flatten out and is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.35 presented shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rates of influence and high loading matrix can be distinguished. The same method and concept of factor loading score used previously with the likelihood occurrences of cause factors of legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important ones.

	Component Matrix[a]	
		Component
		1
IS2	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	.821
IS3	Weak power of law in enforcing correct decisions of violations	.800
IS4	No deterrent punishments for violators	.883
IS5	Absence of community awareness in building regulations and nature tasks of Municipality	.566

Table 8.35: Matrix loading score for Overall Likelihood occurrences

8.5.5.5 Components for the overall likelihood occurrences of impact factors on Public Health

By applying factor analysis and data reduction in this survey, the questionnaire 59 impact factors are reduced to 14 factors/components (one component for impact factors of legal part of BC, three components for administrative impact factors, nine components for technical impact factors, one component for social impact factors), which are shown in Table 8.36 below. The percentages of variance of each component in Table 8.36 are extracted from Table 8.3. Common themes of the components were identified and each component was given new terms for reference.

Impact component	Extracted eigenvalue	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Impact factors aggregated to component following rotation	
				Factor loading score	Factor details
Component 1	3.481	69.621	-	.867 .868 .849 .658 .907	IL1:Lack many of the technical requirements in building regulations in Kuwait IL2:Not taking into account the changes in building technology in current law IL3:Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law) IL4:Inexistence of building materials testing system (because of the law) IL5:Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)
Component 2	3.862	55.168	47.253	.597 .897 .835 .927	IA1:Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects IA2:lose and damage of documents and records of building projects at Kuwait Municipality IA3:Improper Municipality technical and managerial capabilities to follow up and control building and construction works IA4:Unclear and inadequate procedures of review of building plans at Municipality
Component 3	1.210	17.283	25.198	.604 .642 .925	IA5:Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform its responsibilities properly in controlling and following local construction works IA6:Neglecting of testing of building materials and concrete by certified testing centers during projects execution IA7:Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy
Component 4	20.348	47.320	15.871	.497 .523 .536 .797 .711 .526 .629 .778 .585 .636 .622	IT12: Exterior walls IT13: Gas piping installations IT14: Glass and glazing IT16: Increase number of persons occupying housing unit IT17: Interior environment IT19: Maintenance of drinking water cooler sets IT24: Plumbing systems IT25: Poor electric and lighting works during alteration, movement, and repairing IT26; Property maintenance IT27: Safeguards during construction IT28: Sanitation of exterior property areas
Component 5	3.529	8.206	14.597	.802 .767 .624 .781 .766 .664 .701	IT29: Sewage disposal IT30: Sheds and Car metal shed IT31: Signs IT32: Site preparation IT33: Smoke detectors for houses IT34: Soil and foundations IT35: Solar systems

Impact component	Extracted eigenvalue	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Impact factors aggregated to component following rotation	
				Factor loading score	Factor details
Component 6	2.337	5.434	11.751	.632 .572 .645 .648 .463 .792 .805	IT1: Accessibility IT10: Energy conservation IT18: Interior finishes IT40: Swimming pools IT41: Type of construction IT42: Weather condition such humidity , dust and wind condition IT43: Wood
Component 7	1.887	4.388	8.951	.563 .609 .606 .663	IT2: Aluminium IT9: Encroachments into public right of way IT11: Existing structures IT15: Gypsum board and plaster
Component 8	1.713	3.983	8.912	.619 .433 .560 .533 .690 .488 .571	IT4: Concrete and reinforce concrete works IT7: Electrical works IT8: Elevators and conveying systems IT20: Masonry IT21: Mechanical systems IT22: Parking IT23: Plastic
Component 9	1.482	3.447	7.609	.695 .522 .734 .424	IT36: Sound transmission IT37: Steel IT38: Structural design IT39: Structural tests and inspections
Component 10	1.284	2.985	5.897	.766 .603	IT6: Demolition of buildings and facilities IT13: Gas piping installations
Component 11	2.415	60.380	-	.821 .800 .883	IS2:Ineffective engineering supervision and inspection tasks to prevent violations or cheatings IS3:Weak of power of law in enforcing correction decisions of violations IS4:No deterrent punishments for violators

Table 8.36: Components for the overall likelihood occurrence for impact factors on Public Health

8.5.6 Overall Likelihood occurrence of impact factors on Public Welfare

As the interpretation of the Eigen values correlation matrix to the factor analysis already being explained in the previous section (Section 8.4.4), the next few sections will explain only the most relevant data for the impact factors on Public Welfare.

8.5.6.1 Impact Factors of Legal Part of BC

Total Variance Explained						
	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.646	72.924	72.924	3.646	72.924	72.924
2	.627	12.538	85.462			
3	.370	7.404	92.866			
4	.192	3.848	96.714			
5	.164	3.286	100.000			

Table 8.37: Total Variance Explained - impact factors of legal part of BC

For impact factors of legal part of BC, the Eigen value of the first factor in Table 8.37, is 3.646. Hence, the proportion of the total test variance accounted by the first factor is 72.924% (the figure given in percentage of variance column). In this analysis for cause factors of legal part of BC, just one components carries Eigen values of one and more, and account for 72.924% of the variance as shown in the cumulative % column. This means that the selected 1 component presents 72.924% of the whole variance for the impact factors of legal part of BC and less than 28% of original data is compromised.

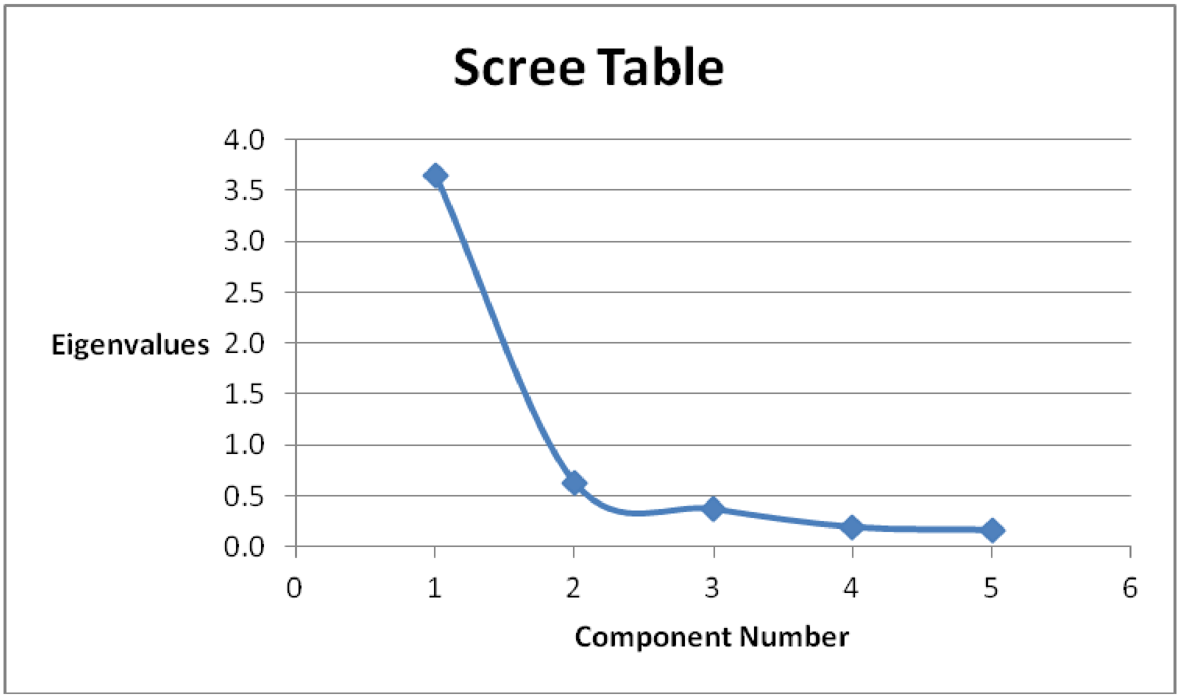

Figure 8.13: Scree plot of impact factors of legal part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.13 for impact factors of legal part of BC is defined between components 1 and 2, where the figure curve connects to the points, starting to flatten out and it is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.38 presented, shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rates of influence and high loading matrix can be distinguished. The same method and concept of factor loading score used previously with the likelihood occurrence of legal /technical cause factors (Section 8.4.4), is also used for the impact factors in extracting the most important impact factors.

	Component Matrix[a]	
		Component
		1
IL1	Lacks many technical requirements in building regulations in Kuwait	.811
IL2	Not taking into account the changes in building technology in current law	.762
IL3	Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	.872
IL4	Inexistence of building materials testing system (because of the law)	.909
IL5	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	.905

Table 8.38: Matrix loading score for Overall Likelihood occurrences

8.5.6.2 Impact Factors of Administrative Part of BC

Total Variance Explained						
	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.053	72.184	72.184	5.053	72.184	72.184
2	.697	9.962	82.146			
3	.499	7.132	89.278			
4	.239	3.414	92.692			
5	.197	2.819	95.511			
6	.173	2.466	97.978			
7	.142	2.022	100.000			

Table 8.39: Total Variance Explained - impact factors of Legal part of BC

For impact factors of Administrative part of BC, the Eigen value of the first factor in Table 8.6, is **5.053**. Hence, the proportion of the total test variance accounted by the first factor is **72.184**% (the figure given in percentage of variance column). In this analysis for cause factors of Administrative Part of BC, just one component carries Eigen values of one and more, and accounts for **72.18**% of the variance as shown in the cumulative percentage column. This means that the selected one component presents **72.18**% of the whole variance for the impact factors of Administrative Part of BC and less than 28% of original data is compromised.

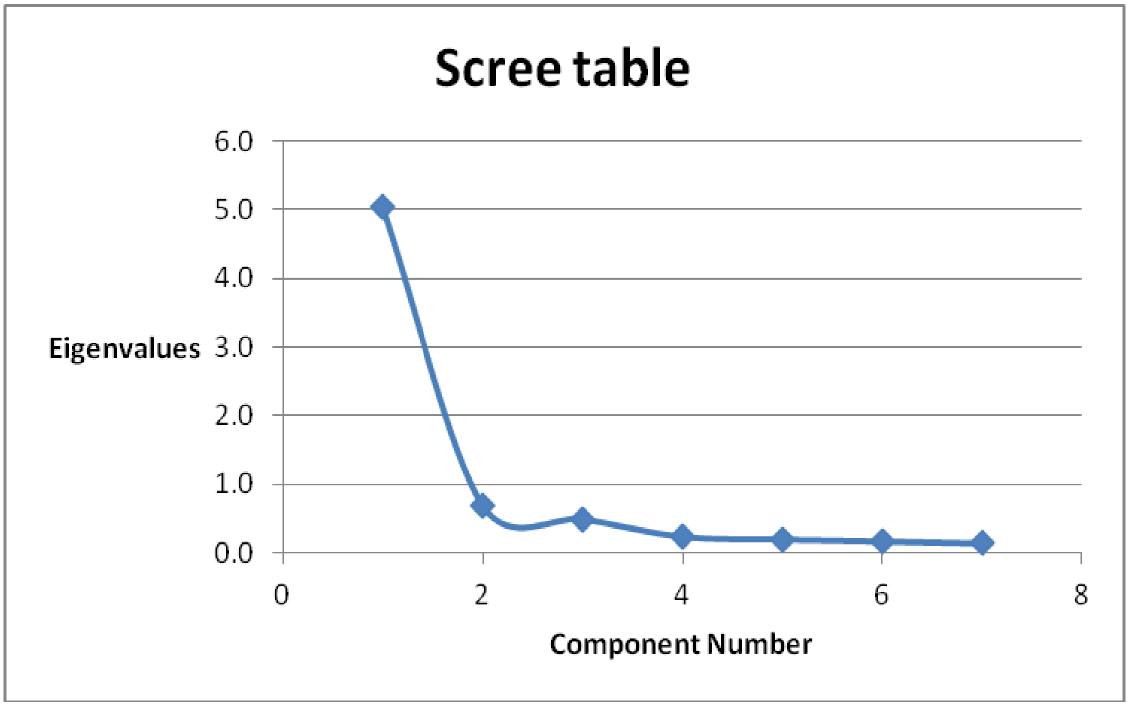

Figure 8.14: Scree plot of impact factors of Administrative part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.14 for impact factors of Administrative Part of BC is defined between components 1 and 2, where the figure curve connects to the points, starting to flatten out and it is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.40 presented, shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rates of influence and high loading matrix can be distinguished. The shaded values in Table 8.40, show the items cluster into these two groups defined by high loadings. The same method and concept of factor loading score used previously with the likelihood of occurrence of technical cause factors (Section 8.4.4), is also used for the impact factors in extracting the most important impact factors.

	Component Matrix[a]	
		Component
		1
IA1	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	.840
IA2	lose and damage of documents and records of building projects at Kuwait Municipality	.847
IA3	Improper technical Municipality technical and managerial capabilities to follow up and control building and construction works	.909
IA4	Unclear and inadequate procedures of review of building plans at municipality	.881
IA5	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform its responsibilities properly in controlling and following local construction works	.820
IA6	Neglecting of testing of building materials and concrete by certified testing centers during projects execution	.842
IA7	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	.803

Table 8.40: Matrix loading score for Overall Likelihood occurrences

8.5.6.3 Impact Factors of Technical Part of BC

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	26.760	62.234	62.234	26.760	62.234	62.234	8.097	18.830	18.830
2	2.593	6.030	68.264	2.593	6.030	68.264	7.807	18.156	36.985
3	1.791	4.166	72.430	1.791	4.166	72.430	5.280	12.280	49.265
4	1.394	3.243	75.673	1.394	3.243	75.673	5.215	12.127	61.393
5	1.267	2.947	78.620	1.267	2.947	78.620	4.507	10.481	71.874
6	1.042	2.423	81.042	1.042	2.423	81.042	3.942	9.168	81.042
7	.971	2.258	83.300						
8	.838	1.948	85.248						
9	.771	1.792	87.040						
10	.568	1.321	88.361						
11	.526	1.223	89.584						
12	.483	1.124	90.708						
13	.458	1.065	91.773						

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
14	.417	.969	92.742						
15	.337	.784	93.526						
16	.322	.748	94.274						
17	.301	.701	94.974						
18	.258	.601	95.576						
19	.241	.560	96.136						
20	.208	.485	96.621						
21	.186	.433	97.053						
22	.174	.406	97.459						
23	.167	.389	97.848						
24	.135	.313	98.161						
25	.116	.269	98.430						
26	.100	.232	98.662						
27	.091	.213	98.874						
28	.085	.197	99.072						
29	.069	.160	99.232						
30	.057	.133	99.365						
31	.051	.120	99.485						
32	.048	.113	99.598						
33	.040	.094	99.691						
34	.033	.076	99.767						
35	.026	.061	99.828						
36	.021	.049	99.877						
37	.019	.044	99.921						
38	.012	.028	99.949						
39	.009	.022	99.971						
40	.006	.013	99.984						
41	.003	.008	99.991						
42	.003	.007	99.998						
43	.001	.002	100.000						

Table 8.41: Total Variance Explained - impact factors of technical part of BC

For impact factors of technical part of BC, the Eigen value of the first factor in Table 8.6, is **26.760**. Hence, the proportion of the total test variance accounted by the first factor is **62.234**% (the figure given in percentage of variance column). In this analysis for cause factors of technical part of BC, just six components carry Eigen values of 1 and more, and account for **81.042**% of the variance as shown in the cumulative percentage column. This means that the selected 6 components present **81.042**% of the whole variance for the impact factors of technical part of BC and less than 19% of original data is compromised.

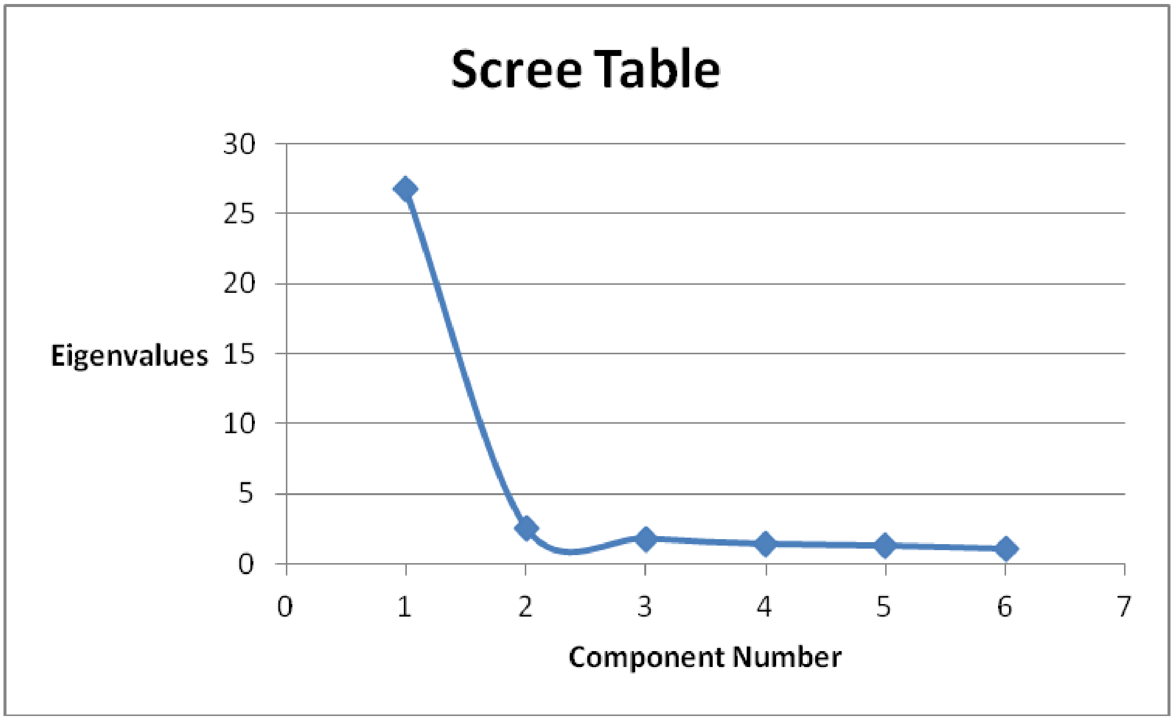

Figure 8.15: Scree plot of impact factors of technical part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.15 for impact factors of technical part of BC is defined between components 6 and 7, where the figure curve connects to the points, starting to flatten out and it is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.42 presented, shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rates of influence and high loading matrix can be distinguished. The shaded values in Table 8.42, show the items cluster into these six groups defined by high loadings. The same method and concept of factor loading score used previously with the likelihood occurrence of legal/technical cause factors (Section 8.4.4), is also used for the impact factors in extracting the most important ones.

	Rotated Component Matrix[a]						
		Component					
		1	2	3	4	5	6
IT1	Accessibility	.356	.605	-.093	.361	.113	.309
IT2	Aluminium	.769	.372	.145	.131	.091	.108
IT3	Boilers/water heaters	.525	.615	-.037	.359	.215	-.069
IT4	Concrete and reinforce concrete works	.697	.311	-.025	.023	.315	.217
IT5	Construction equipment	.323	.694	.143	.204	.321	.241
IT6	Demolition of buildings and facilities	.376	.704	.130	.199	.179	.309
IT7	Electrical works	.705	.052	.322	.168	.190	.421
IT8	Elevators and conveying systems	.343	.229	.429	.233	.182	.654
IT9	Encroachments into public right of way	.312	.709	.247	.157	.080	.228
IT10	Energy conservation	.321	.304	.136	.390	.157	.647
IT11	Existing structures	.374	.609	.331	.144	.173	-.025
IT12	Exterior walls	.502	.277	.602	.289	.153	.248
IT13	Gas piping installations	.557	.252	.569	.116	.143	.346
IT14	Glass and glazing	.693	.054	.380	.496	.042	.036
IT15	Gypsum board and plaster	.128	.531	.197	.575	.284	.249
IT16	Increase number of persons occupying housing unit	.776	.223	.282	.255	.154	.153
IT17	Interior environment	.796	.104	.357	.205	.175	.160
IT18	Interior finishes	.372	.489	.239	.512	.050	.345
IT19	Maintenance of drinking water cooler sets	.569	.388	.176	.283	.164	.492
IT20	Masonry	.489	.266	.147	.450	.199	.409
IT21	Mechanical systems	.627	.253	.333	.339	.214	.220
IT22	Parking	.403	.213	.236	.702	.117	.230
IT23	Plastic	.459	.205	.298	.631	.141	.336
IT24	Plumbing systems	.310	.342	.180	.440	.329	.549
IT25	Poor electric and lighting works during alteration, movement, and repairing	.456	.357	.216	.506	.361	.222
IT26	Property maintenance	.379	.412	.257	.458	.385	.203
IT27	Safeguards during construction	.352	.429	.310	.586	.336	.133
IT28	Sanitation of exterior property areas	.203	.476	.384	.444	.457	.265
IT29	Sewage disposal	.048	.458	.365	.497	.360	.398
IT30	Sheds and Cars metal sheds	.334	.454	.458	.241	.261	.297
IT31	Signs	.295	.289	.808	.248	.153	.080
IT32	Site preparation	.357	.264	.770	.212	.180	.127
IT33	Smoke detectors for houses	.248	.256	.645	.145	.417	.295
IT34	Soil and foundations	.073	.291	.449	.433	.526	.290
IT35	Solar systems	.534	.285	.385	.267	.434	.036
IT36	Sound transmission	.167	.219	.285	.371	.689	.020
IT37	Steel	.304	.274	.194	.101	.823	.073

	Rotated Component Matrix[a]						
		Component					
		1	2	3	4	5	6
IT38	Structural design	.202	.291	.046	.047	.752	.307
IT39	Structural tests and inspections	.195	.529	.277	.233	.379	.415
IT40	Swimming pools	.294	.619	.295	.217	.314	.372
IT41	Type of construction	.152	.637	.371	.183	.282	.398
IT42	Weather condition such as humidity , dust and wind	.193	.725	.259	.257	.192	.160
IT43	Wood	-.117	.551	.245	.013	.264	-.046

Table 8.42: Matrix loading score for Overall Likelihood occurrences

8.5.6.4 Impact Factors of Social Part of BC

Total Variance Explained						
Component	**Initial Eigen values**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	**2.897**	**72.420**	**72.420**	**2.897**	**72.420**	**72.420**
2	**.480**	**12.000**	**84.420**			
3	**.349**	**8.721**	**93.141**			
4	**.274**	**6.859**	**100.000**			

Table 8.43: Total Variance Explained - impact factors of Social part of BC

Regarding the impact factors of social part of BC, the Eigen value of the first factor in Table 8.6, is **2.897**. Hence, the proportion of the total test variance accounted by the first factor is **72.420**% (the figure given in percentage of variance column). In this analysis for cause factors of social part of BC, just one component carries Eigen values of one and more, and accounts for **72.420**% of the variance as shown in the cumulative percentage column. This means that the selected one component presents **72.420**% of the whole variance for the impact factors of social part of BC and less than 28% of original data is compromised

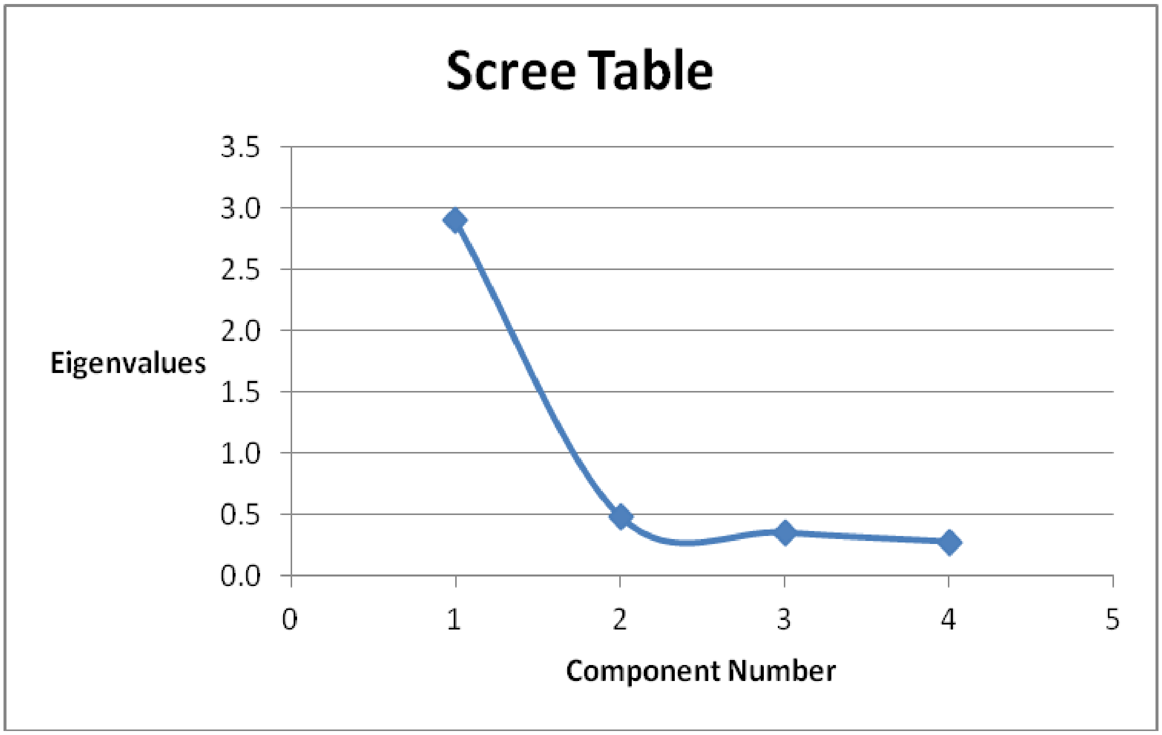

Figure 8.16: Scree plot of impact factors of Social part of BC for Overall likelihood occurrences

The point of interest in the Scree plot in Figure 8.16 for impact factors of Social part of BC is defined between components 1 and 2, where the figure curve connects to the points, starting to flatten out and it is horizontal (For details for the interpretation of Scree Plot refer to Section 8.4.4).

Table 8.44 presented, shows the degree of influence of each impact factor in the survey, and the impact factors with the highest rates of influence and high loading matrix can be distinguished. The same method and concept of factor loading score used previously with the likelihood occurrence of cause factors of legal/technical (Section 8.4.4), is also used for the impact factors in extracting the most important ones.

	Component Matrix[a]	
		Component
		1
IS2	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	.836
IS3	Weak of power of law in enforcing correction decisions of violations	.878
IS4	No deterrent punishments for violators	.846
IS5	Absence of community awareness in building regulations and nature tasks of Municipality	.844

Table 8.44: Matrix loading score for Overall Likelihood occurrences

8.5.6.5 Components for the overall likelihood occurrence of impact factors on Public Welfare

The most important and influential impact factors of each component are extracted to form a reduced list of impact factors, which are highly manageable without losing a large amount of data. Factor analysis helps to analyse the factors, and categorises the factors according to their relationship and correlations to each other in this survey. By applying factor analysis and data reduction in this survey, the questionnaire 54 impact factors are reduced to 14 factors/components (3 components for impact factors of legal part of BC, 9 components for impact factors of administrative, 2 components for impact factors of technical, 2 components for impact factors of social), which are shown in Tables 8.5, 8.6, and 8.45 below. The percentages of variance of each component in Table 8.5 are extracted from Table 8.3. Common themes of the components were identified and each component was given new terms for reference.

Impact component	Extracted Eigen value	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Impact factors aggregated to component following rotation	
				Factor loading score	Factor details
Component 1	**3.646**	**72.924**	**-**	**.811 .762 .872 .909 .905**	**IL1: Lacks many technical requirements in building regulations in Kuwait** **IL2: Not taking into account the changes in building technology in current law** **IL3: Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)** **IL4: Inexistence of building materials testing system (because of the law)** **IL5: Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)**
Component 2	**5.053**	**72.184**	**-**	**.840 .847 .909 .881 .820 .842 .803**	**IA1: Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects** **IA2: lose and damage of documents and records of building projects at Kuwait Municipality** **IA3: Improper capabilities of Municipality in technical and managerial sides to follow up and control building and construction works** **IA4: Unclear and inadequate procedures of review of building plans at Municipality** **IA5: Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works** **IA6: Neglecting the testing of building materials and concrete by certified testing centres during projects execution** **IA7: Municipality, Fire-fighting and Electricity are not performing periodical inspections after linking electricity and building occupancy**
Component 3	**26.760**	**62.234**	**18.830**	**.769 .697 .705 .502 .557 .693 .776 .796 .569 .489 .627 .534**	**IT2:** Aluminium **IT4:** Concrete and reinforce concrete works **IT7:** Electrical works **IT12:** Exterior walls **IT13:** Gas piping installations **IT14:** Glass and glazing **IT16:** Increase number of persons occupying housing unit **IT17:** Interior environment **IT19:** Maintenance of drinking water cooler sets **IT20:** Masonry **IT21:** Mechanical systems **IT35:** Solar systems
Component 4	**2.593**	**6.030**	**18.156**	**.605 .615 .694 .704 .709 .609 .531**	**IT1:** Accessibility **IT3:** Boilers/water heaters **IT5:** Construction equipment **IT6:** Demolition of buildings and facilities **IT9:** Encroachments into public right of way **IT11:** Existing structures

Impact component	Extracted Eigen value	Extracted sum of squared loadings: variance %	Rotation sum of squared loadings: variance %	Impact factors aggregated to component following rotation	
				Factor loading score	**Factor details**
				.529 **.619** **.637** **.725** **.551**	**IT15:** Gypsum board and plaster **IT39:** Structural tests and inspections **IT40:** Swimming pools **IT41:** Type of construction **IT42:** Weather condition such humidity , dust and wind condition **IT43:** Wood
Component 5	**1.791**	**4.166**	**12.280**	**.602** **.569** **.458** **.808** **.770** **.645**	**IT12:** Exterior walls **IT13:** Gas piping installations **IT30:** Sheds and Car metal shed **IT31:** Signs **IT32:** Site preparation **IT33:** Smoke detectors for houses
Component 6	**1.394**	**3.243**	**12.127**	**.575** **.512** **.702** **.631** **.506** **.458** **.586** **.444** **.497**	**IT15:** Gypsum board and plaster **IT18:** Interior finishes **IT22:** Parking **IT23:** Plastic **IT25:** Poor electric and lighting works during alteration, movement, and repairing **IT26:** Property maintenance **IT27:** Safeguards during construction **IT28:** Sanitation of exterior property areas **IT29:** Sewage disposal
Component 7	**1.267**	**2.947**	**10.481**	**.526** **.689** **.823** **.752**	**IT34:** Soil and foundations **IT36:** Sound transmission **IT37:** Steel **IT38:** Structural design
Component 8	**1.042**	**2.423**	**9.168**	**.836** **.878** **.846** **.844**	**IS2: Ineffective engineering supervision and inspection tasks to prevent violations or cheatings** **IS3: Weak of power of law in enforcing correction decisions of violations** **IS4: No deterrent punishments for violators** **IS5: Absence of community awareness in building regulations and nature tasks of Municipality**
Component 9	**2.897**	**72.420**	**-**	**.836** **.878** **.846** **.844**	**IS2: Ineffective engineering supervision and inspection tasks to prevent violations or cheatings** **IS3: Weak of power of law in enforcing correction decisions of violations** **IS4: No deterrent punishments for violators** **IS5: Absence of community awareness in building regulations and nature tasks of Municipality**

Table 8.45: Components for the overall likelihood occurrence for impact factors on Public Welfare

8.6 Summary

Exploratory Factor Analysis for data reduction was used to reduce the number of questionnaire questions to a lower number of variables. The existence of 54 cause factors and 59 impact factors in this survey makes it difficult to handle the analysis, therefore factor analysis and data reduction are considered as an important process to reduce the number of cause and impact factors in order to handle the task more successfully. Based on the factors relationship and correlations, the outcome of the data reduction is presented in in few components that consist of the most important cause and impact factors of the original large group cause and impact factors.

The percentage of variance explained by each factor was calculated by “principle component analysis (Eigen values). The factor analysis is also use to explore the possibility of pattern findings between questions basically based on the correlation matrix between these questions. It is also used to remove redundancy that might exist between correlated independent variables. Prior to conducting factor analysis, reliability analysis was conducted on the research questionnaire.

The reduced list of cause and impact factors will be further discussed in the next chapter along with results of other statistical techniques such as analysis within groups using Correlation Coefficient (Pearson Correlation) to assess the relationship between cause or impact factors, analysis between groups using T-test to compare the mean score of opinions of two different groups of people with one continuous factor, and correlations between cause and impact using Cross Tabulation to correlate and compare the cause factors rankings to extracted impact of the three building code objectives to assess which cause and impact factors are likely to be important in practice.

Chapter Nine

Advanced Analysis of Survey One & Two: Hypothesis Testing and Correlations

Chapter Nine

Advanced Analysis of Survey One & Two:

Hypothesis Testing and Correlations

9.1 Introduction

In this chapter, a group of an advanced statistical analysis performed to test surveys' hypothesis, including (I) analysis within groups using Correlation Coefficient (Pearson Correlation), to assess the relationship between cause or impact factors, (II) analysis among groups using T-test, to compare the mean score of opinions of two different groups of people with one continuous factor and (III) correlations between cause and impact using Cross Tabulation to correlate and compare the cause factors rankings to extracted impact of the three building code objectives to assess which cause and impact factors are likely to be important in practice.

9.2 Analysis of Cause Factors

9.2.1 Clustering of Likelihood Occurrence of Cause Factors (results of Factor's Analysis)

This initial clustering into 13 components and the relationship with individual cause factors is entirely empirically determined, in common with the previous research adopting this approach (for example, Sharma and Kumar, 2006). The major components (those with the largest variances and with variances numbering reported in parenthesis) are: (1) 34.58%, (2) 31.017%, (3) 27.95%, (4) 26.47%, (5) 17.24%, (6) 17.19%, and (7) 12.32%. The identification of cause factors in Tables 8.6, 8.8, and 8.10, provides a guide to the interpretation of the cause components and articulating the findings and presents a view on clustering in the context of the framework of building code to determine causes in relation to meaningful framework parts.

Thus, the 13 cause components being assessed and interpreted .Clusters could be formed and might be placed into the framework of building code context. The approach is to allow factor's analysis to establish the initial dimensionality (the 13 cause components of Tables 8.6, 8.8, and 8.10) and then to interpret the results in terms of the framework of building code context. In examining the make-up of the cause components (that is, from the cause factors in the Tables 8.6, 8.8, and 8.10) a number of themes were observed to be consistent with the framework of building code. This is supported by an examination of the factor loadings of the cause factors which are reported in the fifth column of Tables 8.11, 8.12, and 8.13 and which reports the loading factors extracted from the rotated component matrix of the cause data sample. This is the main basis for the component interpretation used.

The 13 components extracted from factor's analysis were then clustered together to form few clusters that have common themes according to the framework of building code. Each cluster degree of effect in the likelihood occurrence of cause is calculated based on the percentage of variance of each component derived from Tables 8.5, 8.7, and 8.9. The analysis shows 3 main clusters emerging that are consistent and which we label:

- Cluster 1: Legal/Technical
- Cluster 2: Administrative
- Cluster 3: Social

- **Cluster 1: Legal/Technical**

Cluster 1 is defined as "Legal/Technical ' and this is comprised of components 1, 2 and 3 and represents 71.61% of the total variance explained. This has been labelled to include issues of Legal and Technical issues of building code framework. Only 3 components make-up this cluster and they relate to building law, regulations, technical requirements, methods, materials testing, specifications, certification of professionals, fees, and insurance cover. The new components for the likelihood occurrence of cause factors are shown in Table 9.1 below:

Ref.	Component	% variance	Main cause factors	Total % variance
DLC1	**Component 1** Weak building regulations, methods, and certification of professionals	**27.95**	**LC5**: Major obstacle to approve system of building methods for Kuwait is the inexistence of related article in Municipality laws **LC6**: Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law) **LC10**:Unavailable laws to prevent the monopoly of lands, which led to the increase of land price and misuse of lands and real estates **LC13**: Weak regulations by Municipality Council **LC14**: Weak regulations from National Parliament	**71.61**
DLC2	**Component 2** Inexistence of law to prepare and enforce codes, materials testing, specifications, and effective insurance for building	**26.47**	**LC1:**Inexistence of law to prepare and enforce Building Codes to safeguard minimum requirements of public health, safety and general welfare **LC2:** Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law) **LC3:** Inexistence of building materials testing system (because of the law) **LC4:**Major obstacle to approve standard building specifications for Kuwait is the inexistence of related articles in Municipality laws **LC8:** Not taking into account the changes in building technology in current law **LC11:**Unclear regulations texts	
DLC3	**Component 3** Problems in technical requirements, conflict, collect fees in building regulations	**17.19**	**LC7:**More laws and codes and the resulting conflict among them **LC9:** Lack of many technical requirements in building regulations in Kuwait **LC12:**Unconstitutional decisions to collect fees	

Table 9.1: Cluster 1: Legal/Technical for likelihood occurrence of cause factors

Five items loaded onto Component 1. It is clear from Table 9.1 that these five items (LC5, LC6, LC10, LC13, and LC14) all relate to the importance of laws to prepare regulations by Municipality Council and National Parliament, and a law for building methods certification, and zoning regulations to control lands.

Six items loaded onto Component 2. It is clear from Table 9.1 that these six items (LC1, LC2, LC3, LC4, LC8, and LC11) all relate to the importance of improper Municipality procedures for plan review and inspection.

Three items loaded onto Component 3. It is clear from Table 9.1 that these three items all relate to the significance of laws to technical requirements, conflict of regulations, problems of collect fees in enforcement.

- **Cluster 2: Administrative**

Cluster 2 is defined as "Administrative ' and this is comprised of eight components and represents 76% of the total variance explained. This has been labelled to include administration issues of building code framework. Only 8 components make-up this cluster and they relate to general management, plan review, site inspection, certification qualifications of building officials, and violations. The new components for the likelihood occurrence of cause factors are shown in Table 9.2 below:-

Ref.	Component	% variance	Main cause factors	Total % variance
DAC1	**Component 1** Improper procedures to prepare and enforce codes, proper workforce capabilities, testing of building materials, and system to provide information	**17.236**	**AC1:**Administrative procedures at Municipality are the main obstacles to implement and enforce regulations and laws **AC3:**Building decisions and regulations were created without proper study which affect the investors **AC4:**Conflict in issuing the licenses from Ministry of Trade and Municipality **AC8:**It is hard to obtain specific information from Municipality, Kuwait Fire Department, Ministry of Electricity and Ministry of Public Works **AC13:**Conflict and unclear area of expertise of organizations participated in administration of building process **AC14:**Design and supervision engineers from engineering offices usually get licenses from Municipality, but they are not tested technically to know their abilities **AC15:** Improper capabilities of Municipality in technical and managerial sides to follow up and control building and construction works **AC20:**Weak workforce at Municipality departments **AC26:**It is incorrect to award all engineering supervisions and inspection tasks to consultancy offices without Municipality control **AC27:**Kuwait Municipality doesn't perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labours **AC29:** Neglecting the testing of building materials and concrete by certified testing centres during projects execution	**75.971**
DAC2	**Component 2** Improper Municipality procedures for plan review and inspection	**12.319**	**AC9:** Improper Municipality procedures to organize the works of consultancy offices from preparing plans and engineering supervision on building projects **AC12:** Procedures of following and monitoring of buildings and construction works at Municipality are not clear and not with satisfying performance **AC24:**Building Department, Inspection Department, and Safety Department at Kuwait Municipality don’t perform their responsibilities properly in controlling and following local construction works	

Ref.	Component	% variance	Main cause factors	Total % variance
			AC32: Unclear and inadequate procedures of review of building plans at Municipality **AC35:** Workers at Kuwait Municipality don't care to use comprehensive checklists to review plans, and monitor projects to faithfully fulfil their work requirements	
DAC3	**Component 3** Problems in enforcement and updating building regulation and consultant supervision capabilities	**10.926**	**AC5:** Difficulty in implementing some matters **AC11:** None of the government organizations performing their tasks of updating the construction requirements properly is due to the use of latest construction materials or methods **AC17:** Municipality Council members don't have the necessary technical education or qualification in preparing the building regulations **AC28:** Many owners and investors have no trust in the supervision capabilities of the engineering offices **AC30:** Most owners and investors don't care to fulfil the demands of energy conservation in buildings due to the low cost of electricity, and weakness of regulations and enforcement	
DAC4	**Component 4** Problems in qualification, tasks, knowledge of officials and professionals, and not performing periodical inspection	**10.109**	**AC2:** Assigning many additional tasks for engineers of the technical department **AC19:** Unsuitable qualification of workforce at Municipality departments **AC25:** Difficulties facing Municipality's technical workforce in acquiring correct data and information to implement and check what have been done on the site with issued licenses **AC31:** Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy **AC34:** To reduce the cost of construction and to finish work quickly, many private projects are not executed as per professional standards and proper workmanship	
DAC5	**Component 5** Weakness in technical, legal, and financial capabilities of officials workforce and government inspection	**8.877**	**AC20:** Weak workforce at Municipality departments **AC21:** Weak legal departments at Municipality branches at governorates **AC23:** Weakness in technical and financial capabilities of Municipality branches at governorates **AC33:** There is no government controlled inspection on building at construction sites	
DAC6	**Component 6** Problems with records keeping of building projects and certification of small contractors	**6.229**	**AC6:** lose and damage of documents and records of building projects at Kuwait Municipality **AC18:** Small contractors usually get licenses from Municipality, but they are not tested technically resulting in engineering problems	
DAC7	**Component 7** Problems with corporation of government organizations in administration of building process	**5.856**	**AC7:** Incorporation of government organizations with Municipality by letting Kuwait Municipality be responsible of direct communication with citizens **AC10:** Many participating organizations in administration of building process	
DAC8	**Component 8** Improper inspection and supervision of consultants and reimbursements for workers at Municipality	**4.419**	**AC22:** Weak reimbursements for workers at Municipality **AC26:** It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control	

Table 9.2: Cluster 2: Administrative for likelihood occurrence of cause factors

Ten items loaded onto Component 1. It is clear from Table 9.2 that these ten items all relate to improper procedures to prepare and enforce codes, proper workforce capabilities, testing of building materials, and system to provide information.

Five items loaded onto Component 2. It is clear from Table 9.2 that these ten items all relate to improper Municipality procedures for plan review and inspection.

Five items loaded onto Component 3. It is clear from Table 9.2 that these five items all relate to problems in enforcement and updating building regulation, and consultant supervision capabilities.

Five items loaded onto Component 4. It is clear from Table 9.2 that these five items all relate to problems in qualification, tasks, knowledge of officials and professionals, and in performing periodical inspection.

Four items loaded onto Component 5. It is clear from Table 9.2 that these four items all relate to weakness in technical, legal, and financial capabilities of officials workforce, and government inspection.

Two items loaded onto Component 6. It is clear from Table 9.2 that these two items all relate to problems with records of building projects, and certification of small contractors.

Two items loaded onto Component 7. It is clear from Table 9.2 that these two items all relate to problems with corporation of government organizations in administration of building process.

Two items loaded onto Component 8. It is clear from Table 9.2 that these two items all relate to improper inspection and supervision of consultants, and reimbursements for workers at municipality.

- **Cluster 3: Social**

Cluster 3 is defined as " Social ' and this is comprised of two components and represents 65.6% of the total variance explained. This has been labelled in away to include social issues of building codes framework. Only 2 components make-up this cluster and they are associated with inspection, enforcing, correct decisions of violations, and monetary value for penalty. The new cluster for the likelihood occurrence of cause factors is shown in Table 9.3 below:-

Ref.	Component	% variance	Main cause factors	Total % variance
DSC1	**Component 1** Ineffective inspection, and weak and delay in enforcing correct decisions of violations	**34.579**	**SC2:**Delay of issuing and enforcing legal court rules based on violation cases **SC5:**Weak power of law in enforcing correct decisions for violations **SC6:** Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	**65.596**
DSC2	**Component 2** No deterrent punishments for violators and Low monetary values of penalty	**31.017**	**SC3:**Low monetary values of penalty by Municipality law (max. 500 k.d. = 1000 £) **SC4:**No deterrent punishments for violators	

Table 9.3: Cluster 3: Social for the likelihood occurrence of cause factor

Three items loaded onto Component 1. It is clear from Table 9.3 that these two items are associated with improper enforcing, correct decisions, engineering supervision and inspection tasks to prevent violations or cheatings.

Two items loaded onto Component 2. It is clear from Table 9.3 that these two items are associated with deterrent punishments for violators, and monetary value for penalty.

9.2.2 Correlation of Cause Factors (results of Pearson)

Pearson's correlation coefficient was computed to assess the relationship between cause factors. Correlation Matrix describes the strength and direction of the linear relationship between factors. Correlation provides ***Pearson r*** with correlation coefficients between each pair of 13 factors listed using both 1% and 5 % significance to support the questionnaire. Table 9.4 shows the correlation structure and presents a general picture of the association between outcome /dependent factors and the independent factors.

The correlation coefficient is always between -1 and +1. The closer the correlation is to +/-1, the closer to a perfect linear relationship. Interpretation correlations are according to the following (this rule, is somewhat arbitrary):

- -1.0 to -0.7 strong negative association.
- -0.7 to -0.3 weak negative association.
- -0.3 to +0.3 little or no association.
- +0.3 to +0.7 very weak positive association (VWPA).
- +0.5 to +0.7 weak positive association (WPA).
- +0.7 to +1.0 strong positive association (SPA).

DAC1 has the strongest relation among all other relations in comparison with the rest of the components, and has the strongest relation with DLC1 (.807). DAC1 has the second strongest relation with DLC2 (.722). While the weakest relationship was between DLC3 and DAC7 (.152). The summery of weak and strong associations is shown in the following Table 9.4 and 9.5:-

Correlations														
		DLC1	**DLC2**	**DLC3**	**DAC1**	**DAC2**	**DAC3**	**DAC4**	**DAC5**	**DAC6**	**DAC7**	**DAC8**	**DSC1**	**DSC2**
DLC1	Pearson Correlation	1	.608**	.444**	.807**	.680**	.615**	.524**	.321**	.158**	.452**	.562**	.705**	.320**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.003	.000	.000	.000	.000
	N	361	358	346	340	361	346	344	346	346	358	358	361	361
DLC2	Pearson Correlation	.608**	1	.301**	.722**	.352**	.644**	.176**	.412**	.189**	.110*	.375**	.566**	-.027-
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.001	.000	.000	.032	.000	.000	.594
	N	358	387	372	366	387	372	370	372	372	384	384	387	387
DLC3	Pearson Correlation	.444**	.301**	1	.313**	.382**	.584**	.291**	.259**	.199**	.152**	.060	.393**	-.066-
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.003	.251	.000	.205
	N	346	372	375	354	375	360	358	360	360	372	372	375	375
DAC1	Pearson Correlation	.807**	.722**	.313**	1	.637**	.646**	.427**	.621**	.509**	.277**	.624**	.633**	.136**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.009
	N	340	366	354	369	369	354	355	369	369	369	369	369	369
DAC2	Pearson Correlation	.680**	.352**	.382**	.637**	1	.430**	.593**	.508**	.549**	.211**	.355**	.638**	.376**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	361	387	375	369	390	375	373	375	375	387	387	390	390
DAC3	Pearson Correlation	.615**	.644**	.584**	.646**	.430**	1	.374**	.316**	.274**	.207**	.418**	.489**	.037
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.474
	N	346	372	360	354	375	375	358	360	360	372	372	375	375
DAC4	Pearson Correlation	.524**	.176**	.291**	.427**	.593**	.374**	1	.439**	.503**	.433**	.487**	.698**	.307**
	Sig. (2-tailed)	.000	.001	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	344	370	358	355	373	358	373	358	358	373	373	373	373
DAC5	Pearson Correlation	.321**	.412**	.259**	.621**	.508**	.316**	.439**	1	.582**	.297**	.222**	.428**	.073
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.161
	N	346	372	360	369	375	360	358	375	375	372	372	375	375
DAC6	Pearson Correlation	.158**	.189**	.199**	.509**	.549**	.274**	.503**	.582**	1	.129*	.331**	.431**	.161**
	Sig. (2-tailed)	.003	.000	.000	.000	.000	.000	.000	.000		.013	.000	.000	.002
	N	346	372	360	369	375	360	358	375	375	372	372	375	375
DAC7	Pearson Correlation	.452**	.110*	.152**	.277**	.211**	.207**	.433**	.297**	.129*	1	.359**	.119*	.011
	Sig. (2-tailed)	.000	.032	.003	.000	.000	.000	.000	.000	.013		.000	.019	.832
	N	358	384	372	369	387	372	373	372	372	387	387	387	387
DAC8	Pearson Correlation	.562**	.375**	.060	.624**	.355**	.418**	.487**	.222**	.331**	.359**	1	.556**	.146**
	Sig. (2-tailed)	.000	.000	.251	.000	.000	.000	.000	.000	.000	.000		.000	.004
	N	358	384	372	369	387	372	373	372	372	387	387	387	387
DSC1	Pearson Correlation	.705**	.566**	.393**	.633**	.638**	.489**	.698**	.428**	.431**	.119*	.556**	1	.359**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.019	.000		.000
	N	361	387	375	369	390	375	373	375	375	387	387	390	390
DSC2	Pearson Correlation	.320**	-.027-	-.066-	.136**	.376**	.037	.307**	.073	.161**	.011	.146**	.359**	1
	Sig. (2-tailed)	.000	.594	.205	.009	.000	.474	.000	.161	.002	.832	.004	.000	
	N	361	387	375	369	390	375	373	375	375	387	387	390	390
**. Correlation is significant at the 0.01 level (2-tailed).														
*. Correlation is significant at the 0.05 level (2-tailed).														

Table 9.4: Correlations

	DLC1	DLC2	DAC1	DAC4	DSC1
DLC1			**.807****		**.705****
DLC2			**.722****		
DAC1	**.807****	**.722****			
DSC1	**.705****			**.698****	

Table 9.5: Summery of strong association

9.2.3 Comparison of Cause Factors (results of T-Test)

Independent sample T-test is used to compare the mean score of two different groups of people with one continuous factor. For hypothesis, T-test will be conducted. The purpose of hypothesis testing is to determine which of the following two hypotheses is correct:

- **Null hypothesis:**

There is no significant difference among Building Officials and Construction professionals for the likelihood of ***cause factors*** occurrence.

- **Alternative hypothesis:**

There is a significant difference among Building Officials and Construction professionals for the likelihood of ***cause factors*** occurrence.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
DLC1	Equal variances assumed	39.169	.000	-13.045-	359	.000	-1.05636-	.08098	-1.21561-	-.89711-
	Equal variances not assumed			-12.409-	255.592	.000	-1.05636-	.08513	-1.22400-	-.88872-
DLC2	Equal variances assumed	46.115	.000	-7.602-	385	.000	-.70478-	.09271	-.88706-	-.52250-
	Equal variances not assumed			-7.169-	265.948	.000	-.70478-	.09831	-.89833-	-.51122-
DLC3	Equal variances assumed	1.192	.276	-3.448-	373	.001	-.29933-	.08682	-.47005-	-.12861-
	Equal variances not assumed			-3.526-	350.439	.000	-.29933-	.08490	-.46631-	-.13235-
DAC1	Equal variances assumed	105.787	.000	-12.275-	367	.000	-.85749-	.06986	-.99486-	-.72012-
	Equal variances not assumed			-11.531-	240.850	.000	-.85749-	.07437	-1.00398-	-.71100-
DAC2	Equal variances assumed	.008	.929	-9.607-	388	.000	-.77619-	.08079	-.93504-	-.61734-
	Equal variances not assumed			-9.705-	371.977	.000	-.77619-	.07998	-.93346-	-.61892-
DAC3	Equal variances assumed	64.756	.000	-5.470-	373	.000	-.44061-	.08055	-.59901-	-.28222-
	Equal variances not assumed			-5.216-	263.997	.000	-.44061-	.08448	-.60695-	-.27427-
DAC4	Equal variances assumed	.978	.323	-2.534-	371	.012	-.19769-	.07802	-.35111-	-.04427-
	Equal variances not assumed			-2.546-	357.807	.011	-.19769-	.07766	-.35041-	-.04497-
DAC5	Equal variances assumed	.476	.491	-6.048-	373	.000	-.46043-	.07613	-.61012-	-.31073-
	Equal variances not assumed			-6.006-	346.551	.000	-.46043-	.07666	-.61121-	-.30964-
DAC6	Equal variances assumed	2.269	.133	-3.155-	373	.002	-.24111-	.07643	-.39139-	-.09083-
	Equal variances not assumed			-3.100-	327.296	.002	-.24111-	.07777	-.39412-	-.08811-
DAC7	Equal variances assumed	.043	.836	-4.963-	385	.000	-.43399-	.08745	-.60593-	-.26205-
	Equal variances not assumed			-4.922-	342.333	.000	-.43399-	.08817	-.60741-	-.26057-
DAC8	Equal variances assumed	180.550	.000	-6.740-	385	.000	-.60328-	.08951	-.77926-	-.42729-
	Equal variances not assumed			-6.125-	216.587	.000	-.60328-	.09849	-.79740-	-.40915-
DSC1	Equal variances assumed	5.200	.023	-7.286-	388	.000	-.62543-	.08583	-.79419-	-.45667-
	Equal variances not assumed			-7.207-	344.037	.000	-.62543-	.08678	-.79611-	-.45475-
DSC2	Equal variances assumed	2.809	.095	-3.488-	388	.001	-.25861-	.07415	-.40439-	-.11282-
	Equal variances not assumed			-3.419-	329.961	.001	-.25861-	.07564	-.40740-	-.10982-

Table 9.6: Independent Sample T- Test

Table 9.6 and 9.7 show that there is a significant difference between the scores of respondents (Building Officials and Construction Professionals). This score (sig. for t-test for Equality of Means) has to be (0.05), or less to be considered significant. Opinions of Construction Professionals are greater than Building Officials in all variables. Therefore, reject Null's hypothesis and accept an alternative one.

Group Statistics

	Job	N	Mean	Std. Deviation	Std. Error Mean
DLC1	Building Official in Municipality	159	2.9585	.93323	.07401
	Construction Professional	202	4.0149	.59782	.04206
DLC2	Building Official in Municipality	165	3.1030	1.09854	.08552
	Construction Professional	222	3.8078	.72230	.04848
DLC3	Building Official in Municipality	153	2.8824	.76612	.06194
	Construction Professional	222	3.1817	.86524	.05807
DAC1	Building Official in Municipality	162	3.0455	.84544	.06642
	Construction Professional	207	3.9029	.48109	.03344
DAC2	Building Official in Municipality	168	3.0571	.75697	.05840
	Construction Professional	222	3.8333	.81422	.05465
DAC3	Building Official in Municipality	168	3.0357	.95912	.07400
	Construction Professional	207	3.4763	.58639	.04076
DAC4	Building Official in Municipality	165	3.7600	.73125	.05693
	Construction Professional	208	3.9577	.76173	.05282
DAC5	Building Official in Municipality	168	3.4152	.76008	.05864
	Construction Professional	207	3.8756	.71048	.04938
DAC6	Building Official in Municipality	168	4.0536	.80238	.06191
	Construction Professional	207	4.2947	.67739	.04708
DAC7	Building Official in Municipality	165	3.3273	.87766	.06833
	Construction Professional	222	3.7613	.83027	.05572
DAC8	Building Official in Municipality	165	3.5364	1.17463	.09145
	Construction Professional	222	4.1396	.54512	.03659
DSC1	Building Official in Municipality	168	3.4226	.87660	.06763
	Construction Professional	222	4.0480	.81013	.05437
DSC2	Building Official in Municipality	168	3.9554	.78311	.06042
	Construction Professional	222	4.2140	.67799	.04550

Table 9.7: Group Statistics

9.3 Analysis of Impact Factors on Public Safety

9.3.1 Clustering of Likelihood Occurrence of Impact Factors (results of Factor Analysis)

The 14 components extracted from factor analysis were then clustered together to form few clusters that have some common themes. The analysis shows 4 main clusters emerging, they are consistent and labelled as:

- Cluster 1: Legal
- Cluster 2: Administrative
- Cluster 3: Technical
- Cluster 4: Social

The new components for the likelihood occurrence of impact factors are shown in Tables 9.8, 9.9, 9.10, and 9.11, below.

- **Cluster 1: Legal**

Cluster 1 is defined as "Legal ' and this is comprised of one component. This has been labelled to include Legal issues of building codes framework. Only one component make-ups this cluster and it is associated with problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials. The new cluster for the likelihood occurrence of impact factors is shown in Table 9.8 below:-

Ref.	Component	Main cause factors
IL	**Component 1** Problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials	**IL1: Lack many technical requirements in building regulations in Kuwait** **IL2: Not taking into account the changes in building technology in current law** **IL3: Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)** **IL4: Inexistence of building materials testing system (because of the law)** **IL5: Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)**

Table 9.8: Cluster 1: Legal for likelihood occurrence of impact factor

- **Cluster 2: Administrative**

Cluster 2 is defined as "Administrative ' and this is comprised of three components and represents **72.36**% of the total variance explained. This has been labelled to include issues of administration and building code framework. Only 3 components make-up this cluster and they are associated with general management, plan review, site inspection, certification, qualification of building officials, and violations. The new cluster for the likelihood occurrence of cause factors are shown in Table 9.9 below:-

Ref.	Component	% variance	Main cause factors	Total % variance
IAONE	**Component 1** Improper procedures to perform plan review and inspection	28.990	**IA1:** Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects **IA3:** Improper capabilities of Municipality in technical and managerial sides to follow up and control building and construction works **IA4:** Unclear and inadequate procedures of review of building plans at Municipality	72.36
IATWO	**Component 2** Problems with records keeping of building projects and to perform plan review and inspection	23.577	**IA2:** lose and damage of documents and records of building projects at Kuwait Municipality **IA5:** Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	
IATHREE	**Component 3** Problems with testing of building materials and performing periodical inspection after occupancy	19.792	**IA6:** Neglecting the testing of building materials and concrete by certified testing centres during projects execution **IA7:** Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	

Table 9.9: Cluster 2: Administrative for likelihood occurrence of impact factors

- **Cluster 3: Technical**

Cluster 3 is defined as "Technical ' and this is comprised of seven components and represents 75.45% of the total variance explained. This has been labelled to include Technical issues of building codes framework. The new cluster for the likelihood occurrence of impact factors is shown in Table 9.10 below:

Ref.	Component	% variance	Main cause factors	Total % variance
ITONE	Component 1	26.426	IT1: Accessibility IT10: Energy conservation IT11: Existing structures IT15: Gypsum board and plaster IT19: Maintenance of drinking water cooler sets IT20: Masonry IT23: Plastic IT24: Plumbing systems IT25: Poor electric and lighting works during alteration, movement, and repairing IT26: Property maintenance IT27: Safeguards during construction IT28: Sanitation of exterior property areas IT29: Sewage disposal **IT37:** Steel **IT39:** Structural tests and inspections	75.451
ITTWO	Component 2	12.084	**IT4:** Concrete and reinforcement of concrete works **IT13:** Gas piping installations **IT16: The** Increasing number of persons occupying housing units **IT17:** Interior environment **IT32:** Site preparation **IT35:** Solar systems **IT36:** Sound transmission	
ITTHREE	Component 3	9.367	**IT3:** Boilers/water heaters **IT6:** Demolition of buildings and facilities **IT21:** Mechanical systems **IT30:** Sheds and Car metal sheds	
ITFOUR	Component 4	8.123	**IT7:** Electrical works **IT18:** Interior finishes **IT42:** Weather condition such humidity , dust and wind condition **IT43:** Wood	
ITFIVE	Component 5	6.921	**IT5:** Construction equipments **IT14:** Glass and glazing **IT31:** Signs	
ITSEX	Component 7	6.584	**IT2:** Aluminium **IT40:** Swimming pools **IT41:** Type of construction	
ITSEVEN	Component 8	5.946	**IT9:** Encroachments into public right of way **IT12:** Exterior walls **IT13:** Gas piping installations **IT22:** Parking	

Table 9.10: Cluster 3: Technical for likelihood occurrence of impact factors

- **Cluster 4: Social**

Cluster 4 is defined as " Social ' and this is comprised of one component. This has been labelled to include social issues of building codes framework. One component makes-up this cluster and it is associated with ineffective inspection, weak enforcement to take correct decisions for violations, and absence of community awareness. The new cluster for the likelihood occurrence of impact factors is shown in Table 9.11 below:

Ref.	Component	Main cause factors
IS	**Component 1** Ineffective inspection, weak enforcing correct decisions of violations , and the absence of community awareness	**IS2:** Ineffective engineering supervision and inspection tasks to prevent violations or cheatings **IS3:** Weak power of law in enforcing correct decisions for violations **IS4:** No deterrent punishments for violators **IS5:** Absence of community awareness in building regulations and nature tasks of Municipality

Table 9.11: Cluster 4: Social for likelihood occurrence of impact factors

9.3.2 Correlation of Impact Factors (results of Pearson)

Table 9.12 shows the correlation structure and presents a general picture of the association between outcome /dependent factors and the independent factors.

For the components of impact factors likelihood Table 9.12, four main areas of impact factors were observed in terms of the extracted components. These are most positive associations, which are in fact, observed in relation to IL, IAONE, ITONE, and ITSEVEN impact factors. IL has the strongest relation among all other relations in comparison with the rest of the components, and has the strongest relation with IAONE (.821). The summery of weak and strong associations is shown in the following Table 9.12 and 9.13:

Correlations

		IL	IAONE	IATWO	IATHREE	IS	ITONE	ITTWO	ITTHREE	ITFOUR	ITFIVE	ITSEX	ITSEVEN
IL	Pearson Correlation	1	.821**	.470**	.421**	.510**	.694**	.502**	.690**	.475**	.266**	.479**	.606**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	378	378	374	371	378	371	378	364	364	378	378	370
IAONE	Pearson Correlation	.821**	1	.502**	.219**	.439**	.416**	.411**	.572**	.523**	.255**	.381**	.438**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	378	382	374	375	382	375	382	368	368	382	382	374
IATWO	Pearson Correlation	.470**	.502**	1	.286**	.311**	.664**	.434**	.461**	.545**	.594**	.432**	.426**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	374	374	374	367	374	367	374	360	364	374	374	366
IATHREE	Pearson Correlation	.421**	.219**	.286**	1	.389**	.534**	.519**	.374**	.307**	.196**	.494**	.560**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	371	375	367	383	383	379	383	369	369	383	383	375
IS	Pearson Correlation	.510**	.439**	.311**	.389**	1	.536**	.573**	.531**	.371**	.343**	.500**	.653**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	378	382	374	383	390	383	390	376	376	390	390	382
ITONE	Pearson Correlation	.694**	.416**	.664**	.534**	.536**	1	.690**	.673**	.478**	.511**	.603**	.770**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	371	375	367	379	383	383	383	369	369	383	383	375
ITTWO	Pearson Correlation	.502**	.411**	.434**	.519**	.573**	.690**	1	.640**	.464**	.486**	.608**	.590**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
	N	378	382	374	383	390	383	390	376	376	390	390	382
ITTHREE	Pearson Correlation	.690**	.572**	.461**	.374**	.531**	.673**	.640**	1	.583**	.635**	.534**	.627**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000
	N	364	368	360	369	376	369	376	376	372	376	376	368
ITFOUR	Pearson Correlation	.475**	.523**	.545**	.307**	.371**	.478**	.464**	.583**	1	.396**	.465**	.476**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
	N	364	368	364	369	376	369	376	372	376	376	376	368
ITFIVE	Pearson Correlation	.266**	.255**	.594**	.196**	.343**	.511**	.486**	.635**	.396**	1	.291**	.463**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	378	382	374	383	390	383	390	376	376	390	390	382
ITSEX	Pearson Correlation	.479**	.381**	.432**	.494**	.500**	.603**	.608**	.534**	.465**	.291**	1	.513**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000
	N	378	382	374	383	390	383	390	376	376	390	390	382

Correlations													
		IL	IAONE	IATWO	IATHREE	IS	ITONE	ITTWO	ITTHREE	ITFOUR	ITFIVE	ITSEX	ITSEVEN
ITSEVEN	Pearson Correlation	.606**	.438**	.426**	.560**	.653**	.770**	.590**	.627**	.476**	.463**	.513**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	370	374	366	375	382	375	382	368	368	382	382	382

Table 9.12: Correlations

	IL	IAONE	ITONE	ITSEVEN
IL		**.821****		
IAONE	**.821****			
ITONE				**.770****
ITSEVEN			**.770****	

Table 9.13: Summery of strong association

9.3.3 Comparison of Impact Factors (results of T-Test)

Independent sample T-test is used to compare the mean score of two different groups of people with one continuous factor. For hypothesis, T-test will be conducted. The purpose of hypothesis testing is to determine which of the following two hypotheses is correct:

- **Null hypothesis:**

There is no significant difference among the respondents rating for the impacts of insufficient Building codes on ***Public Safety*** in Kuwait

- **Alternative hypothesis:**

There is a significant difference among the respondents rating for the impacts of insufficient Building codes on ***Public Safety*** in Kuwait

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
IL	Equal variances assumed	2.077	.150	-.600	376	.549	-.02828	.04717	-.12103	.06446
	Equal variances not assumed			-.598	365.606	.551	-.02828	.04733	-.12136	.06480
IAONE	Equal variances assumed	14.898	.000	-3.247	380	.001	-.16648	.05127	-.26729	-.06568
	Equal variances not assumed			-3.326	347.361	.001	-.16648	.05006	-.26494	-.06803
IATWO	Equal variances assumed	3.348	.068	1.340	372	.181	.08505	.06345	-.03972	.20982
	Equal variances not assumed			1.338	367.247	.182	.08505	.06355	-.03991	.21001
IATHREE	Equal variances assumed	.306	.581	.753	381	.452	.02381	.03163	-.03837	.08599
	Equal variances not assumed			.758	380.993	.449	.02381	.03141	-.03794	.08556
IS	Equal variances assumed	11.246	.001	3.169	388	.002	.13757	.04341	.05223	.22291
	Equal variances not assumed			3.098	324.793	.002	.13757	.04440	.05022	.22491
ITONE	Equal variances assumed	66.958	.000	5.324	381	.000	.32079	.06025	.20232	.43926
	Equal variances not assumed			5.200	303.887	.000	.32079	.06170	.19939	.44220
ITTWO	Equal variances assumed	76.418	.000	4.202	388	.000	.23042	.05484	.12260	.33825
	Equal variances not assumed			4.056	286.699	.000	.23042	.05681	.11861	.34224
ITTHREE	Equal variances assumed	42.388	.000	2.545	374	.011	.13764	.05409	.03129	.24398
	Equal variances not assumed			2.443	274.956	.015	.13764	.05634	.02672	.24855
ITFOUR	Equal variances assumed	.423	.516	-.487	374	.626	-.01849	.03794	-.09309	.05611
	Equal variances not assumed			-.486	355.128	.628	-.01849	.03808	-.09338	.05640
ITFIVE	Equal variances assumed	18.285	.000	4.462	388	.000	.25476	.05710	.14249	.36703
	Equal variances not assumed			4.335	306.271	.000	.25476	.05877	.13912	.37041
ITSEX	Equal variances assumed	4.410	.036	1.638	388	.102	.07407	.04523	-.01486	.16300
	Equal variances not assumed			1.617	352.086	.107	.07407	.04582	-.01604	.16419
ITSEVEN	Equal variances assumed	29.283	.000	3.457	380	.001	.20865	.06035	.08999	.32732
	Equal variances not assumed			3.416	344.580	.001	.20865	.06108	.08851	.32879

Table 9.14: Independent Sample T- Test

Table 9.14 and 9.15 show that there is a significant difference among the scores of respondents (professionals of Design/plan review and Construction/maintenance or site inspection). Opinions of Design/plan review Professionals are mostly greater than Construction/maintenance or site inspection Professionals in most variables. Therefore, it is better to reject Null's hypothesis and accept an alternative one.

Group Statistics

	job	N	Mean	Std. Deviation	Std. Error Mean
IL	Design or Plan Review	198	3.6162	.44166	.03139
	Construction/ Maintenance or Site Inspection	180	3.6444	.47534	.03543
IAONE	Design or Plan Review	202	3.5743	.58754	.04134
	Construction/ Maintenance or Site Inspection	180	3.7407	.37876	.02823
IATWO	Design or Plan Review	194	3.5851	.60158	.04319
	Construction/ Maintenance or Site Inspection	180	3.5000	.62535	.04661
IATHREE	Design or Plan Review	203	3.8571	.32516	.02282
	Construction/ Maintenance or Site Inspection	180	3.8333	.28948	.02158
IS	Design or Plan Review	210	3.7857	.36326	.02507
	Construction/ Maintenance or Site Inspection	180	3.6481	.49167	.03665
ITONE	Design or Plan Review	203	3.6378	.46412	.03257
	Construction/ Maintenance or Site Inspection	180	3.3170	.70296	.05240
ITTWO	Design or Plan Review	210	3.6841	.40526	.02797
	Construction/ Maintenance or Site Inspection	180	3.4537	.66341	.04945
ITTHREE	Design or Plan Review	206	3.7112	.40388	.02814
	Construction/ Maintenance or Site Inspection	170	3.5735	.63645	.04881
ITFOUR	Design or Plan Review	206	3.7609	.35980	.02507
	Construction/ Maintenance or Site Inspection	170	3.7794	.37371	.02866
ITFIVE	Design or Plan Review	210	3.7548	.45158	.03116
	Construction/ Maintenance or Site Inspection	180	3.5000	.66853	.04983
ITSEX	Design or Plan Review	210	3.7778	.40901	.02822
	Construction/ Maintenance or Site Inspection	180	3.7037	.48425	.03609
ITSEVEN	Design or Plan Review	202	3.6716	.52729	.03710
	Construction/ Maintenance or Site Inspection	180	3.4630	.65102	.04852

Table 9.15: Group Statistics

9.4 Analysis of Impact Factors on Public Health

9.4.1 Clustering of Likelihood Occurrence of Impact Factors (results of Factor Analysis)

The 11 components extracted from factor analysis were clustered together to form few clusters that have some common themes. The analysis shows 4 main clusters emerging consistent and are labelled as follows:

- Cluster 1: Legal
- Cluster 2: Administrative
- Cluster 3: Technical
- Cluster 4: Social

The new components for the likelihood occurrence of impact factors are shown in Tables 9.16, 9.17, 9.18, and 9.19, below.

- **Cluster 1: Legal**

Cluster 1 is defined as "Legal ' and this is comprised of one components. This has been labelled to include Legal issues of building code framework. Only one component makes-up this cluster and it is associated with problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials. The new cluster for the likelihood occurrence of impact factors is shown in Table 9.16 below:-

Ref.	Component	Main cause factors
IL	**Component 1** Problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials	**IL1: Lack many technical requirements in building regulations in Kuwait** **IL2: Not taking into account the changes in building technology in current law** **IL3: Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)** **IL4: Inexistence of building materials testing system (because of the law)** **IL5: Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)**

Table 9.16: Cluster 1: Legal for likelihood occurrence of impact factors

- **Cluster 2: Administrative**

Cluster 2 is defined as "Administrative ' and this is comprised of two components and represents 72.4% of the total variance explained. This has been labelled to include administration issues of building codes framework. Only 2 components make-up this cluster and they relate to general management, plan review, site inspection, certification and qualification of building officials, and violations. The new components for the likelihood occurrence of cause factors are shown in Table 9.17 below:

Ref.	Component	% variance	Main cause factors	Total % variance
IAONE	**Component 1** Problems with records keeping of building projects and performing plan review and inspection	47.253	IA1:Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects IA2:lose and damage of documents and records of building projects at Kuwait Municipality IA3:Improper capabilities of Municipality in technical and managerial sides to follow up and control building and construction works IA4:Unclear and inadequate procedures of review of building plans at Municipality	72.451
IATWO	Component 2 Problems with testing of building materials, performing periodical inspection after occupancy, and performing plan review and inspection	25.198	IA5:Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform its responsibilities properly in controlling and following local construction worksl IA6:Neglecting of testing of building materials and concrete by certified testing centres during projects execution IA7:Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	

Table 9.17: Cluster 2: Administrative for likelihood occurrence of impact factors

- **Cluster 3: Technical**

Cluster 1 is defined as "Technical ' and this is comprised of seven components and represents 73.6% of the total variance explained. This has been labelled to include Technical issue of building code framework. The new components for the likelihood occurrence of impact factors are shown in Table 9.18 below:-

Ref.	Component	% variance	Main cause factors	Total % variance
ITONE	Component 1	15.871	IT12: Exterior walls IT13: Gas piping installations IT14: Glass and glazing IT16:The Increase number of persons occupying housing units IT17: Interior environment IT19: Maintenance of drinking water cooler sets IT24: Plumbing systems IT25: Poor electric and lighting works during alteration, movement, and repairing IT26; Property maintenance IT27: Safeguards during construction IT28: Sanitation of exterior property areas	73.588
ITTWO	Component 2	14.597	IT29: Sewage disposals IT30: Sheds and Car metal sheds IT31: Signs IT32: Site preparation IT33: Smoke detectors for houses IT34: Soil and foundations IT35: Solar systems	
ITTHREE	Component 3	11.751	IT1: Accessibility IT10: Energy conservation IT18: Interior finishes IT40: Swimming pools IT41: Type of construction IT42: Weather condition such as humidity , dust and wind IT43: Wood	
ITFOUR	Component 4	8.951	IT2: Aluminium IT9: Encroachments into public right of way IT11: Existing structures IT15: Gypsum board and plaster	
ITFIVE	Component 5	8.912	IT4: Concrete and reinforcement of concrete works IT7: Electrical works IT8: Elevators and conveying systems IT20: Masonry IT21: Mechanical systems IT22: Parking IT23: Plastic	
ITSEX	Component 6	7.609	IT36: Sound transmission IT37: Steel IT38: Structural design IT39: Structural tests and inspections	
ITSEVEN	Component 7	5.897	IT6: Demolition of buildings and facilities IT13: Gas piping installations	

Table 9.18: Cluster 3: Technical for likelihood occurrence of impact factors

- **Cluster 4: Social**

Cluster 4 is defined as " Social ' and this is comprised of one component. This has been labelled to include social issues of building codes framework. One component makes-up this cluster and it is associated with ineffective inspection and weak enforcing correct decisions for violations. The new components for the likelihood occurrence of impact factors are shown in Table 9.19 below:-

Ref.	Component	Main cause factors
IS	**Component 1** Ineffective inspection, weak and enforcing correction decisions of violations	IS2:Ineffective engineering supervision and inspection tasks to prevent violations or cheatings IS3:Weak power of law in enforcing correct decisions for violations IS4:No deterrent punishments for violators

Table 9.19: Cluster 4: Social for likelihood occurrence of impact factors

9.4.2 Correlation of Impact Factors (results of Pearson)

Table 9.20 shows the correlation structure and presents a general picture of the association between the outcome /dependent factors and the independent factors.

For the components of impact factors likelihood Table 9.20, seven main areas of impact factors were observed in terms of the extracted components. These have the most positive association, and where in fact, observed in relation to IL, IAONE, IATWO, ITONE, ITTWO, ITFOUR, and ITFIVE impact factors. ITONE, ITFOUR, and ITFIVE as extracted components of Impact factors correlated with at least 2 different components of impact factors. IL, IAONE and ITFOUR as extracted impact factors are correlated with IL. IL has the strongest relation among all other relations in comparison with the rest of the components, and has the strongest relation with IAONE (.865). The summery of weak and strong associations is shown in the following in Table 9.20 and 9.21:-

Correlations

		IL	IAONE	IATWO	IS	ITONE	ITTWO	ITTHREE	ITFOUR	ITFIVE	ITSEX	ITSEVEN
IL	Pearson Correlation	1	.865**	.696**	.601**	.384**	.210**	.507**	.701**	.452**	.241**	.540**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	379	375	372	379	379	375	375	372	371	379	379
IAONE	Pearson Correlation	.865**	1	.558**	.533**	.347**	.233**	.503**	.610**	.439**	.254**	.419**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	375	378	368	378	378	374	378	371	370	378	378
IATWO	Pearson Correlation	.696**	.558**	1	.686**	.572**	.535**	.564**	.675**	.525**	.310**	.607**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	372	368	372	372	372	368	368	368	364	372	372
IS	Pearson Correlation	.601**	.533**	.686**	1	.554**	.531**	.676**	.644**	.532**	.517**	.429**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	379	378	372	390	390	386	386	383	382	390	390
ITONE	Pearson Correlation	.384**	.347**	.572**	.554**	1	.747**	.563**	.681**	.794**	.616**	.566**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	379	378	372	390	390	386	386	383	382	390	390
ITTWO	Pearson Correlation	.210**	.233**	.535**	.531**	.747**	1	.469**	.556**	.691**	.621**	.467**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
	N	375	374	368	386	386	386	382	379	378	386	386
ITTHREE	Pearson Correlation	.507**	.503**	.564**	.676**	.563**	.469**	1	.680**	.606**	.552**	.454**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000
	N	375	378	368	386	386	382	386	379	378	386	386
ITFOUR	Pearson Correlation	.701**	.610**	.675**	.644**	.681**	.556**	.680**	1	.695**	.527**	.597**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
	N	372	371	368	383	383	379	379	383	375	383	383
ITFIVE	Pearson Correlation	.452**	.439**	.525**	.532**	.794**	.691**	.606**	.695**	1	.632**	.515**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	371	370	364	382	382	378	378	375	382	382	382
ITSEX	Pearson Correlation	.241**	.254**	.310**	.517**	.616**	.621**	.552**	.527**	.632**	1	.337**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000
	N	379	378	372	390	390	386	386	383	382	390	390
ITSEVEN	Pearson Correlation	.540**	.419**	.607**	.429**	.566**	.467**	.454**	.597**	.515**	.337**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	379	378	372	390	390	386	386	383	382	390	390

Table 9.20: Correlations

	IL	IAONE	IATWO	ITONE	ITTWO	ITFOUR	ITFIVE
IL		**.865****	**.696****			**.701****	
IAONE	**.865****						
IATWO	**.696****						
ITONE					**.747****		**.794****
ITTWO				**.747****			
ITFOUR	**.701****			**.681****			**.695****
ITFIVE				**.794****		**.695****	

Table 9.21: Summery of strong association

9.4.3 Comparison of Impact Factors (results of T-Test)

Independent sample T-test is used to compare the mean score of two different groups of people with one continuous factor. For the hypothesis, T-test will be conducted. The purpose of hypothesis testing is to determine which of the following two hypotheses is correct:

- **Null hypothesis:**

There is no significant difference among the respondents rating for the impacts of insufficient Building codes on ***Public Health*** in Kuwait

- **Alternative hypothesis:**

There is a significant difference among the respondents rating for the impacts of insufficient Building codes on ***Public Health*** in Kuwait

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
IL	Equal variances assumed	13.412	.000	1.208	377	.228	.08839	.07314	-.05543	.23220
	Equal variances not assumed			1.186	311.179	.236	.08839	.07450	-.05820	.23497
IAONE	Equal variances assumed	27.494	.000	.033	376	.974	.00253	.07655	-.14799	.15304
	Equal variances not assumed			.033	324.768	.974	.00253	.07768	-.15029	.15534
IATWO	Equal variances assumed	17.554	.000	.654	370	.514	.03414	.05223	-.06857	.13685
	Equal variances not assumed			.651	356.225	.516	.03414	.05246	-.06902	.13731
IS	Equal variances assumed	24.748	.000	-3.384	388	.001	-.15992	.04725	-.25282	-.06702
	Equal variances not assumed			-3.455	382.656	.001	-.15992	.04629	-.25093	-.06892
ITONE	Equal variances assumed	19.942	.000	-5.257	388	.000	-.26190	.04982	-.35985	-.16396
	Equal variances not assumed			-5.367	382.627	.000	-.26190	.04880	-.35785	-.16596
ITTWO	Equal variances assumed	5.554	.019	-5.172	384	.000	-.26845	.05191	-.37051	-.16640
	Equal variances not assumed			-5.241	382.420	.000	-.26845	.05122	-.36916	-.16775
ITTHREE	Equal variances assumed	1.446	.230	-1.773	384	.077	-.07947	.04483	-.16760	.00867
	Equal variances not assumed			-1.767	371.221	.078	-.07947	.04498	-.16791	.00898
ITFOUR	Equal variances assumed	5.053	.025	-1.591	381	.112	-.08778	.05516	-.19624	.02068
	Equal variances not assumed			-1.611	377.893	.108	-.08778	.05447	-.19489	.01933
ITFIVE	Equal variances assumed	12.859	.000	-4.181	380	.000	-.23663	.05659	-.34791	-.12536
	Equal variances not assumed			-4.237	375.073	.000	-.23663	.05586	-.34646	-.12680
ITSEX	Equal variances assumed	20.079	.000	-6.556	388	.000	-.34074	.05197	-.44292	-.23856
	Equal variances not assumed			-6.733	373.396	.000	-.34074	.05061	-.44026	-.24122
ITSEVEN	Equal variances assumed	12.080	.001	-.926	388	.355	-.04206	.04540	-.13133	.04721
	Equal variances not assumed			-.942	386.662	.347	-.04206	.04467	-.12989	.04577

Table 9.22: Independent Sample T- Test

Table 9.22 and 9.23 show that there is no significant difference among the scores of respondents (professionals of Design/plan review and Construction/maintenance or site inspection). Opinions of Design/plan review Professionals are not greater than Construction/maintenance or site inspection Professionals in most of the variables. Therefore, it is better to accept Null's hypothesis and to reject the alternative one.

Group Statistics					
	Job	N	Mean	Std. Deviation	Std. Error Mean
IL	Design or Plan Review	199	3.2995	.57133	.04050
	Construction/ Maintenance or Site Inspection	180	3.2111	.83892	.06253
IAONE	Design or Plan Review	198	3.2247	.62366	.04432
	Construction/ Maintenance or Site Inspection	180	3.2222	.85584	.06379
IATWO	Design or Plan Review	192	3.5156	.46991	.03391
	Construction/ Maintenance or Site Inspection	180	3.4815	.53693	.04002
IS	Design or Plan Review	210	3.4512	.51850	.03578
	Construction/ Maintenance or Site Inspection	180	3.6111	.39393	.02936
ITONE	Design or Plan Review	210	3.4048	.54672	.03773
	Construction/ Maintenance or Site Inspection	180	3.6667	.41524	.03095
ITTWO	Design or Plan Review	206	3.4300	.55301	.03853
	Construction/ Maintenance or Site Inspection	180	3.6984	.45273	.03374
ITTHREE	Design or Plan Review	206	3.5502	.42886	.02988
	Construction/ Maintenance or Site Inspection	180	3.6296	.45107	.03362
ITFOUR	Design or Plan Review	203	3.4261	.58874	.04132
	Construction/ Maintenance or Site Inspection	180	3.5139	.47619	.03549
ITFIVE	Design or Plan Review	202	3.3634	.60778	.04276
	Construction/ Maintenance or Site Inspection	180	3.6000	.48208	.03593
ITSEX	Design or Plan Review	210	3.3444	.58547	.04040
	Construction/ Maintenance or Site Inspection	180	3.6852	.40897	.03048
ITSEVEN	Design or Plan Review	210	3.5690	.48789	.03367
	Construction/ Maintenance or Site Inspection	180	3.6111	.39393	.02936

Table 9.23: Group Statistics

9.5 Analysis of Impact Factors on Public Welfare

9.5.1 Clustering of Likelihood Occurrence of Impact Factors (results of Factor Analysis)

The 9 components extracted factors' analysis were then clustered together to form few clusters that have some common themes. The analysis shows 4 main clusters emerging they are consistent and which labelled as follows:

- Cluster 1: Legal
- Cluster 2: Administrative
- Cluster 3: Technical
- Cluster 4: Social

The new components for the likelihood occurrence of impact factors are shown in Tables 9.8, 9.9, 9.10, and 9.11, below.

- **Cluster 1: Legal**

Cluster 1 is defined as "Legal ' and this is comprised of one components. This has been labelled to include Legal issues of building code framework. Only one component makes-up this cluster and it is associated with problems of law in technical requirements, changes in building technology, insurance cover, certification of professionals and building materials. The new components for the likelihood occurrence of impact factors are shown in Table 9.24 below:-

Ref.	Component	Main cause factors
IL	**Component 1** Problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials	IL1: Lack of many technical requirements in building regulations in Kuwait IL2: Not taking into account the changes in building technology in current law IL3: Inexistence of testing and certification systems for building engineers, contractors, and skilled labours (because of the law) IL4: Inexistence of building materials testing systems (because of the law) IL5: Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)

Table 9.24: Cluster 1: Legal for likelihood occurrence of impact factors

- **Cluster 2: Administrative**

Cluster 2 is defined as "Administrative ' and this is comprised of one component. This has been labelled to include issues of administration issues of building codes framework. Only one component makes-up this cluster and it is associated with general management, plan review, site inspection, certification, qualification of building officials, and violations. The new components for the likelihood occurrence of cause factors are shown in Table 9.25 below:-

Ref.	Component	Main cause factors
IA	**Component 2** Problems to perform plan review and inspection, records keeping of building project, testing of building materials, and performing periodical inspection after occupancy	IA1: Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects IA2: lose and damage of documents and records of building projects at Kuwait Municipality IA3: Improper capabilities in technical and managerial sides of Municupality to follow up and control building and construction works IA4: Unclear and inadequate procedures of review of building plans at Municipality IA5: Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works IA6: Neglecting the testing of building materials and concrete by certified testing centres during projects execution IA7: Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy

Table 9.25: Cluster 2: Administrative for likelihood occurrence of impact factors

- **Cluster 3: Technical**

Cluster 1 is defined as "Technical ' and this is comprised of six components and represents 81% of the total variance explained. This has been labelled to include Technical issues of building codes framework. The new components for the likelihood occurrence of impact factors are shown in Table 9.26 below:-

Ref.	Component	% variance	Main cause factors	Total % variance
ITONE	Component 1	18.830	**IT1:** Accessibility **IT3:** Boilers/water heaters **IT5:** Construction equipment **IT6:** Demolition of buildings and facilities **IT9:** Encroachments into public right of way **IT11:** Existing structures **IT15:** Gypsum board and plaster **IT39:** Structural tests and inspections **IT40:** Swimming pools **IT41:** Type of construction **IT42:** Weather condition such humidity , dust and wind **IT43:** Wood	81.042
ITTWO	Component 2	18.156	**IT12:** Exterior walls **IT13:** Gas piping installations **IT30:** Sheds and Car metal shed **IT31:** Signs **IT32:** Site preparation **IT33:** Smoke detectors for houses	
ITTHREE	Component 3	12.280	**IT15:** Gypsum board and plaster **IT18:** Interior finishes **IT22:** Parking **IT23:** Plastic **IT25:** Poor electric and lighting works during alteration, movement, and repairing **IT26:** Property maintenance **IT27:** Safeguards during construction **IT28:** Sanitation of exterior property areas **IT29:** Sewage disposal	
ITFOUR	Component 4	12.127	**IT34:** Soil and foundations **IT36:** Sound transmission **IT37:** Steel **IT38:** Structural design	
ITFIVE	Component 5	10.481	**IS2**: Ineffective engineering supervision and inspection tasks to prevent violations or cheatings **IS3**: Weak of power of law in enforcing correction decisions of violations **IS4**: No deterrent punishments for violators **IS5**: Absence of community awareness in building regulations and nature tasks of Municipality	
ITSEX	Component 6	9.168	**IT1:** Accessibility **IT3:** Boilers/water heaters **IT5:** Construction equipment **IT6:** Demolition of buildings and facilities **IT9:** Encroachments into public right of way **IT11:** Existing structures **IT15:** Gypsum board and plaster **IT39:** Structural tests and inspections **IT40:** Swimming pools **IT41:** Type of construction **IT42:** Weather condition such humidity , dust and wind condition **IT43:** Wood	

Table 9.26: Cluster 3: Technical for the likelihood occurrence of impact factors

- **Cluster 4: Social**

Cluster 4 is defined as " Social ' and this is comprised of one component. This has been labelled to include social issues of building codes framework. Only one component makes-up this cluster and it is associated with ineffective inspection, weak enforcing correction decisions of violations, and absence of community awareness. The new components for the likelihood occurrence of impact factors are shown in Table 9.27 below:-

Ref.	Component	Main cause factors
IS	**Component 1** Ineffective inspection, weak Enforcing of correct decisions for violations , and the absence of community awareness	**IS2:** Ineffective engineering supervision and inspection tasks to prevent violations or cheatings **IS3:** Weak power of law in enforcing correct decisions of violations **IS4:** No deterrent punishments for violators **IS5:** Absence of community awareness in building regulations and nature tasks of Municipality

Table 9.27: Cluster 4: Social for the likelihood occurrence of impact factors

9.5.2 Correlation of Impact Factors (results of Pearson)

Table 9.28 shows the correlation structure and presents a general picture of the association between outcome /dependent factors and the independent factors.

For the components of impact factors likelihood Table 9.28, eight main areas of impact factors were observed in terms of the extracted components. These are most positive association, in fact, observed in relation to IL, IA, IS, ITONE, ITTWO, ITTHREE, ITFOUR, and ITSEX impact factors. IL, ITONE, ITTWO, ITTHREE, and ITFOUR as extracted components of impact factors are correlated with all other different components of impact factors. IL has the strongest relation among all other relations in comparison to the rest of the components, and has the strongest relation with IA (.865) and with ITFOUR .871). The summery of weak and strong associations is shown in the following in Table 9.28 and 9.29:-

Correlations

		IL	IA	IS	ITONE	ITTWO	ITTHREE	ITFOUR	ITFIVE	ITSEX
IL	Pearson Correlation	1	.886**	.761**	.843**	.761**	.752**	.871**	.626**	.860**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000
	N	380	369	380	373	366	376	380	376	376
IA	Pearson Correlation	.886**	1	.850**	.845**	.735**	.791**	.786**	.629**	.694**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000
	N	369	369	369	362	362	365	369	365	365
IS	Pearson Correlation	.761**	.850**	1	.793**	.794**	.744**	.727**	.616**	.610**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000
	N	380	369	390	383	376	386	390	386	386
ITONE	Pearson Correlation	.843**	.845**	.793**	1	.744**	.798**	.827**	.627**	.768**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000
	N	373	362	383	383	372	379	383	379	379
ITTWO	Pearson Correlation	.761**	.735**	.794**	.744**	1	.731**	.830**	.731**	.764**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000
	N	366	362	376	372	376	372	376	372	372
ITTHREE	Pearson Correlation	.752**	.791**	.744**	.798**	.731**	1	.757**	.670**	.698**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000
	N	376	365	386	379	372	386	386	382	386
ITFOUR	Pearson Correlation	.871**	.786**	.727**	.827**	.830**	.757**	1	.707**	.837**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000
	N	380	369	390	383	376	386	390	386	386
ITFIVE	Pearson Correlation	.626**	.629**	.616**	.627**	.731**	.670**	.707**	1	.659**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000
	N	376	365	386	379	372	382	386	386	382
ITSEX	Pearson Correlation	.860**	.694**	.610**	.768**	.764**	.698**	.837**	.659**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	
	N	376	365	386	379	372	386	386	382	386

Table 9.28: Correlations

	IL	IA	IS	ITONE	ITTWO	ITTHREE	ITFOUR	ITFIVE	ITSEX
IL	1	.886**	.761**	.843**	.761**	.752**	.871**	.626**	.860**
IA	.886**	1	.850**	.845**	.735**	.791**	.786**	.629**	.694**
IS	.761**	.850**	1	.793**	.794**	.744**	.727**	.616**	.610**
ITONE	.843**	.845**	.793**	1	.744**	.798**	.827**	.627**	.768**
ITTWO	.761**	.735**	.794**	.744**	1	.731**	.830**	.731**	.764**
ITTHREE	.752**	.791**	.744**	.798**	.731**	1	.757**	.670**	.698**
ITFOUR	.871**	.786**	.727**	.827**	.830**	.757**	1	.707**	.837**
ITSEX	.860**	.694**	.610**	.768**	.764**	.698**	.837**	.659**	1

Table 9.29: Summary of strong association

9.5.3 Comparison of Impact Factors (results of T-Test)

Independent sample T-test is used to compare the mean score of two different groups of people with one continuous factor. For hypothesis, T-test will be conducted. The purpose of hypothesis testing is to determine which of the following two hypotheses is correct:

- **Null hypothesis:**

There is no significant difference among the respondents rating for the impacts of insufficient Building codes on ***Public Welfare*** in Kuwait

- **Alternative hypothesis:**

There is no significant difference among the respondents rating for the impacts of insufficient Building codes on ***Public Welfare*** in Kuwait

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
IL	Equal variances assumed	21.222	.000	1.616	378	.107	.12300	.07613	-.02670	.27270
	Equal variances not assumed			1.590	324.590	.113	.12300	.07737	-.02921	.27521
IA	Equal variances assumed	.000	.987	.049	367	.961	.00378	.07644	-.14653	.15409
	Equal variances not assumed			.049	365.916	.961	.00378	.07645	-.14655	.15411
IS	Equal variances assumed	14.612	.000	-.714	388	.476	-.05198	.07279	-.19510	.09113
	Equal variances not assumed			-.724	387.734	.469	-.05198	.07179	-.19314	.08917
ITONE	Equal variances assumed	.055	.815	-1.011	381	.313	-.07520	.07441	-.22151	.07111
	Equal variances not assumed			-1.007	369.806	.314	-.07520	.07465	-.22200	.07160
ITTWO	Equal variances assumed	2.123	.146	.730	374	.466	.05143	.07048	-.08715	.19001
	Equal variances not assumed			.725	354.514	.469	.05143	.07093	-.08806	.19093
ITTHREE	Equal variances assumed	6.337	.012	.890	384	.374	.06710	.07542	-.08118	.21538
	Equal variances not assumed			.882	360.580	.378	.06710	.07603	-.08243	.21662
ITFOUR	Equal variances assumed	.382	.537	2.176	388	.030	.15212	.06991	.01466	.28957
	Equal variances not assumed			2.161	366.626	.031	.15212	.07039	.01370	.29053
ITFIVE	Equal variances assumed	.001	.980	.074	384	.941	.00526	.07069	-.13372	.14424
	Equal variances not assumed			.074	376.725	.941	.00526	.07071	-.13377	.14428
ITSEX	Equal variances assumed	2.827	.094	2.271	384	.024	.18590	.08186	.02495	.34685
	Equal variances not assumed			2.252	359.674	.025	.18590	.08256	.02354	.34826

Table 9.30: Independent Sample T- Test

Table 9.30 and 9.31 show that there is no significant difference among the scores of respondents (professional of Design/plan review and Construction/maintenance or site inspection). Opinions of design/plan review professionals are not greater than construction/maintenance or site inspection professionals in most of variables. Therefore, it is better to accept Null's hypothesis and reject any alternative one.

Group Statistics

	job	N	Mean	Std. Deviation	Std. Error Mean
IL	Design or Plan Review	200	2.9230	.62274	.04403
	Construction/ Maintenance or Site Inspection	180	2.8000	.85352	.06362
IA	Design or Plan Review	189	2.8927	.73195	.05324
	Construction/ Maintenance or Site Inspection	180	2.8889	.73599	.05486
IS	Design or Plan Review	210	3.0036	.77277	.05333
	Construction/ Maintenance or Site Inspection	180	3.0556	.64490	.04807
ITONE	Design or Plan Review	203	2.8446	.70822	.04971
	Construction/ Maintenance or Site Inspection	180	2.9198	.74726	.05570
ITTWO	Design or Plan Review	196	3.1827	.63138	.04510
	Construction/ Maintenance or Site Inspection	180	3.1313	.73449	.05475
ITTHREE	Design or Plan Review	206	2.9893	.69597	.04849
	Construction/ Maintenance or Site Inspection	180	2.9222	.78574	.05857
ITFOUR	Design or Plan Review	210	3.0873	.65969	.04552
	Construction/ Maintenance or Site Inspection	180	2.9352	.72024	.05368
ITFIVE	Design or Plan Review	206	3.0886	.69166	.04819
	Construction/ Maintenance or Site Inspection	180	3.0833	.69415	.05174
ITSEX	Design or Plan Review	206	3.1489	.75328	.05248
	Construction/ Maintenance or Site Inspection	180	2.9630	.85504	.06373

Table 9.31: Group Statistics

9.6 Correlation of Cause and Impact Factors

9.6.1 Introduction

In linking cause factors to extracted impact factors, the statistical approach is to estimate factors' scores using Cross tabulation, and which are available as an option in standard Ms Excel packages. Cross-tabulation is taking two variables and tabulating the results of one variable against the other (Stevens, 2006). Cross Tabulation is a survey analysis feature that allows to compare responses and to show the relationship between responses to two different questions of investigations.

From this, the analysis (Cross-tabulation) enables to correlate and compare the cause factors rankings to extracted impact of the three building code objectives to assess which cause and impact factors are likely important in practice. The analysis undertaken for the cause and impact factors perceptions, the factor analysis, the clustering of cause and impact factors were all being discussed in isolation of one another. This part of the chapter will be elaborated in greater details of interactions and correlation of the cause and impact factors.

For the purpose of this chapter, the full Table 6.1 illustrates the statistical ranking results for all 55 indicators and is shown in the Appendix A. In Table 6.1, the overall ranking, and the ranking by each practitioner for every cause factor are presented. The full Tables 6.2, 6.3, and 6.4 illustrate the statistical ranking results for all 59 indicators and are shown in the Appendix B. In Table 6.2, 6.3, and 6.4 the overall ranking, and the ranking by each practitioner for every impact factor are presented.

Severity index (S.1) measure is used to rank cause and impact factors according to their significance. Equation 5.2 presents how S.I is calculated (Section 6.3).

- **Research Hypothesis**

Before performing the analysis and interpreting the data, the hypothesis established to have some idea of what is expected to find in the results. There is a need to understand the theory of cause (insufficient and infringements of BC) and effect (problems of BC). Hypothesis is an assumption or a concession made for the purpose of argument (Merriam-Webster, Incorporated, 2012). The research mean hypothesis is:

> ***'Many of the problems encountered to meet the objectives of building codes in Kuwait (ensure the minimum requirements of public health, safety and welfare for people and buildings) caused by insufficient building codes/regulations and infringements of those that currently exist.***

From the research main hypothesis, three sub-hypothesis excreted according to the three objectives of building codes, as the following:

(i) Public Safety:

- **Null's hypothesis:** Insufficient and infringements of building regulations (codes) have no impact on the shortcomings in meeting the minimum requirements of public safety.

- **Alternative hypothesis:** Insufficient and infringements of building regulations (codes) have an impact on the shortcomings in meeting the minimum requirements of public safety.

(ii) Public Health:

- **Null's hypothesis:** Insufficient and infringements of building regulations (codes) have no impact on the shortcomings in meeting the minimum requirements of public health.
- **Alternative hypothesis:** Insufficient and infringements of building regulations (codes) have an impact on the shortcomings in meeting the minimum requirements of public health.

(iii) Public Welfare:

- **Null's hypothesis:** Insufficient and infringements of building regulations (codes) have no impact on the shortcomings in meeting the minimum requirements of public welfare.
- **Alternative hypothesis:** Insufficient and infringements of building regulations (codes) have an impact on the shortcomings in meeting the minimum requirements of public welfare.

- **Rating Scale**

For reasons of clarity of presentation, only Severity index (S.1) that is significantly over 60% level is reported. Correlation between cause and impact factors (rows) and Severity index (columns) are reported in Table 9.33 to Table 9.43, and Figure 9.1 to 9.21. A very high value for the correlation implies a positive association (high Severity index values of cause and impact factors). A low value for the correlation implies a negative or inverse association (low Severity index values of cause and impact factors).

Rating	Grade
Very High	**80 - 100**
High	**60 - 80**
Moderate	**40 - 60**
Low	**20 - 40**
Very Low	**0 - 20**

Table 9.32: Rating Scale

The detailed results of the correlation calculations between cause and impact factors on the three building code objectives are reported in Table 9.1 and Table 10.2.

9.6.2 Correlation of Cause and Impact Factors on Public Safety

Legal Part of BC

The legal part of BC consists of 5 cause and impact factors. For the impact of factors on public safety, ranking results in Table 9.33 and Fig. 9.1 shows that all cause factors have high occurrence and impact on public safety. Variable No 4 is considered to have the highest impact on public safety for the Legal part of BC, with severity index of almost 60% (impact factor) and 76.47% (cause factor).

Variable No	Impact Factor (Public Safety)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IL1	3.69	0.49	13.18	74.12	LC9	3.32	1.087	32.72	65
2	IL2	3.47	0.75	21.55	71.76	LC8	3.99	1.117	28.00	74
3	IL3	3.62	0.71	19.57	73.33	LC6	3.51	1.312	37.40	73
4	IL4	3.76	0.53	14.02	76.47	LC3	3.38	1.288	38.15	59
5	IL5	3.61	0.71	19.67	72.94	LC2	3.56	1.311	36.85	72

Table 9.33: Correlation of Cause and Impact Factors on Public Safety in Legal Part of BC

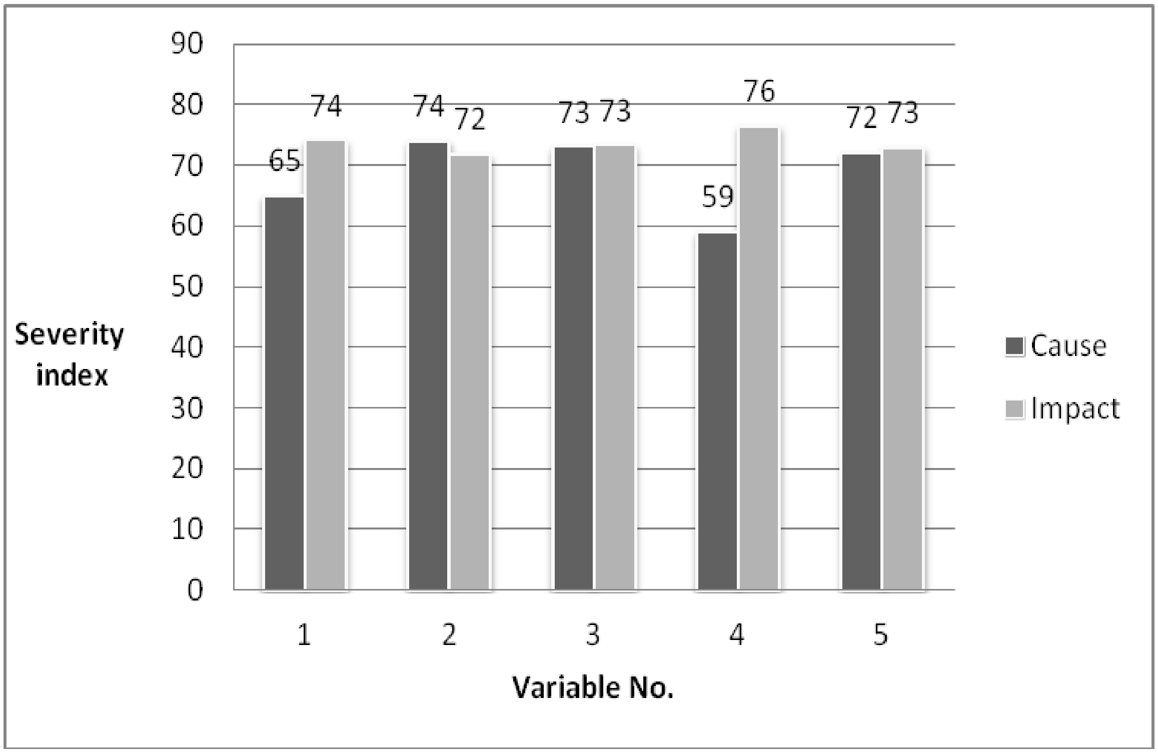

Fig. 9.1: Correlation of Cause and Impact Factors on Public Safety in Legal Part of BC

Administrative part of BC

The administrative part of BC consists of 7 cause and impact factors. For the impact of factors on public safety, ranking results in Table 9.34 and Fig. 9.2 shows that all cause factors have high occurrence and impact on public safety. Variable No 1 is considered the highest impact on public safety for the Administrative part of BC, with severity index of almost 78% (impact factors) and 71% (cause factors).

Variable No	Impact Factor (Public Safety)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IA1	3.75	0.52	13.93	77.65	AC9	3.32	1.002	30.20	71
2	IA2	3.40	0.88	25.97	70.59	AC6	4.17	.866	20.77	79
3	IA3	3.69	0.58	15.81	75.29	AC15	3.54	.960	27.12	67
4	IA4	3.53	0.72	20.28	73.33	AC32	3.58	1.186	33.10	81
5	IA5	3.71	0.55	14.86	77.33	AC24	3.48	1.028	29.57	73
6	IA6	3.86	0.35	9.00	77.65	AC29	3.83	.975	25.48	78
7	IA7	3.82	0.41	10.83	75.29	AC31	4.10	.988	24.09	87

Table 9.34: Correlation of Cause and Impact Factors on Public Safety in Admin. Part of BC

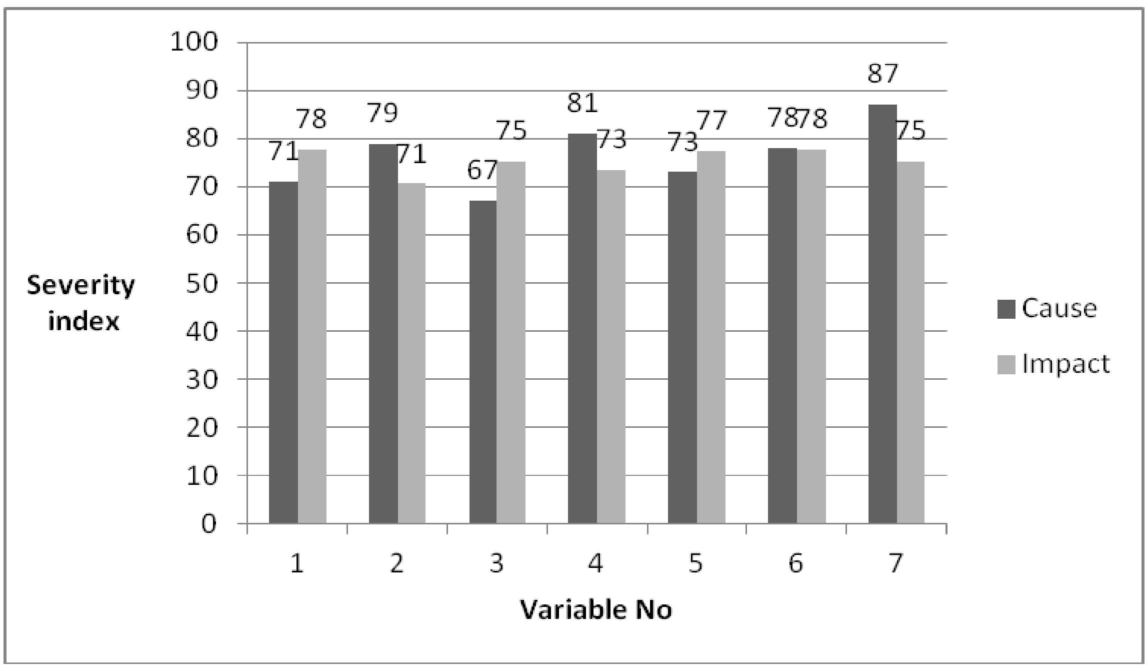

Fig. 9.2: Correlation of Cause and Impact Factors on Public Safety in Administrative part of BC

Technical part of BC

The technical part of BC consists of 43 impact factors and one general cause factor. For the impact of factors on public safety, ranking results in Table 9.35 and Fig. 9.3, 9.4, 9.5, and 9.6 shows that all cause factors have high occurrence and impact on public safety. Variable No 41 and 31 are considered the highest impact on public safety for the Technical part of BC, with severity index of 80% (impact factors) and 65% (cause factors) for Variable No 41 and 78% (impact factors) and 65% (cause factors) for Variable No 31.

Variable No	Impact Factor (Public Safety)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IT1	3.49	0.80	22.95	74.12	LC9	3.32	1.087	32.72	65
2	IT2	3.72	0.63	17.01	76.47	LC9	3.32	1.087	32.72	65
3	IT3	3.68	0.66	17.85	76.47	LC9	3.32	1.087	32.72	65
4	IT4	3.60	0.66	18.34	75.29	LC9	3.32	1.087	32.72	65
5	IT5	3.65	0.69	18.79	76.47	LC9	3.32	1.087	32.72	65
6	IT6	3.62	0.71	19.60	75.29	LC9	3.32	1.087	32.72	65
7	IT7	3.63	0.62	17.05	72.94	LC9	3.32	1.087	32.72	65
8	IT8	3.39	0.89	26.38	72.94	LC9	3.32	1.087	32.72	65
9	IT9	3.58	0.67	18.78	75.29	LC9	3.32	1.087	32.72	65
10	IT10	3.42	0.76	22.15	74.12	LC9	3.32	1.087	32.72	65
11	IT11	3.26	0.89	27.15	69.41	LC9	3.32	1.087	32.72	65
12	IT12	3.60	0.64	17.73	74.12	LC9	3.32	1.087	32.72	65
13	IT13	3.69	0.49	13.18	75.29	LC9	3.32	1.087	32.72	65
14	IT14	3.63	0.63	17.32	74.12	LC9	3.32	1.087	32.72	65
15	IT15	3.49	0.77	22.18	72.94	LC9	3.32	1.087	32.72	65
16	IT16	3.69	0.55	14.95	76.47	LC9	3.32	1.087	32.72	65
17	IT17	3.64	0.61	16.70	74.12	LC9	3.32	1.087	32.72	65
18	IT18	3.74	0.48	12.86	76.47	LC9	3.32	1.087	32.72	65
19	IT19	3.49	0.73	20.91	72.94	LC9	3.32	1.087	32.72	65
20	IT20	3.47	0.74	21.41	74.12	LC9	3.32	1.087	32.72	65
21	IT21	3.54	0.67	18.88	72.94	LC9	3.32	1.087	32.72	65
22	IT22	3.50	0.79	22.62	74.12	LC9	3.32	1.087	32.72	65
23	IT23	3.48	0.69	19.71	75.29	LC9	3.32	1.087	32.72	65
24	IT24	3.33	0.86	25.75	71.76	LC9	3.32	1.087	32.72	65
25	IT25	3.37	0.79	23.36	70.59	LC9	3.32	1.087	32.72	65
26	IT26	3.59	0.65	18.13	76.47	LC9	3.32	1.087	32.72	65
27	IT27	3.56	0.67	18.87	76.47	LC9	3.32	1.087	32.72	65
28	IT28	3.63	0.63	17.26	77.65	LC9	3.32	1.087	32.72	65
29	IT29	3.62	0.62	17.12	75.29	LC9	3.32	1.087	32.72	65
30	IT30	3.66	0.59	16.02	74.12	LC9	3.32	1.087	32.72	65

Variable No	Impact Factor (Public Safety)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
31	IT31	3.71	0.57	15.44	78.82	LC9	3.32	1.087	32.72	65
32	IT32	3.52	0.78	22.11	72.94	LC9	3.32	1.087	32.72	65
33	IT33	3.48	0.77	22.23	71.76	LC9	3.32	1.087	32.72	65
34	IT34	3.46	0.71	20.52	75.29	LC9	3.32	1.087	32.72	65
35	IT35	3.54	0.74	20.87	70.59	LC9	3.32	1.087	32.72	65
36	IT36	3.48	0.73	21.00	72.94	LC9	3.32	1.087	32.72	65
37	IT37	3.35	0.87	25.88	69.41	LC9	3.32	1.087	32.72	65
38	IT38	3.44	0.78	22.54	75.29	LC9	3.32	1.087	32.72	65
39	IT39	3.36	0.89	26.40	71.76	LC9	3.32	1.087	32.72	65
40	IT40	3.69	0.58	15.63	77.65	LC9	3.32	1.087	32.72	65
41	IT41	3.83	0.46	12.01	80.00	LC9	3.32	1.087	32.72	65
42	IT42	3.80	0.46	12.06	76.47	LC9	3.32	1.087	32.72	65
43	IT43	3.81	0.53	13.92	77.65	LC9	3.32	1.087	32.72	65

Table 9.35: Correlation of Cause and Impact Factors on Public Safety in Technical part of BC

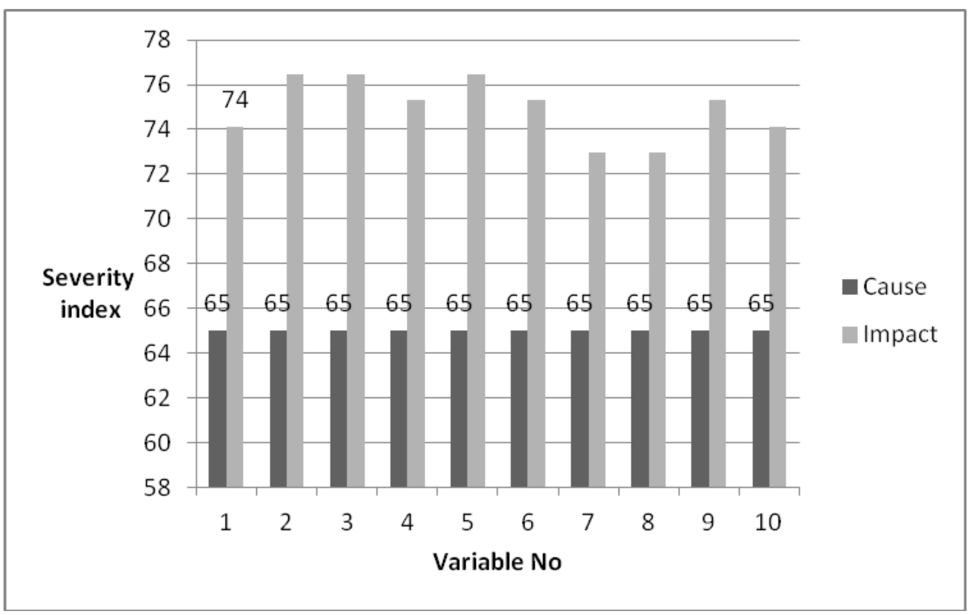

Fig. 9.3: Correlation of Cause and Impact Factors on Public Safety in Technical part of BC

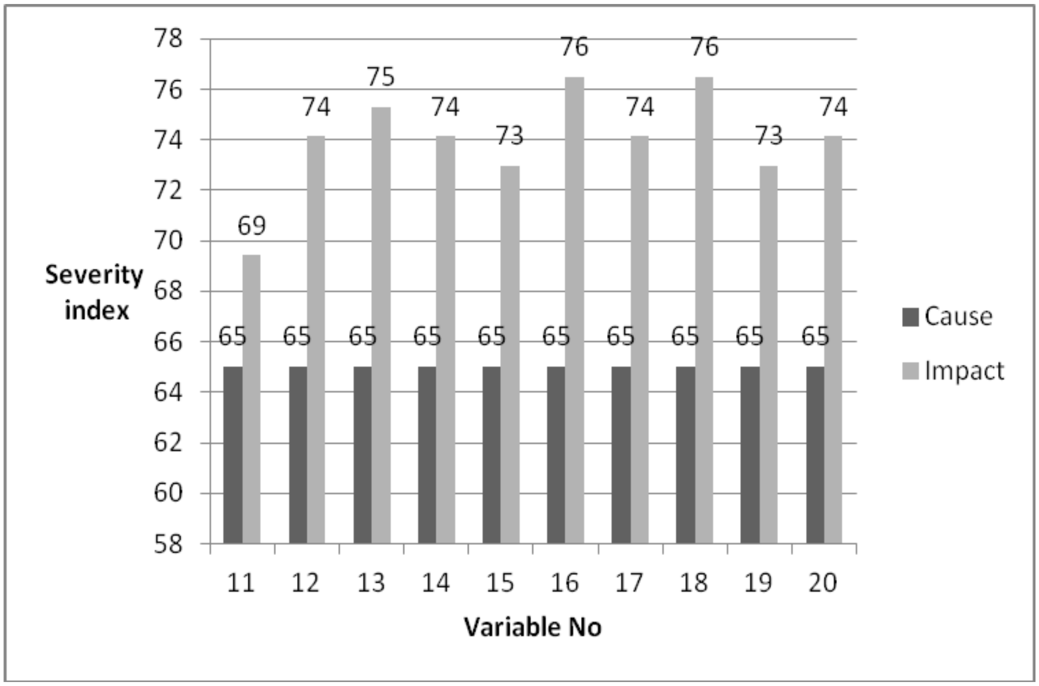

Fig. 9.4: Correlation of Cause and Impact Factors on Public Safety in Technical part of BC

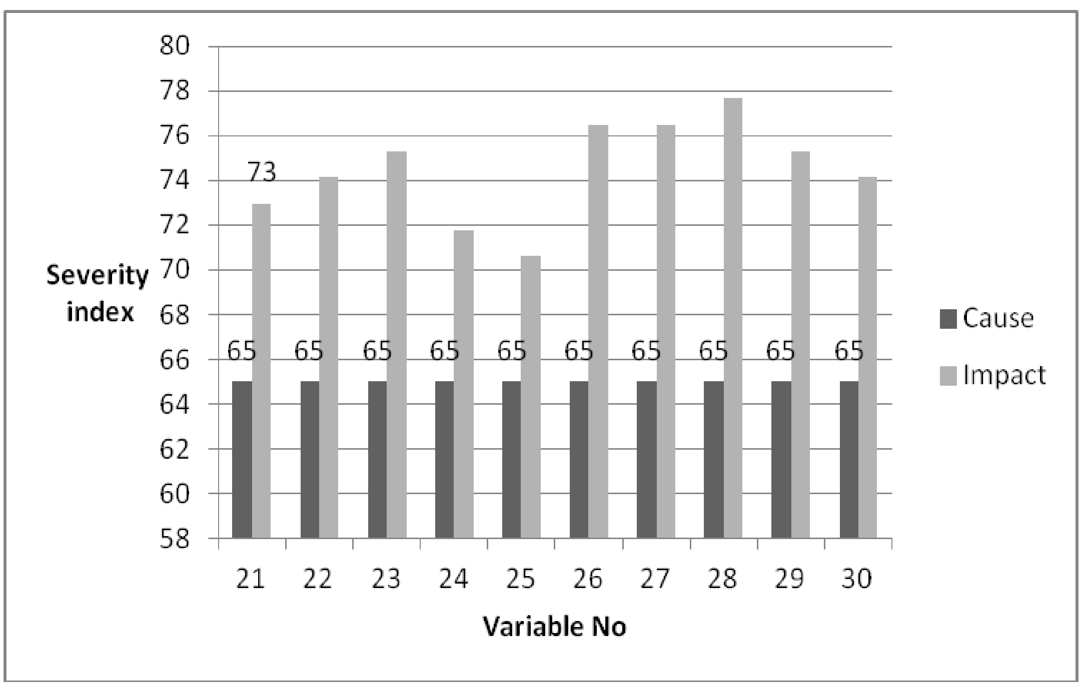

Fig. 9.5: Correlation of Cause and Impact Factors on Public Safety in Technical part of BC

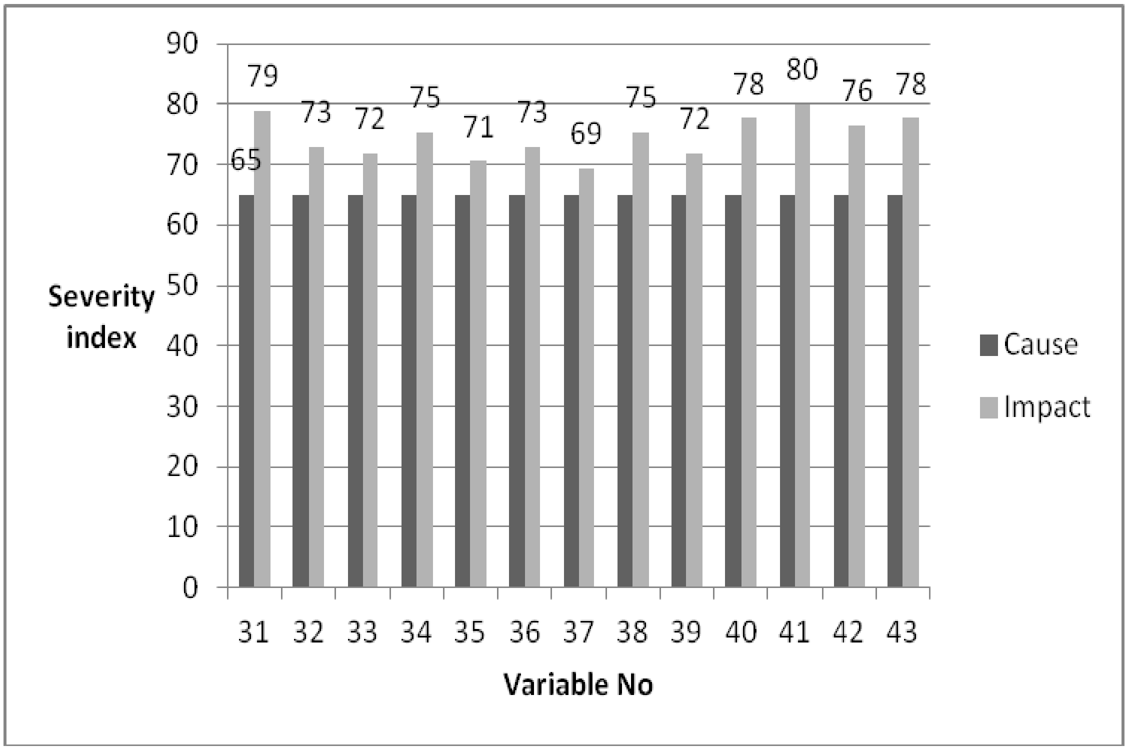

Fig. 9.6: Correlation of Cause and Impact Factors on Public Safety in Technical part of BC

Social part of BC

The social part of BC consists of 4 cause and impact factors. For the impact of factors on public safety, ranking results in Table 9.36 and Fig. 9.7 shows that all cause factors have high occurrence and an impact on public safety. Variable No 2 is considered the highest impact on public safety for the Social part of BC, with severity index of almost 76% (impact factors) and 86% (cause factors).

Variable No	Impact Factor (Public Safety)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IS1	3.76	0.53	14.06	74.12	SC6	3.73	1.214	32.56	79
2	IS2	3.81	0.39	10.36	76.47	SC5	4.00	1.020	25.53	86
3	IS3	3.76	0.51	13.49	76.47	SC4	4.29	.750	17.47	85
4	IS4	3.60	0.69	19.16	76.47	SC1	3.47	1.048	30.16	62

Table 9.36: Correlation of Cause and Impact Factors on Public Safety in Social part of BC

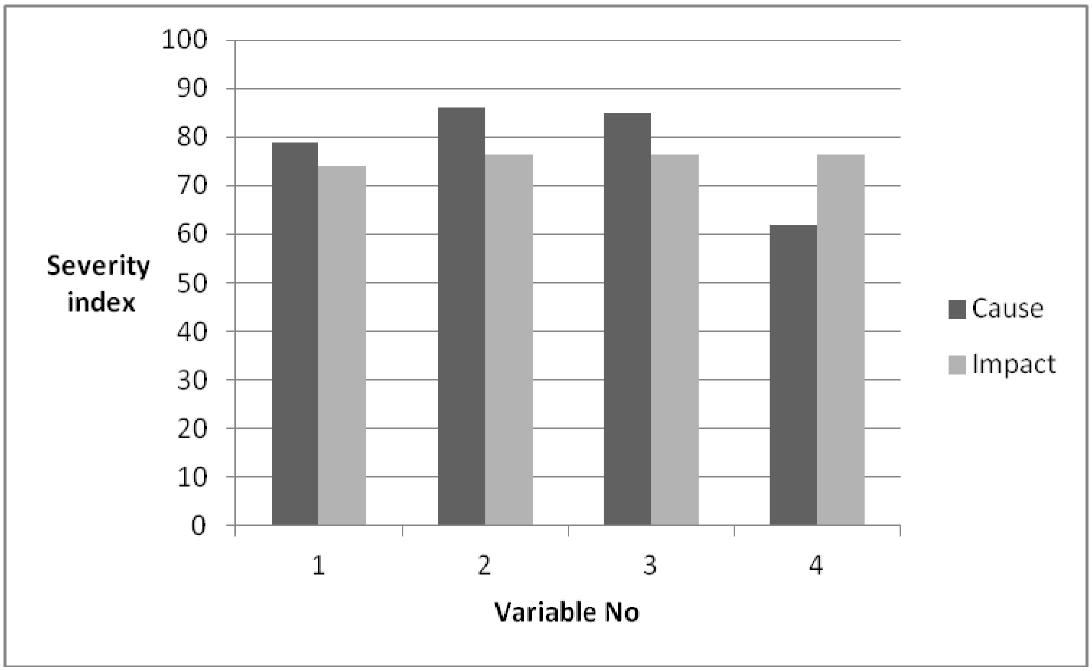

Fig. 9.7: Correlation of Cause and Impact Factors on Public Safety in Social part of BC

Insufficient and infringements of building regulations (codes) have an impact on the shortcomings in meeting the minimum requirements of public safety. Therefore, it would be better to reject Null's hypothesis and accept an alternative one.

9.6.3 Correlation of Cause and Impact Factors on Public Health

Legal Part of BC

The legal part of BC consists of 5 cause and impact factors. For the impact of factors on public health, ranking results in Table 9.37 and Fig. 9.8 shows that almost all cause factors have high occurrence and impact on public health. Variable No 5 is considered of having the highest impact on public health for the Legal part of BC, with severity index of almost 66% (impact factors) and 72% (cause factors).

Variable No	Impact Factor (Public Health)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IL1	3.25	.826	25.40	61.18	LC9	3.32	1.087	32.72	65
2	IL2	3.14	.879	28.01	61.18	LC8	3.99	1.117	28.00	74
3	IL3	3.17	.968	30.59	55.29	LC6	3.51	1.312	37.40	73
4	IL4	3.44	.696	20.20	63.53	LC3	3.38	1.288	38.15	59
5	IL5	3.32	.871	26.22	65.88	LC2	3.56	1.311	36.85	72

Table 9.37: Correlation of Cause and Impact Factors on Public Health in Legal part of BC

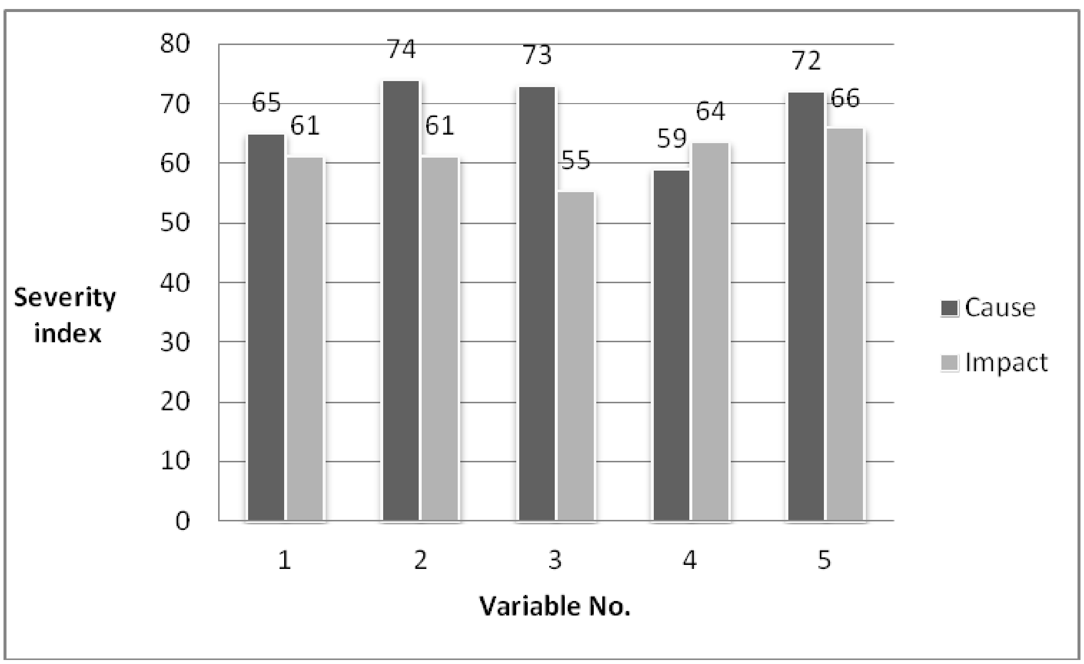

Fig. 9.8: Correlation of Cause and Impact Factors on Public Health in Legal part of BC

Administrative part of BC

The administrative part of BC consists of 7 cause and impact factors. For the impact of factors on public health, ranking results in Table 9.38 and Fig. 9.9 shows that Variables No 1, 3, 5, 6, and 7 cause factors have high occurrence and impact on public health. Variable No 7 is considered of having the highest impact on public health for the Administrative part of BC, with severity index of almost 72% (impact factors) and 87% (cause factors).

Variable No	Impact Factor (Public Health)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IA1	3.39	.677	20.00	62.35	AC9	3.32	1.002	30.20	71
2	IA2	3.03	1.084	35.80	57.65	AC6	4.17	.866	20.77	79
3	IA3	3.33	.848	25.49	60.00	AC15	3.54	.960	27.12	67
4	IA4	3.14	.950	30.26	56.47	AC32	3.58	1.186	33.10	81
5	IA5	3.47	.610	17.56	68.24	AC24	3.48	1.028	29.57	73
6	IA6	3.38	.733	21.69	66.25	AC29	3.83	.975	25.48	78
7	IA7	3.64	.516	14.16	71.76	AC31	4.10	.988	24.09	87

Table 9.38: Correlation of Cause and Impact Factors on Public Health in Admin. Part of BC

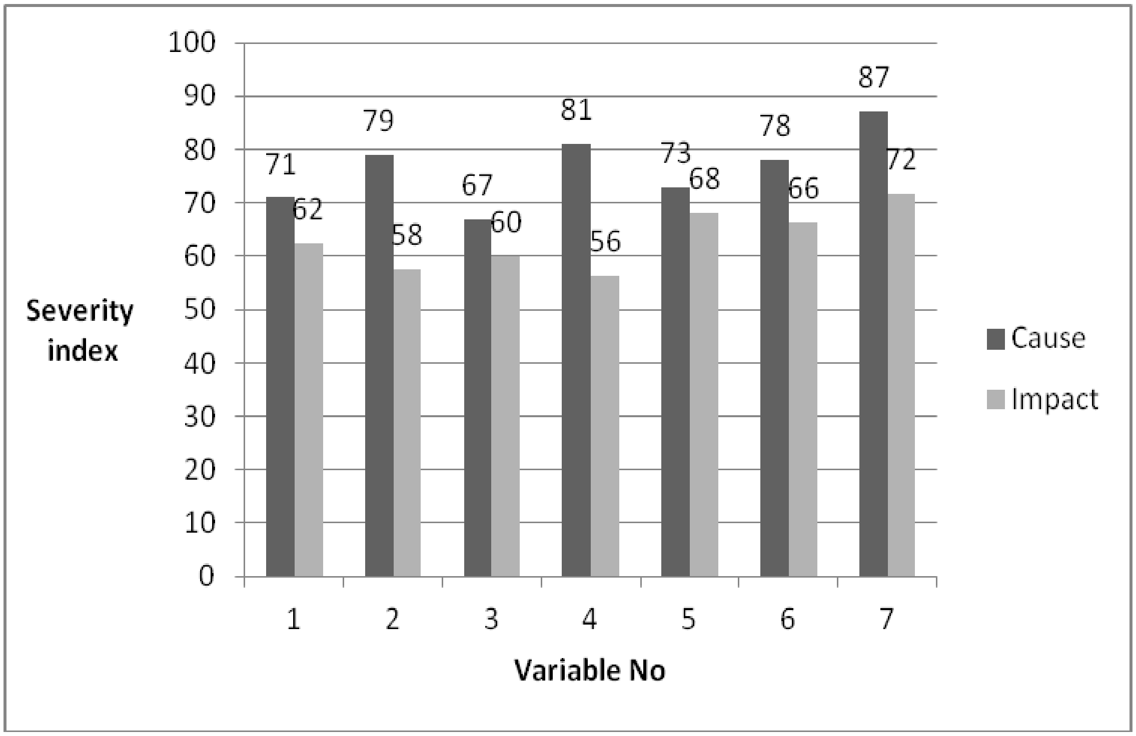

Fig. 9.9: Correlation of Cause and Impact Factors on Public Health in Administrative part of BC

Technical part of BC

The technical part of BC consists of 43 impact factors and one general cause factor .In relation to the impact of factors on public health, ranking results in Table 9.39 and Fig. 9.10, 9.11, 9.12, and 9.13 show that all cause factors have high occurrence and impact on public health. Variable No 41 and 40 are having the highest impact on public health for the Technical part of BC, with severity index of 78% are (impact factors) and 65% are (cause factors) for Variable No 41 and 77% are(impact factors) and 65% are (cause factors) for Variable No 40.

Variable No	Impact Factor (Public Health)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IT1	3.44	.782	22.76	68.24	LC9	3.32	1.087	32.72	65
2	IT2	3.52	.636	18.05	67.06	LC9	3.32	1.087	32.72	65
3	IT3	3.71	.554	14.95	70.59	LC9	3.32	1.087	32.72	65
4	IT4	3.51	.611	17.42	70.59	LC9	3.32	1.087	32.72	65
5	IT5	3.62	.582	16.08	75.29	LC9	3.32	1.087	32.72	65
6	IT6	3.69	.496	13.46	72.94	LC9	3.32	1.087	32.72	65
7	IT7	3.48	.653	18.75	67.06	LC9	3.32	1.087	32.72	65
8	IT8	3.42	.750	21.89	67.06	LC9	3.32	1.087	32.72	65
9	IT9	3.55	.567	15.98	68.24	LC9	3.32	1.087	32.72	65
10	IT10	3.53	.567	16.05	70.59	LC9	3.32	1.087	32.72	65
11	IT11	3.32	.683	20.58	62.35	LC9	3.32	1.087	32.72	65
12	IT12	3.46	.656	18.98	67.06	LC9	3.32	1.087	32.72	65
13	IT13	3.49	.586	16.78	69.41	LC9	3.32	1.087	32.72	65
14	IT14	3.56	.551	15.48	67.06	LC9	3.32	1.087	32.72	65
15	IT15	3.47	.671	19.33	67.06	LC9	3.32	1.087	32.72	65
16	IT16	3.59	.575	16.02	70.59	LC9	3.32	1.087	32.72	65
17	IT17	3.45	.654	18.96	67.06	LC9	3.32	1.087	32.72	65
18	IT18	3.63	.525	14.46	71.76	LC9	3.32	1.087	32.72	65
19	IT19	3.45	.707	20.51	64.71	LC9	3.32	1.087	32.72	65
20	IT20	3.45	.756	21.92	65.88	LC9	3.32	1.087	32.72	65
21	IT21	3.37	.718	21.28	62.50	LC9	3.32	1.087	32.72	65
22	IT22	3.49	.672	19.23	69.41	LC9	3.32	1.087	32.72	65
23	IT23	3.51	.694	19.76	68.24	LC9	3.32	1.087	32.72	65
24	IT24	3.51	.716	20.42	69.41	LC9	3.32	1.087	32.72	65
25	IT25	3.54	.610	17.21	70.59	LC9	3.32	1.087	32.72	65
26	IT26	3.54	.567	16.03	70.59	LC9	3.32	1.087	32.72	65
27	IT27	3.51	.611	17.42	67.06	LC9	3.32	1.087	32.72	65
28	IT28	3.59	.618	17.20	71.76	LC9	3.32	1.087	32.72	65
29	IT29	3.63	.563	15.50	70.59	LC9	3.32	1.087	32.72	65
30	IT30	3.63	.610	16.81	72.94	LC9	3.32	1.087	32.72	65
31	IT31	3.65	.574	15.72	72.94	LC9	3.32	1.087	32.72	65
32	IT32	3.58	.639	17.82	68.24	LC9	3.32	1.087	32.72	65
33	IT33	3.48	.709	20.37	71.76	LC9	3.32	1.087	32.72	65
34	IT34	3.39	.706	20.82	70.00	LC9	3.32	1.087	32.72	65
35	IT35	3.49	.656	18.79	70.59	LC9	3.32	1.087	32.72	65
36	IT36	3.53	.594	16.83	71.76	LC9	3.32	1.087	32.72	65
37	IT37	3.46	.635	18.37	67.06	LC9	3.32	1.087	32.72	65
38	IT38	3.52	.636	18.06	72.94	LC9	3.32	1.087	32.72	65
39	IT39	3.52	.624	17.70	71.76	LC9	3.32	1.087	32.72	65
40	IT40	3.64	.532	14.62	76.47	LC9	3.32	1.087	32.72	65
41	IT41	3.67	.538	14.68	77.65	LC9	3.32	1.087	32.72	65
42	IT42	3.61	.540	14.97	74.12	LC9	3.32	1.087	32.72	65
43	IT43	3.69	.484	13.10	75.29	LC9	3.32	1.087	32.72	65

Table 9.39: Correlation of Cause and Impact Factors on Public Health in Technical part of BC

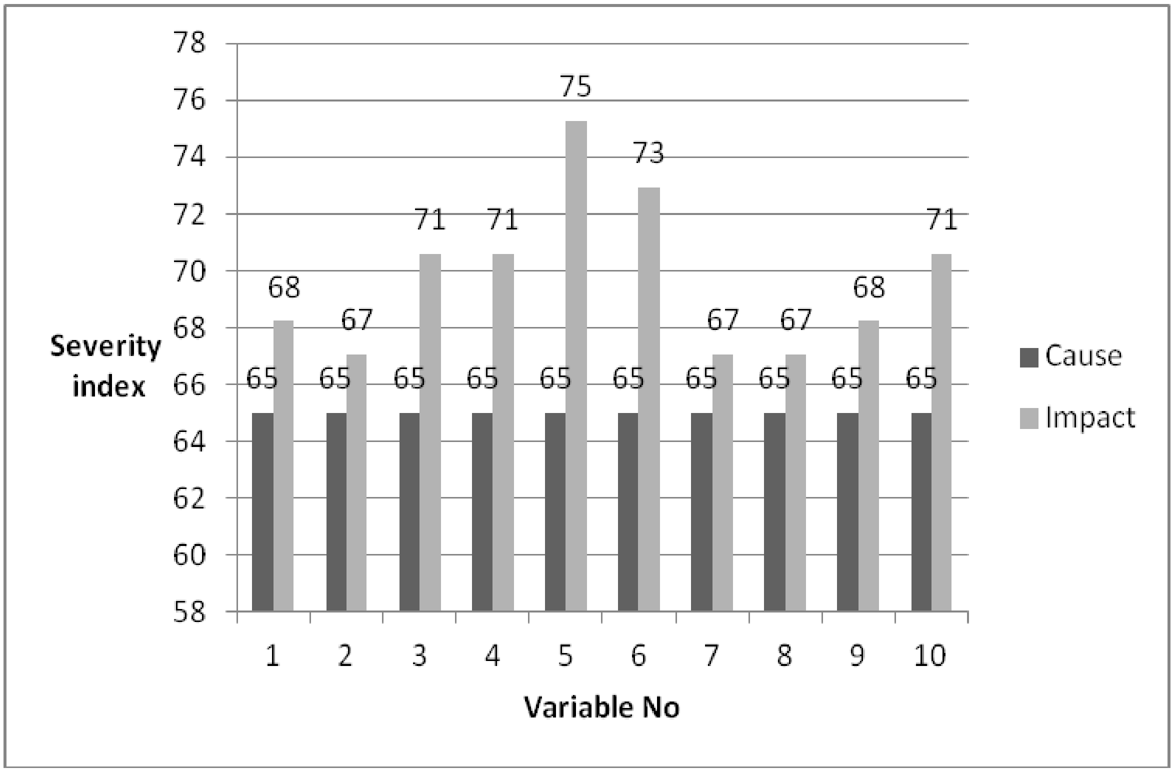

Fig. 9.10: Correlation of Cause and Impact Factors on Public Health in Technical part of BC

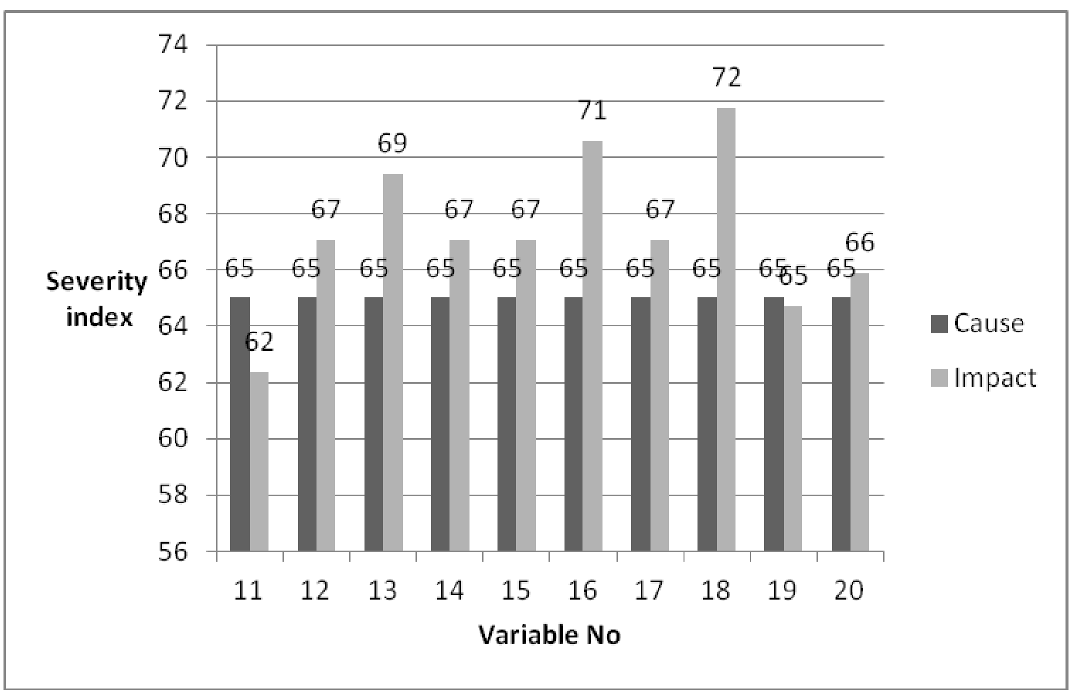

Fig. 9.11: Correlation of Cause and Impact Factors on Public Health in Technical part of BC

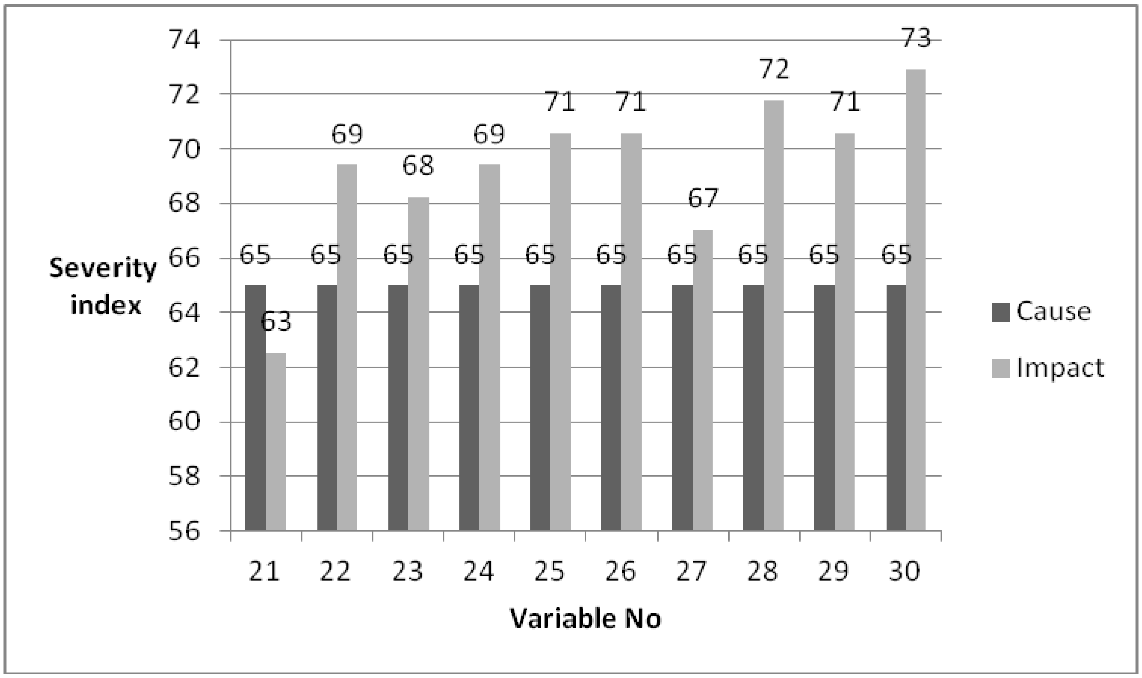

Fig. 9.12: Correlation of Cause and Impact Factors on Public Health in Technical part of BC

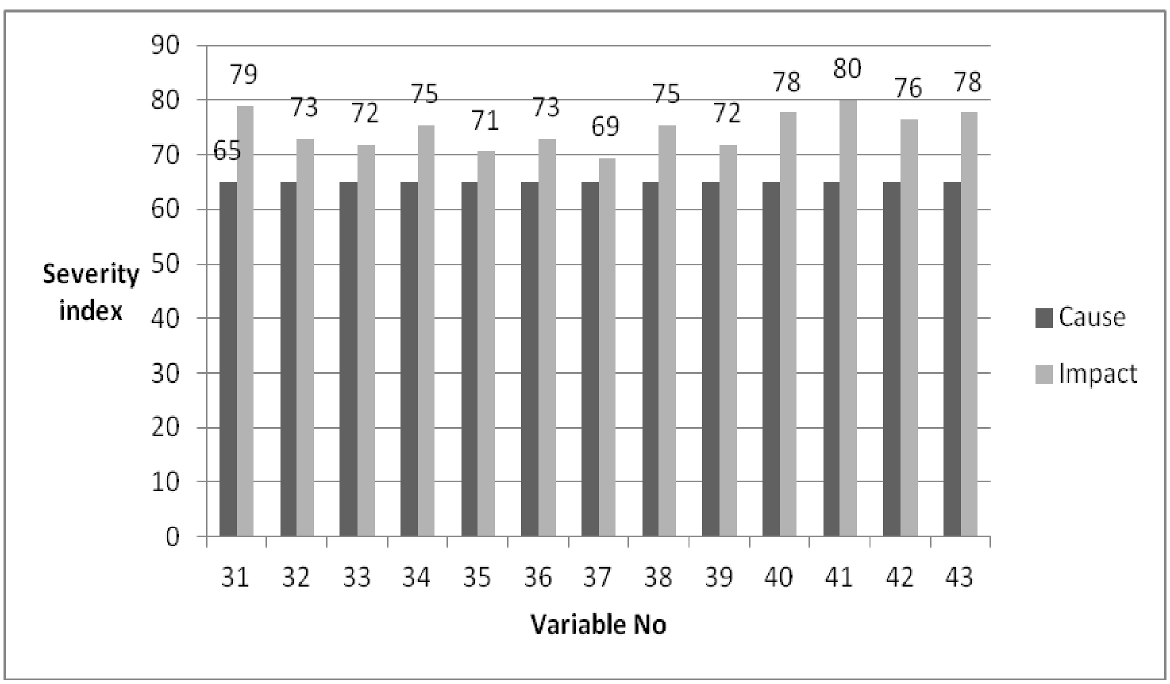

Fig. 9.13: Correlation of Cause and Impact Factors on Public Health in Technical part of BC

Social part of BC

The Social part of BC consists of 4 cause and impact factors. In relation to the impact of factors on public health, ranking results in Table 9.40 and Fig. 9.14 show that all cause factors have high occurrences and an impact on public health. Variable No 4 is considered the highest impact on public health for the Social part of BC, with severity index of 73% of (impact factors) and 62% are (cause factors).

Variable No	Impact Factors (Public Health)					Cause Factors				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IS1	3.57	.586	16.40	64.71	SC6	3.73	1.214	32.56	79
2	IS2	3.53	.549	15.56	70.59	SC5	4.00	1.020	25.53	86
3	IS3	3.51	.644	18.35	68.24	SC4	4.29	.750	17.47	85
4	IS4	3.49	.675	19.35	72.94	SC1	3.47	1.048	30.16	62

Table 9.40: Correlation of Cause and Impact Factors on Public Health in Social part of BC

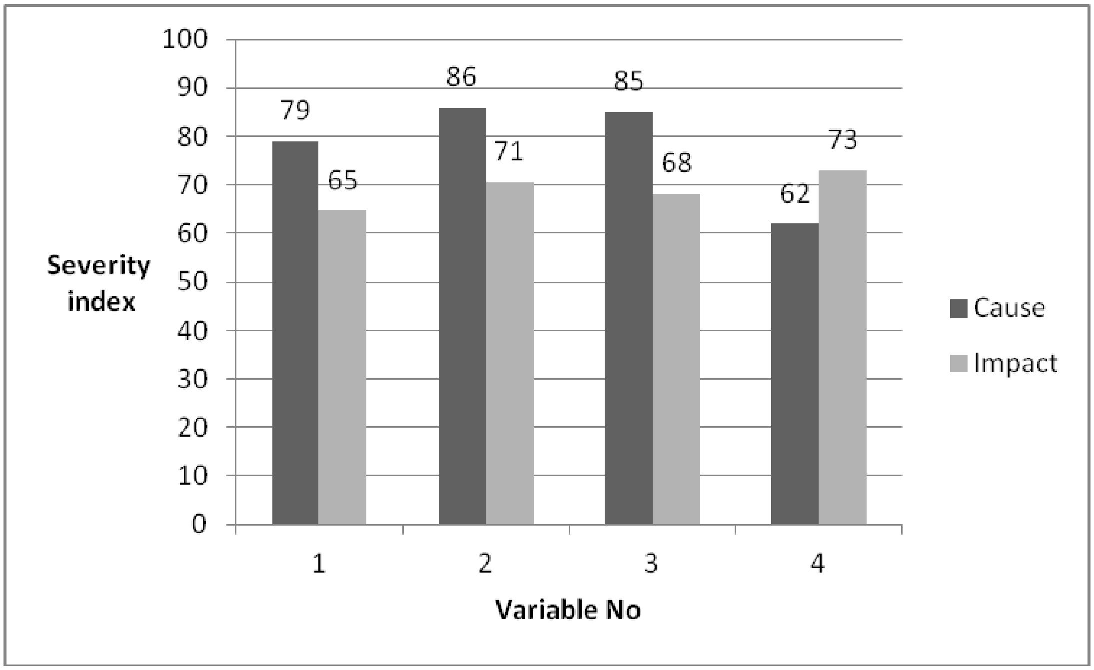

Fig. 9.14: Correlation of Cause and Impact Factors on Public Health in Social part of BC

Insufficient and infringements of building regulations (codes) have an impact on the shortcomings in meeting the minimum requirements of public safety. Therefore, it is better to reject Null's hypothesis and accept an alternative one.

9.6.4 Correlation of Cause and Impact Factors on Public Welfare

Legal Part of BC

The legal part of BC consists of 5 cause and impact factors. Regarding the impact of factors on public welfare, ranking results in Table 9.41 and Fig. 9.15 show that Variable No 2 of cause factor have a high occurrence and an impact on public welfare. Variable No 2 is considered of having the highest impact on Legal part of BC, with severity index of almost 61% (impact factors) and 74% of (cause factors).

Variable No	Impact Factor (Public Welfare)					Cause Factor				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IL1	2.86	.745	26.08	50.59	LC9	3.32	1.087	32.72	65
2	IL2	3.07	.752	24.54	61.18	LC8	3.99	1.117	28.00	74
3	IL3	2.77	.913	32.96	51.76	LC6	3.51	1.312	37.40	73
4	IL4	2.84	.976	34.40	51.76	LC3	3.38	1.288	38.15	59
5	IL5	2.76	.933	33.80	54.12	LC2	3.56	1.311	36.85	72

Table 9.41: Correlation of Cause and Impact Factors on Public Welfare in Legal part of BC

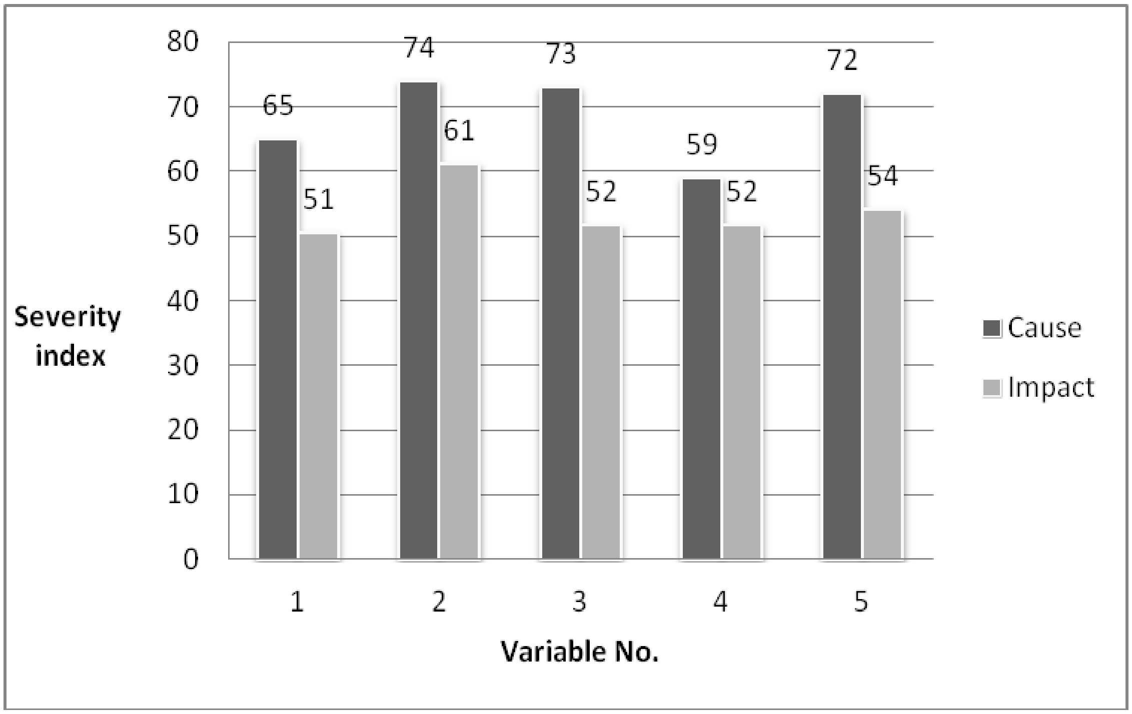

Fig. 9.15: Correlation of Cause and Impact Factors on Public Welfare in Legal part of BC

Administrative part of BC

The administrative part of BC consists of 7 cause and impact factors. For the effect of impact factors on public welfare, ranking results in Table 9.42 and Fig. 9.16 show that all cause factors have moderate occurrence and an impact on public welfare. Variable No 5 is considered of having the highest impact on public welfare for the Administrative part of BC, with severity index of almost 58% (impact factors) and 73% are (cause factors).

Variable No	Impact Factors (Public Welfare)					Cause Factors				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IA1	2.84	.883	31.06	56.47	AC9	3.32	1.002	30.20	71
2	IA2	2.75	.996	36.15	57.65	AC6	4.17	.866	20.77	79
3	IA3	2.88	.815	28.31	55.29	AC15	3.54	.960	27.12	67
4	IA4	2.85	.850	29.86	55.29	AC32	3.58	1.186	33.10	81
5	IA5	3.00	.827	27.58	57.65	AC24	3.48	1.028	29.57	73
6	IA6	2.92	.878	30.06	52.50	AC29	3.83	.975	25.48	78
7	IA7	3.00	.887	29.58	54.12	AC31	4.10	.988	24.09	87

Table 9.42: Correlation of Cause and Impact Factors on Public Welfare in Admin. Part of BC

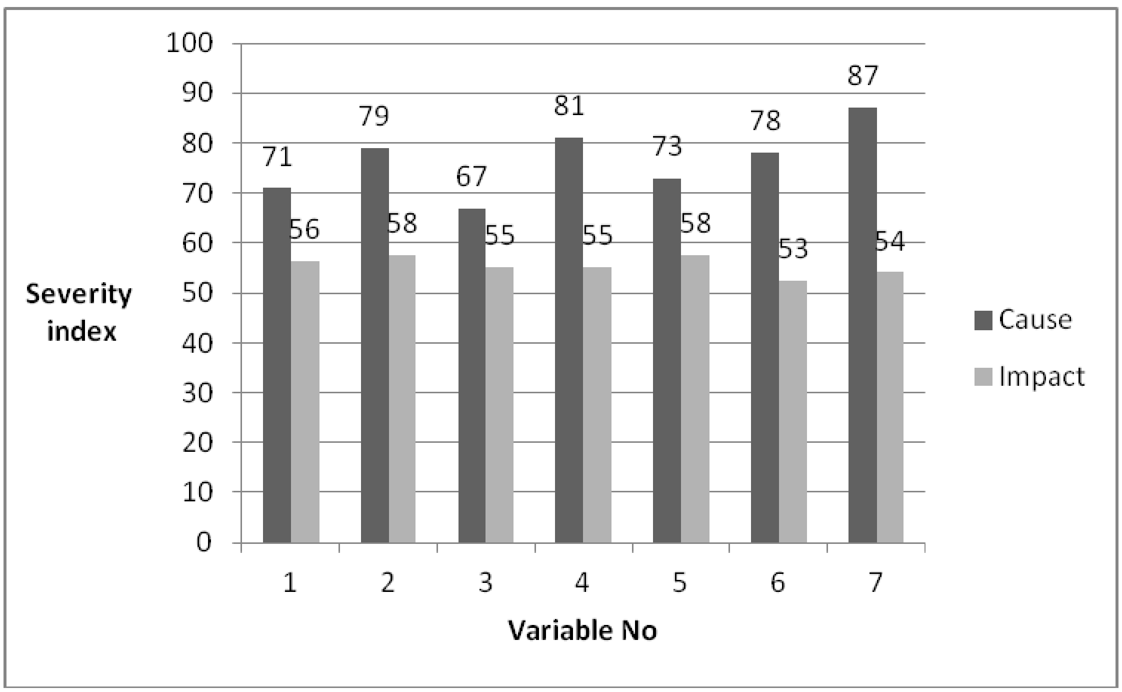

Fig. 9.16: Correlation of Cause and Impact Factors on Public Welfare in Admin. Part of BC

Technical part of BC

The technical part of BC consists of 43 impact factors and one general cause factor. For the effect of impact factors on public welfare, ranking results in Table 9.43 and Fig. 9.17, 9.18, 9.19, and 9.20 show that Variable No 1, 4, 6, 9, 30, 35,39, 29, 41, 11, 36, 37, 42, 5, 38, and 43 cause factors have high occurrences and an impact on public welfare. Variable No 43 and 38 are considered the highest of having an impact on public welfare for the Technical part of BC, with severity index of 70% (impact factors) and 65% (cause factors) for Variables No 43 and 65% of (impact factors) and 65% of (cause factors) for Variable No 38.

Variable No	Impact Factors (Public Welfare)					Cause Factors				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IT1	3.11	.837	26.96	60.00	LC9	3.32	1.087	32.72	65
2	IT2	2.88	.899	31.23	51.76	LC9	3.32	1.087	32.72	65
3	IT3	3.11	.770	24.78	58.82	LC9	3.32	1.087	32.72	65
4	IT4	2.91	.857	29.46	60.00	LC9	3.32	1.087	32.72	65
5	IT5	3.23	.759	23.53	64.71	LC9	3.32	1.087	32.72	65
6	IT6	3.17	.748	23.57	60.00	LC9	3.32	1.087	32.72	65
7	IT7	2.80	.865	30.87	48.24	LC9	3.32	1.087	32.72	65
8	IT8	3.02	.901	29.81	55.00	LC9	3.32	1.087	32.72	65
9	IT9	3.22	.735	22.83	60.00	LC9	3.32	1.087	32.72	65
10	IT10	3.09	.926	29.92	57.65	LC9	3.32	1.087	32.72	65
11	IT11	3.16	.784	24.84	62.35	LC9	3.32	1.087	32.72	65
12	IT12	3.01	.770	25.61	55.00	LC9	3.32	1.087	32.72	65
13	IT13	2.94	.809	27.53	51.76	LC9	3.32	1.087	32.72	65
14	IT14	2.81	.870	30.99	48.24	LC9	3.32	1.087	32.72	65
15	IT15	3.13	.772	24.67	57.65	LC9	3.32	1.087	32.72	65
16	IT16	2.88	.799	27.76	51.76	LC9	3.32	1.087	32.72	65
17	IT17	2.80	.896	32.01	50.59	LC9	3.32	1.087	32.72	65
18	IT18	3.04	.846	27.84	56.47	LC9	3.32	1.087	32.72	65
19	IT19	2.91	.867	29.83	52.94	LC9	3.32	1.087	32.72	65
20	IT20	3.01	.868	28.85	56.47	LC9	3.32	1.087	32.72	65
21	IT21	2.92	.808	27.70	55.29	LC9	3.32	1.087	32.72	65
22	IT22	2.97	.814	27.41	57.65	LC9	3.32	1.087	32.72	65
23	IT23	3.02	.821	27.21	56.47	LC9	3.32	1.087	32.72	65
24	IT24	3.06	.822	26.89	57.65	LC9	3.32	1.087	32.72	65
25	IT25	2.93	.767	26.19	54.12	LC9	3.32	1.087	32.72	65
26	IT26	2.96	.783	26.44	56.47	LC9	3.32	1.087	32.72	65
27	IT27	3.02	.734	24.32	58.82	LC9	3.32	1.087	32.72	65
28	IT28	2.98	.795	26.64	58.82	LC9	3.32	1.087	32.72	65
29	IT29	3.12	.805	25.78	61.18	LC9	3.32	1.087	32.72	65

Variable No	Impact Factors (Public Welfare)					Cause Factors				
	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
30	IT30	3.05	.813	26.64	60.00	LC9	3.32	1.087	32.72	65
31	IT31	2.96	.849	28.67	57.65	LC9	3.32	1.087	32.72	65
32	IT32	2.98	.860	28.87	57.65	LC9	3.32	1.087	32.72	65
33	IT33	2.91	.822	28.26	58.82	LC9	3.32	1.087	32.72	65
34	IT34	3.04	.802	26.35	57.65	LC9	3.32	1.087	32.72	65
35	IT35	2.89	.886	30.64	60.00	LC9	3.32	1.087	32.72	65
36	IT36	3.07	.805	26.26	62.35	LC9	3.32	1.087	32.72	65
37	IT37	3.04	.788	25.90	62.35	LC9	3.32	1.087	32.72	65
38	IT38	3.16	.856	27.07	64.71	LC9	3.32	1.087	32.72	65
39	IT39	3.04	.899	29.53	60.00	LC9	3.32	1.087	32.72	65
40	IT40	2.97	1.068	35.91	57.65	LC9	3.32	1.087	32.72	65
41	IT41	3.01	1.063	35.33	61.18	LC9	3.32	1.087	32.72	65
42	IT42	3.20	.855	26.73	62.35	LC9	3.32	1.087	32.72	65
43	IT43	3.61	.635	17.58	69.41	LC9	3.32	1.087	32.72	65

Table 9.43: Correlation of Cause and Impact Factors on Public Welfare in Technical part of BC

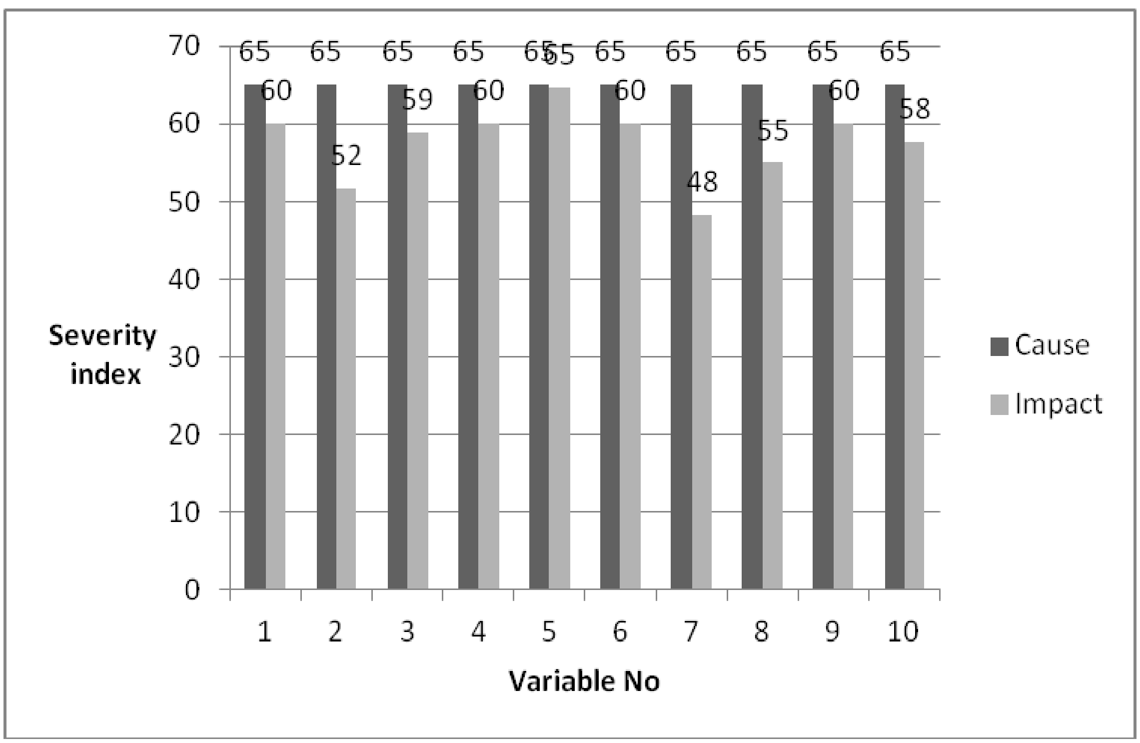

Fig. 9.17: Correlation of Cause and Impact Factors on Public Welfare in Technical part of BC

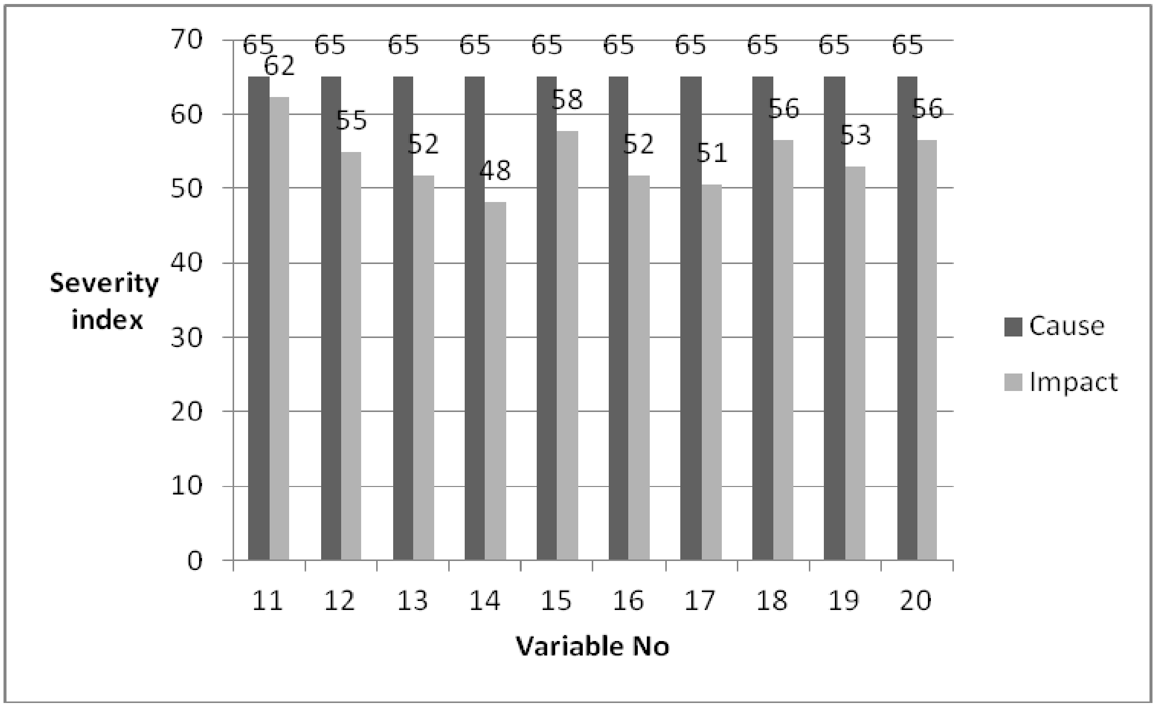

Fig. 9.18: Correlation of Cause and Impact Factors on Public Welfare in Technical part of BC

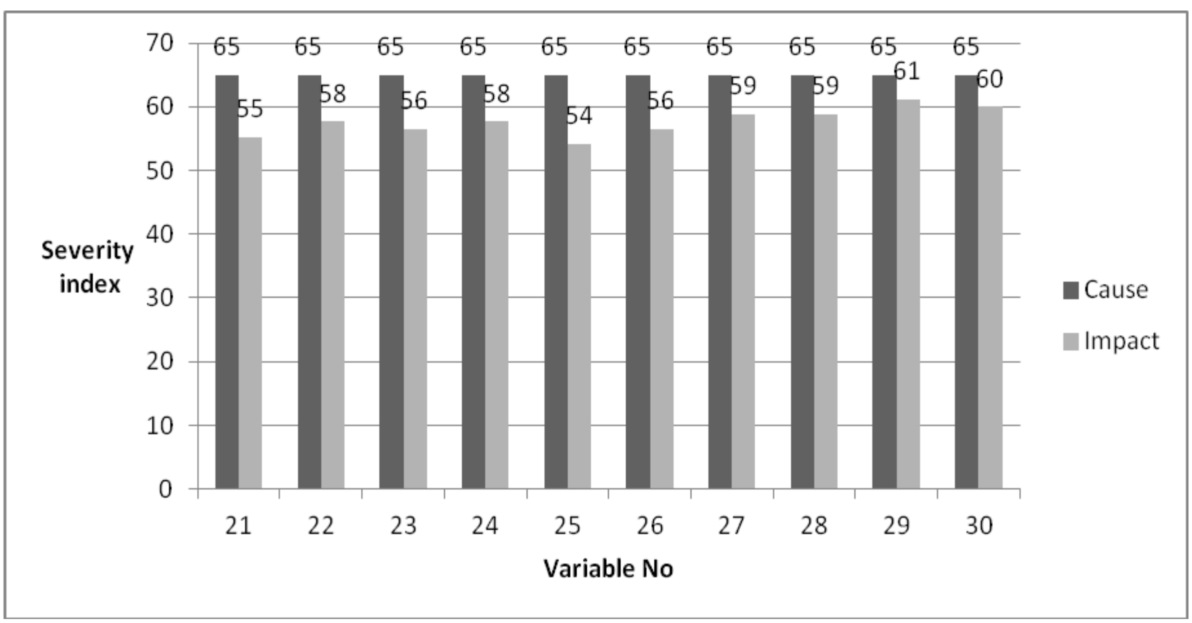

Fig. 9.19: Correlation of Cause and Impact Factors on Public Welfare in Technical part of BC

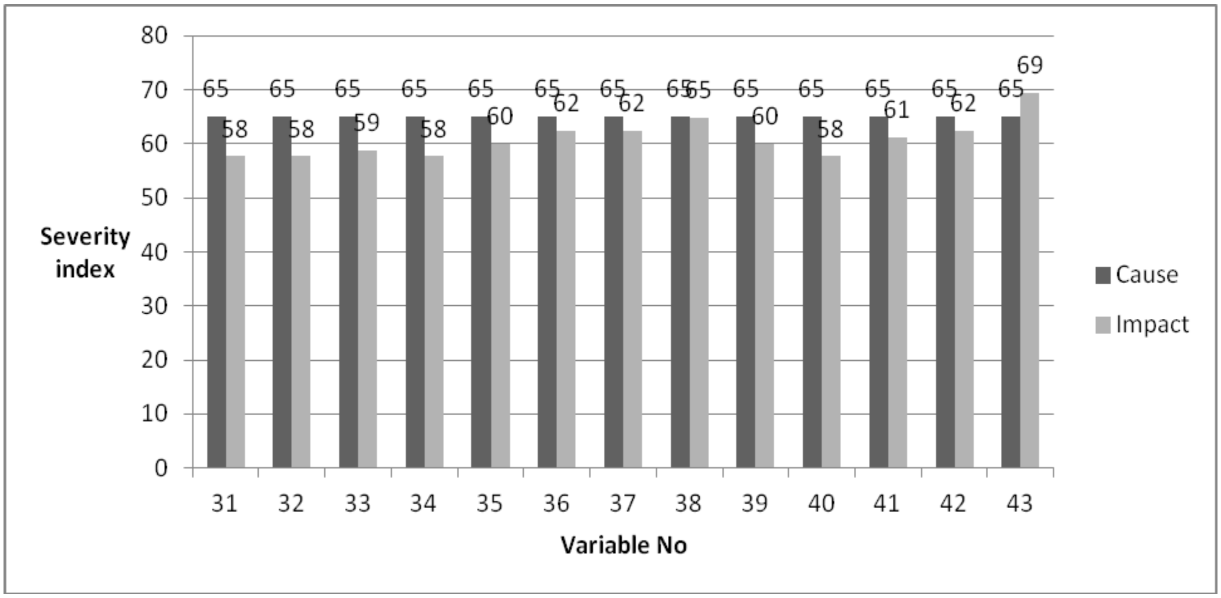

Fig. 9.20: Correlation of Cause and Impact Factors on Public Welfare in Technical part of BC

Social part of BC

The social part of BC consists of 4 cause and impact factors. For the effect of impact factors on public welfare, ranking results in Table 9.44 and Fig. 9.21 show that all cause factors have high occurrences and an impact on public welfare. Variable No 4 is considered the highest of having an impact on public welfare for the Social part of BC, with severity index of 64% (impact factors) and 62% (cause factors).

Variable No	Impact Factors (Public Welfare)					Cause Factors				
	Ref	Mean	Standard Deviation	Coefficients of Variations	Severity index	Ref	Mean	Standard deviation	Coefficients of Variations	Severity index
1	IS1	3.00	.774	25.78	54.12	SC6	3.73	1.214	32.56	79
2	IS2	2.99	.825	27.63	58.82	SC5	4.00	1.020	25.53	86
3	IS3	3.03	.866	28.57	61.18	SC4	4.29	.750	17.47	85
4	IS4	3.09	.901	29.16	63.53	SC1	3.47	1.048	30.16	62

Table 9.44: Correlation of Cause and Impact Factors on Public Welfare in Social part of BC

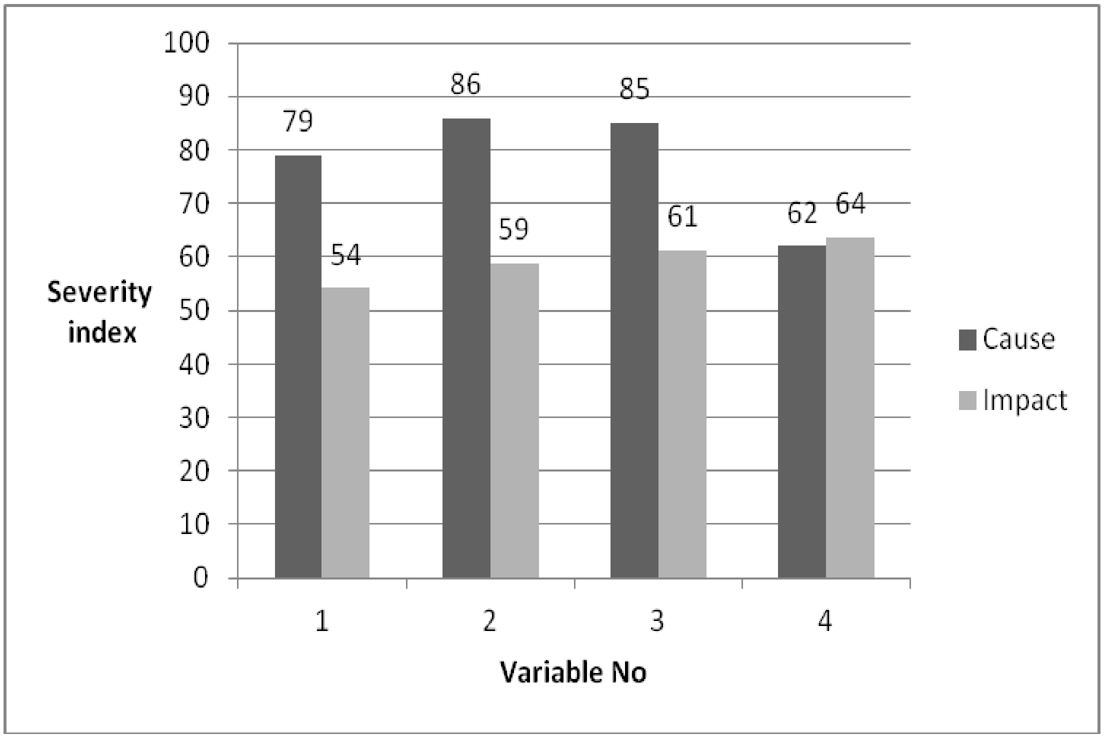

Fig. 9.21: Correlation of Cause and Impact Factors on Public Welfare in Social part of BC

The insufficient and infringements of building regulations (codes) have an impact on the shortcomings in meeting the minimum requirements of public safety. Therefore, it is better to reject Null's hypothesis and accept an alternative one.

9.7 Discussion

9.7.1 Common Agreement

From Tables 9.12, 9.13, 9.22, and 9.23 there is a linear relationship between a group of impact factors such as IL (Public Safety, Health, & Welfare), IAONE (Public Safety & Health), IATWO (Public Safety), IA (Public Welfare), and IS (Public Welfare). Whereas for the rating of the impact of these cause factors on BC objectives, the minimum average rating was 2.85 and the maximum average rating was 3.6, which shows a relatively above the average relation of impact factors on BC objectives.

While there is a tendency in the increase of problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials, there is an increase in improper procedures to perform plan reviews, inspection, testing of building materials, and performing periodical inspection after occupancy as well, these code insufficiencies have adverse consequences on the public safety, health and welfare.

Moreover, there is an increase in the problems of keeping records of building projects, which leads to unpleasant affect of satisfying construction investors and real estate owners in tracking their future business. Furthermore, there is an increase in the problems of weak enforcement of taking correct decisions for violations, and an absence of community awareness.

From Tables 9.14, 9.15, 9.24, and 9.25 both Building Officials and Construction Professionals are satisfied with the previous observation. Since there is an absence of proper technical requirements for codes, regulations for building technology, and proper certification for professionals and building materials, both groups have problems in performing appropriate plans' review, inspection, testing of building materials, and performing periodical inspection according to the latest technology of employing qualified workforce ,and an advanced building materials testing and certification. Moreover, the absence of proper insurance cover is another issue which hinders the enforcement of codes, due the fact that building officials and professionals are not properly insured to their mistakes and responsibilities.

The previous paragraphs discuss issues of law regarding technical requirements, changes in building technology, insurance cover, certification of professionals and building materials. With this in mind the previous review Chapters 2 and 3 there are evidences for this discussion.

Law has a powerful effect on the selection of BC requirements in countries. Cities like Houston has large oil refineries that create certain hazards, and cities like Chicago and New York require special codes and standards that suit the high-rise buildings and population density (Kubba, 2008). Building regulations are legal requirements adopted by the public policy makers (CIB TG37, 2001). As noticed, the Building Regulations of 1985 in Kuwait are applied by the law which describes the codes. The regulations are very limited with regard to the technical requirements of (Kuwait Municipality, 1985). Most of the requirements such as ; structural strength, safety to life, fire risks, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, safety to life and risks of other hazards attributed to the building environment are absent.

An example of the problem of BC requirements in Kuwait is smoke detectors. There is almost no requirement for smoke detectors for houses. Many houses were inspected and found that none of them have any fire smoke alarms (J. Al-Fahad, Site Visit, 20 February 2006). Another example is the problem of parking space requirements in Kuwait. Many houses in Kuwait have been inspected for the availability of parking spaces requirements, and the results shown that no parking spaces requirements are there (J. Al-Fahad, Site Visit, 11 May 2004).

Keeping in mind the reviews in Chapter 2, BC provides technology and information for professionals. In Kuwait, there is a need for deploying advanced technology in building and construction industry. The codes need to update regularly to reflect the ongoing changes in Building Codes. The technology is in materials selection, engineering designs, installation of products and systems, and testing (BOCA, 1999). Codes offer timely appropriate acceptance of new products, methods, and technology. In some countries, codes are linked with an organization of technology or research. In Norway, the name of international organization of codes is the "National Office of Building Technology and Administration", Norway (NBTA); and in the US, the name of international organization of codes is "The National Research Council", and in Canada the is (NRCC), (IRCC, 2005). The kind of code, the performance based in building regulations can facilitate the use of local materials, traditional construction methods, or new technology (Benge, 1999), (Gross, 1996). A major problem of getting new technology of codes is the obstacles to update the design code of reinforce concrete works which is today more than 30 years old (Ministry of Planning, 1995-1997), (M. Al-Zohali, personal communication, 27 September 2006).

Codes and insurance are highly associated. The National Board of Fire Underwriters which is now the (American Insurance Association) published the first National Building Code (BOCA, 1999; Liebing, 1987). One of the users of building codes is insurance companies (Kubba, 2008).Insurance represents one of the parties which takes actions in building accidents (Legislative Audit Division, 1997). In Kuwait, insurance companies have no effective role in insuring and preserving the quality of building construction works (Al-Fahad, 1998). One of the buildings collapsed, the insurance company was not willing to reimburse for the damages (AL-Qabas, 2004).

9.7.2 Areas of Disagreement

From Tables 9.6 and Table 9.7, the components (group of factors) which have the strongest linear relationship between groups of cause factors are selected for further analysis. The linear relationship between group of cause components are (1) DLC1 with DSC1, (2) DLC2 with DAC1, (3) DAC1 with DLC1 and (4) DAC4 with DSC1. These 5 components (group of factors), which Construction Professionals rated quite high are:-

(5) Improper procedures to prepare and enforce codes, proper workforce capabilities, testing of building materials, and a system to provide information (DAC1)

(6) Weak building regulations, methods, and certification of professionals (DLC1)

(7) Inexistence of law to prepare and enforce codes, materials testing, specifications, and effective insurance for buildings (DLC2)

(8) Problems in qualification, tasks, knowledge of officials and professionals, and the none performing of periodical inspection (DAC4)

(9) Ineffective inspection, and weak and delay in enforcing correct decisions for violations (DSC1)

From Table 9.6 and Table 9.7, Construction Professionals have more consistency and concern with the previous observation than Building Officials .It is Likely to consider here that the building officials are directly involved in the development and implementation of laws and regulations, but construction professionals are not in direct responsibility, and they blame government officials for neglecting the problems of legal and administrative status of building codes in Kuwait, as mentioned in the previous paragraph.

Components DAC1 and DLC1 have the strongest positive correlation (0.807), and the rating of these components cause factors by Construction Professional is (3.9) for DAC1, and (4.0) for DLC1 which shows a high rating than Building Officials. The positive correlation can be explained in that while there is a tendency of increasing the weakness in building regulations, methods, certification of professionals, inexistence of law to prepare and enforce codes, materials testing, specifications, and effective insurance for buildings, there is an increase in improper procedures to prepare and enforce codes to proper workforce capabilities, testing of building materials, and a system to provide information.

Many countries had problems of weakness in building regulations and enforcements. In the UK, there was a feeling that officers won't refuse certificates or prosecutions for failures in energy regulation, and this led to a lack of respect for the regulations by construction professionals (Building Research Establishment, 2008). The same problem in the US and Turkey, the Code Compliance Task Force (2008) addressed the problem of an extremely high rate of inspection failure rate in the US, and McPherson (2008). stated that, in Turkey, three is a great negligence on the part of building officials to control constructions. Furthermore, Kartam, Flood and Koushki (2000) showed that Kuwait Municipality had neglected the very weak enforcement of construction site safety regulations. Based on the experiences of Kuwait and other countries, Construction Professionals are truthful to blame Building Officials for many problems of BC.

The problem is that when a country doesn't have proper building codes, there will be no basis for education and certification of building officials (BOCA, 1999). Black (2004) showed that building and fire officials and inspectors are unable to perform their tasks due to limited resources and technology available. Moreover, McDonald, Smith, and Mehta, (1996) showed that some residential requirements are very hard for the building inspector to enforce. For that reason, Kuwait will have improper workforce capabilities to prepare and enforce codes; in this case Construction Professionals are right to blame Building Officials for many problems of BC.

The problem is that when a country like Kuwait or any other country doesn't have proper building codes, there will be no ***consistent standards in construction*** to provide quality and durability for construction methods and materials (BOCA, 1999). Prescriptive code describes exactly the methods, and materials to be used (BOCA,1999), (O'Bannon, 1989), (Liebing, 1987). Possible material deficiencies problems could arise during construction, start-up, implementation, maintenance, operation, and utilization stages of projects, and this is due to improper periodic inspections for compliance (Feld, Carper, 1997, Richardson, 2003). One of the causes of failure of buildings in Ahmadabad is attributed to poor quality of material (Thiruppugazh, 2008). According to study a conducted by BRE (1988) one of the factors that led to buildings defects were related to materials and components (Ilozor, 2003).

There are problems with certification testing of building materials, and there is no law or regulations (Kuwait National Assembly, 1972). Some researchers in Kuwait realize the need for proper certification **testing** of building materials. Haque (2003) suggests setting particular measures for concrete material and works to accommodate with external Kuwait weather conditions and built environment. Al-Feel (1988) found that building materials of cement for residential projects don't suit the Kuwait environment. Another study showed that Testing of building materials and concrete by certified testing centres get neglected (Al-Fahad, 1998). A professional found that there are a lot of mistakes in the selection of materials and installation works (Hofman, personal communication, 09 October 2003). For that reason, Kuwait will have improper certification **testing** of building materials, and Construction Professionals are right to blame Building Officials for not taking action to update the law, and for many problems of BC.

9.7.3 Correlation of Cause and Impact Factors on Public Safety

A cause is someone or something responsible for a result. Where an effect is a condition or occurrence traceable to a cause (Merriam-Webster, Incorporated, 2012). The detailed results of the correlation calculations between cause and impact factors on Public Safety are reported in Table 9.1 and Table 9.2.

For the impact of cause factors on public safety in Legal part of BC, all impact factors (IL1, IL2, IL3, IL4, and IL5) have high occurrence and high impact on public safety. According to the opinions of design and construction professionals the impact factor (IL4) inexistence of building materials testing system (because of the law) has the highest impact on public safety. In the local market, the issue of testing of building materials, in particular concrete works by certified testing centres gets neglected, and this issue is very annoying to construction owners as well as professionals (Haque, 2003), (Al-Feel, 1988), (Al-Fahad, 1998), (Hofman, personal communication, 09 October 2003). Because of the neglect or the violation, buildings may collapsed, and threaten safety of people and buildings. It seems that there is an intention by design and construction professionals to develop regulations for materials testing to be enforced by the law, in order to solve the problem and to control/prevent violations or cheatings.

The impact factor (IL1) inexistence of many BC requirements (because of the law) is the second highest impact rating (Kuwait Municipality, 1985). The problem of insufficient BC requirements for smoke detectors in current regulation caused deaths and injuries. There is almost no requirement for smoke detectors for houses (KFSD, 2002), (J. AL-Fahad, Site Visit, 20 February 2006).

For the impact of cause factors on public safety in administrative part of BC, all impact factors have high occurrence and high impact on public safety. According to the opinions of design and construction professionals the impact factor (IA1) 'improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects" has the highest effect on public safety. This is not surprising that professionals have identified this factor as the most important. According to reports by Ministry of Planning (1995; 1997), and an opinion of an expert in government research Institution (K. Hassan, personal communication, 11 January 2005), consultant offices working in private housing projects usually produce designs with excessive amount of materials which do not exceed minimum safety requirements, leading to potential unsafe structures.

For the impact of cause factors on public safety in technical part of BC, all impact factors have high occurrence and high impact on public safety. According to the average rating of the opinions of building officials and construction professionals, cause factor (IA1) "lack many of technical requirements in building regulations in Kuwait" has a high occurrence. This factor (IA1) represents the cause factor for all impact technical factors. Impact factor (IT41) Type of construction" has the highest effect on public safety. This is not surprising since professionals have identified this factor as the most important type of construction in dealing with fire-resistance rating and structural systems such as reinforce concrete, steal, and other systems (ICC, 2009). Kuwait had many fire and failures of structural system accidents which threaten safety, and cause loss of lives and injuries (Sadek, 2001), (Hamed, 2004), (AL-Sherhan, 2004), (AL-Sherhan, 2006), (AL-Masaoudi, 2009).

For the impact of cause factors on public safety in social part of BC, all impact factors have high occurrences and high impact on public safety. Impact factor (SC2) "delay of issuing and enforcing legal court rules based on violation cases" has the highest effect on public safety. Senior Building Officials and professionals fond this problem with high occurrence (A. AL-Forih, , 18 March 2002, 14 March

2009), (M. AL-Harris, , 27 February 2000, 19 May 2000, 9 July 2003, 11 November 2005, 27 June 2004, 03 July 2005, 03 August 2006). This is not surprising since Building Officials have identified this factor as the most important. The Building Officials may work hard to spot violations, and the juridical system may take too much time to complete code enforcement, as a result, the delay will weaken the enforcement. If there is no law and code enforcement, all the objectives of BC will be effected negatively. It will threaten public trust and failure of government to fulfil its fundamental duties to protect the safety and welfare of citizens (Commission of Investigation, 2005). According to many governments and organizations' reports, the violations of regulations are the main cause of not meeting the minimum requirements of public health, safety and general welfare [(The Standard, 2009)**,** (Commission of Investigation, 2005)**,** (Legislative Audit Division, 1997)**,** (BRE, 1983), (Ilozor, 2003)].

9.7.4 Correlation of Cause and Impact Factors on Public Health

In relation to the impact of cause factors on public health in Legal part of BC, almost all cause factors have high occurrences and impacts on public health .The impact factor of (IL5) declares that "ineffective cover of insurance companies to preserve quality of building construction works (because of the law)" has the highest effect on public health. According to Meijer and Visscher (2008) building regulations are one of the most important instruments to assure an adequate quality of European built environment. Since in Kuwait there aren't proper building codes, means that there is no guarantee to have excellent quality of buildings. For that reason, officials and professionals in Kuwait are interested in substituting the absent codes with total insurance cover based on organizations in the private sector. Furthermore, officials and professionals were correct. A possible cause for errors in building designs is insufficient codes, which leads to poor buildings (Liebing, 1987). For example , a collapse of a buildings is due to the lack of regulations and enforcements of building codes, poor quality of construction and material (Thiruppugazh, 2008), (Rousseau, 2000), (JSCQB, 2002). Inadequate building codes are noticed to be a contributing factor to poor quality of buildings, such as sound proofing, thermal and waterproofing standards (JSCQB, 2002). Since Public health is dealing with good health, having no diseases, the problems of dissatisfying requirements of good sound proofing, thermal and waterproofing will cause health problems.

In relation to the impact of cause factors on public health in administrative part of BC, many impact factors have high occurrences and high effects on public health. Administrative Factors of (IA7) regarding "Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy" have the highest impact on public health. The three governments' organizations Municipality, Fire-fighting and Electricity are responsible for enforcing a group of codes or technical requirements. Usually Fire-fighting Department is responsible for fire code, Ministry of Electricity is responsible for the Electric code, and almost all other codes are the responsibility of the Municipality. Therefore, not performing periodical inspection after building occupancy will lead to have no assurance that the permit holder does not deviate from the approved building documents and drawings during the course of construction (BOCA, 1999), (O'Bannon, 1989), (Liebing, 1987). In Kuwait, there are many hazards of deaths and injuries happened for buildings' occupants and users. These hazards were caused by severing electric shuts due improper maintenance of drinking water cooler sets, poor electric and lighting works during alteration, movement, repairing, falling of sheds, falling of marble blocks on ceiling, and accumulations of building debris and rubbish (M. AL-Marshed, , 26 September 2003), (M. Al-Bendari, , 15 September 2003), (Hamed, 2004), (Amin, ALSayed, 2002), (J. AL-Fahad, Site Visit, 12 April 2003).

For the impact of cause factors on public health in technical part of BC, the interpretations of findings are having the same details as shown in Section 9.7.3 (For the impact of cause factors on public safety in technical part of BC).

For the impact of cause factors on public health in social part of BC, all impact factors have high occurrence and high impact on public health. Impact factors (SC4) is the "Absence of community awareness in building regulations and nature tasks of Municipality" it has the highest impact on public health. Awareness is the state or condition of being aware; having knowledge; consciousness (Dictionary.com, 2012). The government should work hard to improve the general knowledge and organizations of the Building Codes (JSCQB, 2002), (Australian Building Regulation Bulletin, 2012). There is a need for current and consistent information and training on the building codes for professionals and the public. Many of the hazards of deaths and injuries have happened for buildings occupants and users such as severing electric shuts due improper maintenance of drinking water cooler sets, poor electric and lighting works during alteration, could be minimized by awakening the public for proper methods for downing maintenance and alteration M. AL-Marshed, , 26 September 2003), (M. Al-Bendari, , 15 September 2003), (Hamed, 2004). According to Hughes and Ferrett (2007), there is a need for health and safety awareness even in occupations which many would consider very low hazard, such as schools ,health and social work. Hughes and Ferrett (2007) state a shocking fact, that 70% of all deaths occur in the service sector and manufacturing appears safer than construction.

9.7.5 Correlation of Cause and Impact Factors on Public Welfare

The impact of cause factors on public welfare in Legal part of BC, the impact factor of (IL2) that is" not taking into account the changes in building technology in current law" has the highest effect on public welfare. One of Municipality objectives is safeguarding the public welfare (Kuwait National Assembly, 1972). Building codes are typically updated every few years taking into account advancements in technology (Kubba, 2008). According to Hughes and Ferrett (2007), welfare facilities include washing and sanitation arrangements, the provision of drinking water, heating, lighting, accommodation for clothing, seating (when required by the work activity), eating and rest rooms. There are thousands of labours' buildings and houses around Kuwait, which have adequate facilities for food preparation, and washing facilities found in Khaithan, Julib AL-Shoyokh, Bnid AL-Gar, AL-Jahra, and some other areas (Al-Romi, 2005), (Asam, Site Visit, 28 November 2005). There are many exterior properties and premises that are not clean, safe and sanitary conditions (J. Al-Fahad, Site Visit, 12 April 2003). Therefore, the government should update, modernize, improve building codes to latest technology to set up remedies for the previous problems, and reach improved health, happiness, and fortunes for the public.

For the impact of cause factors on public welfare in administrative part of BC, all impact factors have high effect on public welfare. Factor (IA5) of "Building Department, Inspection Department, and Safety Department at Kuwait Municipality doesn’t perform its responsibilities properly in controlling and following local construction works " it has the highest impact on public welfare. According to the problems as explained in the previous paragraph, if there is any insufficient enforcement of building codes, problems will arise and it will cause negative impact on public welfare.

The impact of cause factors on public welfare in technical part of BC, all impact factors have high occurrence and high impact on public welfare. Impact factor (IT38) of "Structural design " has the highest effect on public welfare. Structural design codes are defined in terms of human safety and property, and it prescribes minimum structural loading requirements to use in the design such as minimum design loads (live, dead, snow, wind, rain, flood and earthquake as well as load combinations), (ICC, 2009). Public welfare means health, happiness, and fortunes of the public. Therefore, in case of failures in structural systems, this leads to buildings collapse, and then may lead to deaths and injuries. In the USA, during the winter of 1996-97, at least 37 buildings collapsed because design did not meet the minimum roof weight-bearing standards. (Legislative Audit Division, 1997). Such incidents of buildings' collapses happened in Kuwait and threatened human safety and properties (Amin, 2002), (Hamed, 2004), (A. AL-Atram, , 14 March 2009), (J. AL-Fahad, Site Visit, 21 November 1998).

For the impact of cause factors on public welfare in social part of BC, all impact factors have high occurrence and high impact on public welfare. Impact factor (SC4) "Absence of community awareness in building regulations and nature tasks of Municipality" has the highest effect on public welfare. The interpretations of findings are having the same details as shown in Section 9.7.4 (For the impact of cause factors on public health in social part of BC).

9.8 Summary

The analysis undertaken for the clustering of cause and impact factors in Chapter 8, using factor analysis in Chapter 8 were all being discussed in isolation of one another. This chapter is elaborated in greater details of interactions and correlation of the factors. Exploratory Factor Analysis for data reduction was used to reduce the number of questionnaire questions to a smaller number of variables. Based on the factors relationships and correlations, the outcome of data reduction is presented in few components that consist of the most important cause and impact factors of the original large group.

Pearson's correlation coefficient was computed to assess the relationship within cause and impact factors. Independent sample T-test is used to compare the mean score of two different groups of respondents with one continuous factor. Cross Tabulation is used to compare responses and to show the relationship between cause and impact factors.

The results of factor analysis and analysis within groups using Correlation Coefficient (Pearson's Correlation), and between groups using T-test, the correlations between cause and impact factors using Cross Tabulation were ***discussed in the chapter*** along with literature of the previous chapters.

Chapter Ten

Discussion

Chapter Ten

Discussion

10.1 Introduction

The main objectives of the study were to identify the important cause factors for the likelihood occurrences and the impact factors that affect the insufficiencies of public health, safety and general welfare in Kuwait, within the framework of building codes (legal, administrative, technical, and social). The perceptions of the practitioners' views of the likelihood occurrences of cause factors and their impact on public health, safety and general welfare were discussed in the previous chapters.

This chapter will discuss the significance and relevance of the research within the overall perspective of the framework of building codes. Relationships and correlations of cause occurrences, their impact on public health, safety and general welfare were identified and highlighted in earlier chapters (Chapter 7 and 9).

10.2 The Subject of Cause/Effect and Building Code Problems

In Kuwait there is a serious problem with insufficient and infringement of building code/regulations. It is important to investigate all things that could cause the problem, before initiating a solution because most theories of causation invoke an explicit requirement that a cause precedes to its effect in time (Pearl, 2000).

A cause is something such as an action, event, or situation that makes something happen (LDOCE, 2012). In our study, a cause (insufficient and infringement BC) is a reason for, or events leading up to an effect (problems of BC).

To determine the cause of the problem, there is a need to investigate and question why it happens and what are the consequences. An effect or an impact for what happens is a result of the cause of two related actions. The effect is a way in which an event, action, or person changes someone or something (LDOCE, 2012). To determine the effect, we need to investigate and question why it happens. In our study, the effect (problems of BC) is the results of a cause or causes in (insufficient and infringement factors of BC).

Previous researches demonstrate that there is a clear relationship between cause and impact factors in the subject of problems of building codes. Not surprising, but certainly it is interesting to see it revealed in the data. It is interesting and perhaps surprising to see that there isn't a strong relationship between cause and impact factors related to insufficient and infringements of building codes/regulations in Kuwait, as well as in other countries.

10.3 Selection and Formation of Cause and Impact Factors

From the available literature reviews, there are high numbers of categories, components and rankings, to explain different types of insufficiencies and infringements in building codes/regulations. These categories and rankings produce inconsistent and overlapping cause and impact factors.

The research focus is concerned about the absence of an agreed cause and impact framework for building codes development and implementation over which there has been academic disagreement for some years. The key issue appears to in a lack for a systematic framework by which the cause formation is developed and organized. The objective within this research is to address this aspect by seeking to clarify the role of framework of building code as the basis for plan cause formation (The Productivity Commission et al, 2004; Baiche, Walliman, & Ogden et al, 2006; Commission of Investigation et al, 2005; McCollum et al, 2004; Ayininuola & Olalusi et al, 2004).

The lack of organized framework could make it more difficult for building officials and professionals to identify, analyze the cause or even to suggest possible cause appraisal mechanism. It may also be difficult to identify the source or origin of the cause factors and the tracking of cause factors. The overlapping of many cause factors could make the cause identification processes difficult and time consuming, especially as the cause identification process also involves tracking and monitoring of factors of impact on public health, safety and general welfare in Kuwait, within a framework of building code. In addition, as most of the cause identification process involved in a lot of interactive processes within the building codes, the cause identification process can be a discouraging task and complex.

In order to organize the cause and impact factors in a structured framework, the research structures the cause and impact factors depending on the framework of building codes (legal, administrative, technical, and social), (refer to Section 1.2.1 of Chapter 1). This is based on the fact that legal, administrative, technical, and social classification are principles that can be logically accepted concepts by a major government recognized in building code activities as in Australia. Furthermore, the legal, administrative, technical, and social framework of BC are functions of any organization of BC in the world.

The basis of using legal, administrative, technical, and social framework of BC principles is that, categories, of cause and impact factors of BC perspectives could potentially provide a broader framing and hence be more widely applicable for insufficiencies and infringements targeted for improvement. Another reason for employing legal, administrative, technical, and social framework of BC perspective is that the resulting cause and impact categories will be placed in context of the parts, and activities within the framework of BC. As such, identification and determination of cause and impact factors become engaged in the framework of BC in a clearer manner.

The framework of BC principles and perspectives were easily understood and discussed by most building officials and professionals of design and construction within their scope of work being more responsible for the consequences.

Furthermore, as most suggested researches that cause and impact identification process is also the responsibility of other stake holders of BC community (and not just the building officials alone), this new framework could be a medium of enhancing communications between the building officials and professionals of design/construction in dealing with insufficiencies and infringement factors in BC framework.

10.4 Classifications of Cause and Impact Factors

The research reports an analysis of a survey of building officials and professionals of design/construction with the objective of ascertaining their views about the occurrences of cause factors, their impact on public health, safety and general welfare in Kuwait.

Whilst there are many different, broad and overlapping definitions of BC development and implementation failures, enforcing the BC without insufficiencies and infringements remains the officials' aim to reach optimum level. Whichever way 'BC failure' is characterized, it is hard to escape the availability of direct or indirect impact implication. Moreover, it is distinguished and analyzed in this survey on the basis of occurrences of impact factors on public health, safety and general welfare as related to 'BC failure. Although the research impact measure refers to public health, safety and general welfare which is almost a comprehensive measure, it provides a logical analysis which is firmly placed into a wider cause and impact set up.

Furthermore, BC objectives consequence approach (to estimate impact) as this research argues is mostly interpreted by survey participants (the research sample) and is naturally agreed upon as major characterization of BC failures in perception. More specifically, the research argument of BC objectives focus leads to survey responses that are directly applicable to the experience of the survey participant base. It is likely to be more relevant to BC development and implementation of goals in a commonly understood manner; this consequently, enhances the art of divining facts concerning properties of the research survey results.

The survey responses were analyzed using principal components analysis (PCA) to determine which of the cause and impact cluster/component into statistical meaningful groupings. PCA has previously been used in grouping cause and impact factors by previous researches. This initial part of the analysis reduces the certainty of cause and impact factors list to those most influential ones. These factors were then grouped as explanatory loadings into cause and impact components. The aggregation of the remaining factors into cause and impact components is a clustering process that is a PCA-determined method forming the degree of co-linearity between them

The empirically derived cause and impact components are then interpreted in terms which are meaningful in relation to the framework of building code (legal, Administrative, technical, & social). This reduction of the research cause and impact formation is an important element of the research contribution .On the basis of theory and further empirical work, why cause and impact components are generally important in practice? Thus, the research seeks to interpret the cause and impact components observed in relation to four functions in building codes; legal, administrative, technical, and social which are typically involved and meaningfully related to the cause and impact formation.

The study analysis indicates the possibility of identifying a grouping of cause and impact factors that are reflective in other different parts of BC (legal, Administrative, technical, & social framework). The findings suggest three identifiable clusters with 13 components when viewing cause factors from likelihood occurrences:

(1) Weak building regulations, methods, and certification of professionals (Cluster 1: Legal/Technical)
(2) Inexistence of law to prepare and enforce codes, materials testing, specifications, and effective insurance for building (Cluster 1: Legal/Technical)
(3) Problems in technical requirements, conflict, collect fees in building regulations (Cluster 1: Legal/Technical)
(4) Improper procedures to prepare and enforce codes, proper workforce capabilities, testing of building materials, and system to provide information (Cluster 2: Administrative)
(5) Improper Municipality procedures for plans review and inspection(Cluster 2: Administrative)
(6) Problems in enforcement and updating building regulations and consultant supervision capabilities(Cluster 2: Administrative)
(7) Problems in qualification, tasks, knowledge of officials and professionals, and performing periodical inspection(Cluster 2: Administrative)
(8) Weak technical, legal, and financial capabilities of officials workforce and government inspection(Cluster 2: Administrative)
(9) Problems with records keeping of building projects and certification of small contractors(Cluster 2: Administrative)
(10) Problems with corporation of government organizations in administration of building process(Cluster 2: Administrative)
(11) Improper inspection and supervision of consultants and reimbursements for workers at Municipality(Cluster 2: Administrative)
(12) Ineffective inspection, and weak and delay in enforcing correct decisions of violations (Cluster 3: Social)
(13) No deterrent punishments for violators and Low monetary value of penalty (Cluster 3: Social)

The findings suggest four identifiable clusters with 12 components, when viewing impact factors from a public safety perspective there were:

(1) Problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials (Cluster 1: Legal)
(2) Improper procedures to perform plan review and inspection (Cluster 2: Administrative)

(3) Problems with records keeping of building projects and to perform plans review and inspection (Cluster 2: Administrative)
(4) Problems with testing of building materials and performing periodical inspection after occupancy(Cluster 2: Administrative)
(5) Seven technical components (Cluster 3: Technical)
(6) Ineffective inspection, weak enforcing of correct decisions for violations , and absence of community awareness (Cluster 4: Social)

The findings suggest four identifiable clusters with 11 components, when viewing impact factors from a public health perspective there were:

(1) Problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials (Cluster 1: Legal)
(2) Problems with records keeping of building projects and performing plans review and inspection (Cluster 2: Administrative)
(3) Problems with testing of building materials, performing periodical inspection after occupancy, plans review and inspection (Cluster 2: Administrative)
(4) seven technical components (Cluster 3: Technical)
(5) Ineffective inspection, weak and enforcing correct decisions for violations (Cluster 4: Social)

The findings suggest four identifiable clusters with 13 components, when viewing impact factors from a public welfare perspective there were:

(1) Problems of law in technical requirements, changes in building technology, insurance cover, and certification of professionals and building materials (Cluster 1: Legal)
(2) Problems to perform plans review and inspection, records keeping of building project, testing of building materials, and performing periodical inspection after occupancy (Cluster 2: Administrative)
(3) six technical components (Cluster 3: Technical)
(4) Ineffective inspection, weak enforcing of correct decisions for violations , and absence of community awareness (Cluster 4: Social)

The research account for this difference is by suggesting a more coherent framework, or cause and impact formation, offered by viewing them within the context of BC (legal, Administrative, technical, & social framework)Also, the research allows those involved in building and construction projects to have a clearer view of the relationships between cause and impact factors. In addition, it allows the various cause and impact components and the associated emergent clusters to be more readily identifiable. In this respect, the research believes to have contributed to the, as yet, unresolved debate of appropriate cause and impact formation in framework of BC code.

10.5 Implications for Research

The literature reviews highlight that the existing frameworks of building code and models have limited applicability and lacking ability to easily communicate an organizing framework for insufficiencies and infringements in building codes/regulations on public health, safety and general welfare. Previous researches had organized and categorized the insufficiencies and infringements according to technical elements of building, qualification aspects, and other common characteristics of insufficiencies and infringement factors (Baiche, Walliman, Ogden, 2006). Other researches had organized and categorized four major areas such as deficient and incomplete construction, subversion of inspections and code enforcements, careless government oversight and regulations, and inadequate consumer protection and remediation (Commission of Investigation, 2005). McCollum (2004) organized and categorized the causes of shortcoming of BC (violations) according to technical components of BC, technical requirements, and some administrative requirements. Ayininuola and Olalusi (2004) organized and categorized the causes of shortcoming of BC (faults) according to a group of technical requirements, code enforcement, and management of construction works.

This can be seen from the overlapping of insufficiencies and infringement factors and categories by previous researches. The focus of the previous researches was mainly on the characteristics of the insufficiencies and infringements factors but lacking of concentration on the four functions of BC, such as legal, administrative, technical, and social function, processes and activities of the framework, which could make the understanding building code development and implementation difficult and complex.

By organizing the tasks and requirements into a general but adaptable model such as the framework of building code (legal, Administrative, technical, & social framework), an approach could make the understanding of factors of insufficiencies and infringements in building codes more accessible and usable by building officials and code writers.

Some countries, cities, and towns have diverse styles of building regulation system to organize their building construction activities. CIB TG37 (2001) defines the building regulation system parameters include local government structure, public policy, education, technology, and general support framework. Other professionals define the framework according to stakeholders. Canada Mortgage and Housing Corporation (2002) defines system parties these are owners, designers, general contractors, subcontractors, manufactures, standard development organization, the national government, provinces, territories, and municipalities. The Chairman of Canadian Commission of Building and Fire Codes defines the set up of construction and regulatory system according to key elements in the construction other such as well-functioning market with knowledgeable, accountable and capable professionals; knowledgeable consumers who have access to the information; legal framework for the conduct of business; Reliable standards, testing and design guides, warranties and insurance, education and training to enhance the knowledge and skills of those involved in the building process (Clemmensen1, 2003).

Unlike the framework and categories used by previous researches which were according to construction stakeholders, and more economic categorizations, these may not benefit the less knowledgeable building officials and technical professionals when it comes to building codes related to insufficiencies and infringements factors .The framework of BC approach is based on clearly defined concepts that are understandable, adaptable to a variety of contexts, and practical use since the framework of BC perspectives are well known by most construction organizations and professionals.

One further important finding from this research compared to previous studies, is the evidence of perception of "***selection and formation of cause and impact factors***" as the process of BC development and implementation proceeds through the parts of BC. In a number of areas from the survey analysis, it is possible to see an evidence of the consequences of failures at the administrative part of the framework of BC being highlighted as the most important impact factor in the public safety. This is previously and rarely reported within the literature of government reports that neglecting the testing of building materials and concrete by certified testing centres during projects executions is important for building officials and private inspectors' tasks.

The failures at the technical part of the framework of BC being highlighted as the most important impact factor in the public health and welfare. This is previously and rarely reported within the literature of local research and government reports that insufficient requirements of boilers/water heaters for buildings are important technical requirements for public health, and wood for buildings is an important technical requirement for public welfare.

A failure at the social part of the framework of BC being highlighted as the most important cause factor. This is previously and rarely reported within the literature of local research and government reports that no deterrent punishments for violators are important for technical cause factor.

This clear understanding of insufficiencies and infringements of impact and cause factors enables building officials and professionals of construction, at least, consider the success of building codes and quality of projects or otherwise, the earlier evaluations of negative cause and impact factors based on the evidence accumulating.

The other findings compared to the previous studies are the evidences related to the impact on public health, safety and general welfare view of cause that provided a stronger view of which components of impact were important, compared with cause likelihood. Moreover, the research on tactical response indicates which things could cause the problem, before initiating a solution.

Previous studies have frequently used building official, town planners, plan reviewers, site inspectors and occasionally owners or buyers of new properties, houses or other buildings as their sample of study (The Productivity Commission et al, 2004; Baiche, Walliman, & Ogden et al, 2006; Commission of Investigation et al, 2005; McCollum et al, 2004; Ayininuola & Olalusi et al, 2004). In Kuwait, the Municipality assigns most of the tasks of plans review and site inspection for design, construction professionals from engineering offices as their supervision tasks. The surveys of this research used the main stakeholders and practitioners within the framework of building code itself, which mainly consists of building official, plan reviewers, site inspectors, design, and construction professionals. Buildings owners and users, houses and other buildings are used while conducting interviews and site inspections.

10.6 Building Officials and Code Writers Implications

The representation developed shows how cause and impact factors can be organized to make them more accessible and more easily communicated within the building officials, plan reviewers, site inspectors, and other professionals. It provides a practical approach for building officials, plan reviewers, site inspectors to use for thinking about whatever level of details relevant and makes sense of them. The research findings adaptability allows building officials, plan reviewers, and site inspectors to eliminate details that are not vital for their purposes. These research findings will truly be practical for use by officials working in legal, quality and improvement departments in Municipality and other government organizations, as well as design and construction professional who are interested in improving their quality of work and selecting design requirements, and performing administration tasks in supervision of construction works.

Compilation of this information could provide means of assessing future building code development and implementing tasks and projects. The measures developed here could then be used to create cause and impact profile for each building code development and implementation. Potentially high problematic BC development and implementation could be flagged at an early process so that appropriate decisions could be made about whether to act and amend regulation and task, or to select an alternative course of action. Practitioners could also administer the instruments at multiple points during building code development and implementation tasks and projects and, track the changes in the faults of regulation or task as it progresses within the framework of building code (legal, Administrative, technical, & social).

In this research, the focus was on exploring the similarities and differences of how building practitioners (building officials and professionals of design and construction) perceived building code cause and impact factors, and exploring the relationship between cause and impact factors to describe the strength and direction of the linear relationship between factors. By mapping these similarities, differences, and relationships between cause or impact factors, the research has provided practitioners with a more structured framework based on building code (legal, Administrative, technical, & social framework) that encompasses the perceptions of the main building practitioners or stakeholders. In corporation with these stakeholders perspectives on BC, cause and impact factors are significant because focusing only on any particular practitioner may result in some BC lower level of attention than they might actually deserve. To mitigate these BC cause and impact factors, it is necessary to consider them judged to be important by all groups and reconcile any differences and linear relationship between factors. This should lead to a more comprehensive approach towards managing cause and impact factors in association with BC development and implementation.

The measures of cause and impact factors in the framework of BC (legal, Administrative, technical, & social) are developed in this study and can also be used to learn more about the effectiveness of various faults mitigation tactics designed to reduce the severity of cause factor's impact and to increase the likelihood of successful building code development and implementation. For keeping good building code development and implementation practices, this would help to ensure that cause and impact assessment is an ongoing process and not something that happens once at the outset of a project.

10.7 Summary

This study has described a group of dimensions of cause and impact factors of BC that building officials and practitioners may use for identifying and managing the shortcomings of minimum requirements of public health, safety and general welfare associated with BC (legal, Administrative, technical, & social framework). As various participants of BC development and implementation viewed cause and impact differently, the comparisons and differences in their assessments factors could provide insight on how to tackle the shortcomings of minimum requirements of public health, safety and general welfare. The framework of BC (legal, Administrative, technical, & social) approach adapted in this study would help to produce an understanding of how the shortcomings profile of BC development and implementation typically changes according to cause factors. By developing a more comprehensive list of cause and impact factors, the research provide a basis of more comprehensive investigation that can be used in developing assessment guidelines for insufficiencies and infringements in BC regulations.

The differences of cause and impact factors perceptions based on the role taken within the building officials and professionals were very important for the coordination among the various groups. This may indicate the need for improved communications in order to develop a shared understanding of problems of building code development and implementation. Without a shared understanding of cause and impact factors, it is unlikely that the building officials and their supporting team will be able to work together effectively, and there may be an increased potentials for conflicts to arise.

Chapter Eleven

Research Summary and Contributions

Chapter Eleven

Research Summary and Contributions

11.1 Introduction

Although, there are a significant amount of research and literatures in building codes and regulations, most of the literatures were of complex presentation and were partially overlapping. Most of the research undertaken did not really organize the cause and impact factors identified in a more systematic manner and easily interpreted for building officials, design or construction professionals, and properties owners. Despite all these researches, the building and construction projects still suffer significant failures, even though failures in terms of lack of proper codes, insufficient enforcement, not meeting minimum requirements, and gross negligence in enforcing even the existing regulations.

The framework of building code (legal, administrative, technical, and social) adopted in this research is based on the customize Australian Government experience (The Productivity Commission, 2004); make up the research added new contribution the field. The parts/functions of framework of building code used this research make it an easier and improved framework for building officials, plan reviewers, inspectors, designers and properties owners to follow through and understand the cause and impact factors in building code projects.

In this research, the main focus is on the occurrence of cause factors and the impact on building codes objectives of buildings and construction projects. As it is believed that, regardless whatever success criteria of a building code development and implementation, finishing the project with compliance of proper and advance building codes is still main priorities for any building officials and owners. The focus is on organizing cause factors to make them more useful and meaningful for building officials and code developers, that helps them identify and mitigate these insufficient and infringements of building regulations and codes.

The total numbers of cause and impact factors makes it all more significant to use an organized framework. The fact that any building regulation and code development projects is also about bringing benefits to the properties owners, building occupants and users. This organized framework could also be used as medium of communication in resolving insufficient and infringements of building regulations factors between Municipality personnel and other related government and private organizations.

11.2 Summary

The significance of building codes is growing along with the progress of people changing awareness, needs and perspectives, advanced technology in construction and new level of knowledge. Every building code development and implementation project faces a significant amount of uncertainty that is usually manifested as possible fault materialization. Generally, the success of a building code development and implementation project is usually connected with the involved problems of building codes framework (legal, administrative, technical, and social) which main project problems should be successfully resolved in order to achieve a successful project. There isn't a magic bullet to prevent all building code development and implementation projects from failure or to resolve all problems. However, it is still possible to mitigate some of the problems and increase the chances of success.

As explained in the previous chapters, many cause factors contributed the insufficiencies and infringements of building regulations. These factors can be legal, administrative, technical, or social oriented in nature. Although some of the individual cause factors may be more significant than the others, the building code development and implementation projects success usually depends on the combination of all insufficiencies, actions used to resolve these insufficiencies and a building officials and professionals' ability to manage them.

Insufficiencies and infringements of building regulations can be identified and addressed in different phases of a building code development and implementation project, but it is essential to identify problems as early as possible and address them promptly because the building code objectives (public health, safety and general welfare) connected with exposed problems could be enormous. It is difficult to address all problems of building code at the same time. In order to successfully address problems that arise on a building code development and implementation project, it is necessary to divide problems into parts/functions or more structured framework. Through the stages or framework, the relevancy and priority of the problems can easily be identified and addressed for the purpose of mitigating these problems and cause factors. Furthermore, with this approach, problems will be mitigated in the early phases of building code development, when the cost of a building code development project is still small.

Throughout the research, most of the previous literatures tend to focus on the technical and administration related issues of building code development and implementation. Although, there are important legal and social factors, but most reviewers were in consensus that there were more crucial factors that have an impact on the building code objectives (public health, safety and general welfare) of a building project and effect on the overall success of development and implementation. Legal issues like law to prepare and enforce building codes, cover of insurance companies, building materials testing system, weak regulations related issues, building specifications, and clearness of regulations texts; as well as social issues like community awareness, issuing and enforcing legal court rules, deterrent punishments for violators, violations or cheatings related issues, were deemed not that critical by most reviewers.

Although it is certainly legitimate to reflect the concerns of building officials and professionals of design and construction attempting to produce building and construction projects to satisfy codes' requirements, a literature of shortcomings of minimum requirements of public health, safety and general welfare that over-emphasizes these concerns inevitably under-emphasizes issues about social and legal of BC which are subject to a broad range of problems more related to the legal status of BC and the built environment on the human relationship than to the direct technical and enforcement issues of BC. This type of imbalance in the literature can lead to gaps in providing guidance to detect and solve causes of problems of building code development and implementation. Focusing solely on technical and enforcement issues of BC ignores the fact that technical requirements and enforcement are just one component of building officials and professionals environment and that many BC faults are due to the legal status and built environment in which a construction project is operating. Limiting the discussion to technical and enforcement issues of BC faults can create a "responsibility gap" in an BC organization if building officials and professionals are responsible for managing social and legal faults of BC, and building officials and professionals, who should be identifying, assessing, and developing strategies for overall problems of BC, are left in the dark.

The results of the analysis discussed throughout this research, showed significant agreement among the practitioners for some factors, but there were also some disagreements. This shows that even experience practitioners can have different opinions of fault (cause) identification and mitigation. In a way, fault (cause) handling should not just be the responsibilities of building officials or one specific professionals of design or construction, but all parties involved. This means that every stakeholder (member) of framework of building code should identify and define fault (cause) connected with their problem area, and faults (causes) should also be identified and defined on the individual, team and organizational levels. In addition, it is more easily understandable and less complex, to do this through the four functions/parts of building code as discussed in this research, as the interpretability of the functions/parts mentioned is well understood by most building officials and professionals.

This research approach was motivated in particularly by the need to improve communication between building officials and professionals by using ideas and methods that are comfortable for professionals of design and construction in dealing with insufficiencies and infringements in building codes/regulations. The approach presented here focuses on the fault (cause) and functions/parts of BC framework that is recognizable and understandable to officials and professionals, as the chances for success of a building and construction project are closely connected with successful fault (cause) addressing. The extensive listing of faults (causes) in literatures demonstrates the potential of organizing faults and cause factors in substantial detail using a model that building officials and professionals can understand readily.

Enabling building officials and professionals of design and construction to speak the same language supports enhanced communication that is necessary for collaboration between every stakeholder (member) of framework of building code attempting to reduce faults and problems of building code development and implementation. Better ways of describing fault (cause) and relating it to everyday building and construction projects and enforcement could help substantially.

The hypothesis of this research is: ***'Many of the problems encountered to meet the objectives of building code in Kuwait (ensure minimum requirements of public health, safety and welfare for people and buildings) caused by insufficient building code/regulations and infringement of those that currently exist'.*** It was found that:

- ***For the impact of cause factors on public safety*** in legal, administrative, technical, and social parts of BC, all impact factors have high occurrence and high impact on public safety (refer to Section 9.7.3).
- ***For the impact of cause factors on public health*** in legal, administrative, technical, and social parts of BC, all impact factors are above average occurrence and impact on public safety (refer to Sections 9.7.4).
- ***For the impact of cause factors on public welfare*** in legal, administrative, technical, and social parts of BC, all impact factors have high occurrence and high impact on public safety (refer to Section 9.7.5).

It was found that the many of the minimum requirements (public health, safety and general welfare) are not available for people and buildings in Kuwait. There is gross negligence in enforcing even the existing laws, such as:

- Non-enforced Safety Law, that Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works (Factor IA5, which has high occurrence and impact on public safety)
- Weak of power of law in enforcing correction decisions of violations (Factor IS2, which has high occurrence and impact on public safety) such as illegal construction, violation of heights and number of floors, etc.
- All hotels along the coast are violating the maximum allowable number of floors, which is three floors (ALFahad, 2010)
- Most owners and investors don't care to fulfil the demands of energy conservation in buildings due to the low cost of electricity, and weakness of regulations and enforcement (Factor AC30, which has high occurrence)

Therefore, the insufficiency and infringements of building regulations and codes should be solved in order for people and buildings in Kuwait to enjoy the enormous benefits of complete and appropriate building codes.

11.3 Research Contributions

As explained in the early chapters, the extant research relates to the lack of agreed fault (cause) identification and selection combined with an empirical validation of the links between cause likelihood, and its impact, in terms of problems mitigation. The research contribution within its proposed fault (cause) identification and selection and the evidence it seek to accumulate is designed to contribute in addressing these deficiencies. The survey then directly reports to key areas of fault (cause) and its impact identification, and potential areas of improvement on framework of building code (legal, Administrative, technical, & social framework). The improvement findings reported are empirically those most likely to be observed as addressing the most likely causes (faults) and those most closely associated with building code objectives (public health, safety and general welfare).

The research was also able to give an evidence opinion on cause (fault) likelihood, the impact of the cause (fault) of building code objectives (public health, safety and general welfare), and the potential responses that are likely effective in resolving the faults (the causes) that emerge in building and construction projects. The contribution of the research relates to the assessment of fault (cause) within its selection and formation that is defined in the context of a fairly broadly accepted view of the building code development and implementation. To sum up, this research contribution is to link, in a consistent manner, fault (cause) identification and its impact. The study was able to verify the causes (faults) that are correlated to other causes (faults), and its impact on building code objectives (public health, safety and general welfare). In this way, the actions or consequences conditioned can be observed on identification of causes (faults) likelihood and its impact on building code objectives as conceptualized in terms of building code development and implementation in framework of building code (legal, Administrative, technical, & social framework), thereby 'closing the loop', as it was, of comprehensive fault (cause) administration in relation to building and construction projects.

The identification and selection of causes (faults) are based on the framework of building code proposed in this research could facilitate a focus on roles and responsibilities, and allows for the coordination and integrations of activities for regular monitoring and aligning with the building and construction projects objectives. This contribution would better enable building officials, code writers, and professionals of design and construction to identify and manage fault (cause) as they emerge with the four functions of building code, such as legal, administrative, technical, and social function, and more closely reflects building project activities and processes, and facilitates potential resolving mechanism for project problems.

Other main contribution is the evidence relating to the building code objectives (public health, safety and general welfare) view of fault (cause) provided a stronger view of which components of faults (causes) and its impact were important: compared with cause (fault) likelihood. Other contributions of the research are presented as follows:-

- Extraction of 55 cause factors (14 legal/technical, 35 administrative, & 6 social)for likelihood occurrence on building code framework (legal, Administrative, technical, & social framework),
- Extraction of 59 cause factors (5 legal, 7 administrative, 4 social,& 43 technical) for likelihood occurrence of cause and its impact on building code objectives (public health, safety and general welfare), the 43 technical cause/impact factors were identified by comparing current building regulations in Kuwait (as shown in Sections 3.3.3.2, & 4.5), with international building codes,
- Ranked cause factors for the likelihood of occurrence and its impact on building code objectives according to the four functions of building code, such as legal, administrative, technical, and social function
- Differences of perceptions of cause factors in building and construction projects among the building officials, and professionals of design and construction,
- Grouping of 3 main clusters of cause factors through factor analysis and extraction of 13 most significant components of cause factors,
- Grouping of 4 main clusters of impact factors through factor analysis and extraction of 12 most significant components of impact factors from a public safety perspective,
- Grouping of 4 main clusters of impact factors through factor analysis and extraction of 11 most significant components of impact factors from a public health perspective,
- Grouping of 4 main clusters of impact factors through factor analysis and extraction of 13 most significant components of impact factors from a public welfare perspective,
- Gives pattern to analyze different aspects of BC framework. The research looks the cause and impact factors in a scope of framework of building code (legal, Administrative, technical, & social framework), which is more easily understandable and less complex framework,

- Gives pattern to analyze different aspects of BC framework according to the four functions of building code, such as legal, administrative, technical, and social function,
- Improve the relationship between research and building regulations that at present, there is evidence that construction industries around the world have little experiences in this area (CIB TG37, 2001).

11.4 Limitations of the research

It need to point out that the selection and formation of cause factors based on framework of building code (legal, Administrative, technical, & social framework) is not exclusively drawn-up within the building officials, and professionals of design and construction in mind. The selection and formation of cause factors and the responses might vary dependent on which practitioner is asked. It is assumed that the selection and formation of cause factors proposed is accepted as a valid formation on the basis on limitations of existing formation of insufficiencies and infringements in building codes/regulations from previous researches and good response rate received.

The responses received from the respondent were based on the respondents' previous experiences. But, whether their experiences were from their most recent building and construction projects, or from their overall judgment of their experiences with a number of previous plan review, inspection, or engineering supervision cannot be differentiated

The research also did not analyze the differences of opinions of the practitioners with experience of different years or different number of reviews, inspections, or engineering supervisions. These limitations may create potential bias to the conclusion, as some practitioners may experience more poor building and construction works than the good quality ones, or vice versa.

There's no certain way of knowing for sure that the responses received were from the practitioners (building officials, and professionals of design and construction) themselves. There's a possibility that their assistants might be answering on their behalf. This research did not gave a very definitive interpretations of practitioners as to who is 'building official', 'inspector', 'plan reviewer', 'design professional', or 'construction site professional'. The research gives trust for practitioners to categorize themselves in what group they belongs to based on their own experiences and judgments, but it is considered to be sufficiently robust since all parties (practitioners and assistants) are likely to be of similar mindset.

The clustering of components into 4 main groups was within the judgment and interpretations of the researcher within the theoretical concept of factor loading score of the components. However, other researchers may still interpretated the components differently and possibly produced a different results and views. The groupings and components of the cause and impact factors may also subject to the selection and formation of cause factors or other part of framework of building code based on the sources of knowledge used by the researchers.

11.5 Recommendations for Further Research

In this current research, the study was limited to retrospectively assessing insufficiencies and infringements in building codes/regulations based on the experiences of practitioners, which is normally accounted from past projects of plan reviews, inspections, design, construction or engineering supervisions. One potential area of further research involves using the selection and formation of cause factors and measures described in this research to study how insufficiencies and infringements perceptions change during the course of a building and construction project, and life cycle of construction project [concept and feasibility studies, architecture and structural engineering design, procurement, construction, start-up, implementation, maintenance, operation and utilization, deconstruction, and demolition, and disposal], (Liebing, 1987), by using a real life case based scenario, and correlated the results with the project performance. Hence, the impact of the actual value and magnitude of the cause factors could be determined in terms of the building code objectives (public health, safety and general welfare) of the building project.

This research focused on the cause factors and its impact on the building code objectives (public health, safety and general welfare) of the building and construction project, but it did not address any additional impact caused by the size of possible losses due to failure. Further research could investigate whether magnitude issues play into perceptions of fault (cause). Other potential aspect for further research is by looking at the different perceptions of fault (cause) by different code enforcement department/organization or in different land zone (Kuwait has six governorates with different code enforcement personals and building projects) into more detail.

There are several other building regulatory framework components that could be investigated for their effects on insufficiency and infringements in the minimum requirements of public health, safety and general welfare. These other building regulatory framework components are building standards, building specifications, construction code of practice, construction professions and trades certification, building material and equipment testing and certification, and construction legal principles. Remedies for insufficiencies and infringements should be invented, and the appropriate frameworks as legislative, technical, administrative and social should be developed and implemented.

There are other regulations and factors, which have relationships with building regulatory framework. These include social, economic, financial regulations, well-functioning market, and knowledgeable consumers. These regulations and factors have potential for further research.

Other important and critical research is the relationship of BC with insurance, and warranties. The BC were seriously developed in The US because of the requirements of the insurance companies. Gwin and Ong (2000) concluded that BC should be implemented for building components exposed to costly defects. Defective workmanship is a distinctive menace in the purchase of new homes. BC enforcement and homeowner warranties are two sources for home buyers to guard against the risk of defective workmanship.

Last Word

The research experience taught me how to think and speak the language of science, and how to prepare scientific evidences, and further keeps me justify my decisions, and improve verbal communication. As the Messenger of Allah Mohammed peace be upon him said (Sahiham Muslim, 786):

"***Wisdom is the goal of the believer wherever he found it more deserving people out***"

Even though, the research subject in BC for a country was very difficult, complex, first of its kind, and involves risks that it might be beyond the scope of PhD; still it helped me to help other people more professionally and fulfills my desire to further my knowledge about how to fix the problem of implementation of building codes for Kuwait. Implementing building codes save life, health, and assets of people, and make people happier in their houses, building, and cities.

As Phillips and Pugh (2005) stated:

'The aim of the PhD is to get you to become a fully professional researcher in your field'.

This research fulfils my ambition to acquire high research standards and this PhD was my main focus in the last 10 years.

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Appendix A

Mean Average Rating for Cause Factors

Table 6.1: Mean Average Rating for Cause Factors

Cause Factor	Ref	Mean	Standard deviation	Ranking: Building Official in Municipality/Expert Department	Ranking: Construction Professional	Coefficients of Variations	Severity index	Overall Ranking
Inexistence of law to prepare and enforce Building Codes to safeguard minimum requirement of public health, safety and general welfare	LC1	3.37	1.253	48	32	37.21	72	43
Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	LC2	3.56	1.311	43	9	36.85	72	32
Inexistence of building materials testing system (because of the law)	LC3	3.38	1.288	46	33	38.15	59	42
Major obstacle to approve standard building specifications for Kuwait is the none existence of related article in Municipality laws	LC4	3.36	1.281	50	34	38.10	66	44
Major obstacle to approve system of building methods for Kuwait is the none existence of related article in Municipality laws	LC5	3.20	1.235	55	43	38.65	68	51
Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	LC6	3.51	1.312	44	20	37.40	73	36
More laws and codes and the resulting conflict among them	LC7	3.25	1.165	26	51	35.88	59	49
Not taking into account the changes in building technology in current law	LC8	3.99	1.117	7	4	28.00	74	7
Lack many of the technical requirements in building regulations in Kuwait	LC9	3.32	1.087	51	41	32.72	65	46
Unavailable laws to prevent the monopoly of lands, which led to increase of land price and misuse of lands and real estates	LC10	3.97	1.085	21	3	27.33	84	8
Unclear regulations texts	LC11	3.38	1.092	28	36	32.30	69	41
Unconstitutional decisions to collect fees	LC12	2.63	1.016	53	55	38.61	49	55
Weak regulations by Municipality Council	LC13	3.65	1.096	36	19	30.04	81	22
Weak regulations from National Parliament	LC14	3.71	1.108	29	16	29.85	76	17
Administrative procedures at Municipality are the main obstacles to implement and enforce regulations and laws	AC1	3.52	.862	39	26	24.50	71	35
Assigning many additional tasks for engineers of the technical department	AC2	3.76	.802	9	30	21.31	82	15
Building decisions and regulations were created without proper study which affect the investors	AC3	3.21	1.177	47	52	36.65	58	50
Conflict in issuing the licenses among Ministry of Trade and Municipality	AC4	3.58	.966	30	28	26.94	69	30
Difficulty in implementing some matters	AC5	3.28	.912	32	48	27.83	60	48
lose and damage of documents and records of building projects at Kuwait Municipality	AC6	4.17	.866	1	13	20.77	79	4
Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible of direct communication with citizens	AC7	3.52	1.066	19	46	30.29	65	34
It is hard to obtain specific information from Municipality, Kuwait Fire	AC8	3.34	.979	41	49	29.28	68	45

Cause Factor	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
				Building Official in Municipality/Expert Department	Construction Professional			
Department, Ministry of Electricity and Ministry of Public Work								
Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	AC9	3.32	1.002	**45**	**50**	30.20	71	47
Many participating organizations in administration of building process	AC10	3.63	.936	**18**	**23**	25.75	78	24
None of the government organizations performed their tasks of updating the construction requirements related to the use of latest construction materials or methods	AC11	3.08	1.243	**37**	**53**	40.34	62	53
Procedures of following and monitoring of building and construction works at Municipality are not clear and not with satisfying performance	AC12	3.64	1.016	**23**	**18**	27.91	79	23
Conflict and unclear area of expertise of organizations participated in administration of building process	AC13	3.15	1.166	**52**	**47**	37.05	62	52
Design and supervision engineers from engineering offices usually get licenses by Municipality, but they are not tested technically to know their abilities	AC14	3.70	.965	**27**	**15**	26.08	76	19
Improper Municipality technical and managerial capabilities to follow up and control building and construction works	AC15	3.54	.960	**31**	**27**	27.12	67	33
Many construction problems are due to unclear professional practice and workmanship standards	AC16	3.82	.725	**11**	**25**	18.97	79	13
Municipality Council members don't have the necessary technical education or qualification in preparing the building regulations	AC17	3.04	1.368	**54**	**54**	45.05	60	54
Small contractors usually get licenses by Municipality, but they are not tested technically resulting in engineering problems	AC18	4.21	.790	**8**	**2**	18.78	84	3
Unsuitable qualification of workforce at Municipality departments	AC19	3.60	.847	**14**	**42**	23.53	76	28
Weak workforce at Municipality departments	AC20	3.60	1.075	**34**	**35**	29.84	71	27
Weak legal departments at Municipality branches at governorates	AC21	3.65	1.019	**17**	**31**	27.90	68	21
Weak reimbursements for workers at Municipality	AC22	3.93	.846	**4**	**37**	21.53	80	9
Weak technical and financial capabilities at Municipality branches at governorates	AC23	3.79	.870	**13**	**24**	22.93	75	14
Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform its responsibilities properly in controlling and following local construction works	AC24	3.48	1.028	**35**	**44**	29.57	73	37
Difficulties facing Municipality technical workforce in acquiring correct data and information to implement and check what have been done on the site with issued licenses	AC25	3.59	1.108	**24**	**38**	30.84	79	29
It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control	AC26	3.82	1.309	**40**	**5**	34.25	76	12

Cause Factor	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
				Building Official in Municipality/Expert Department	Construction Professional			
Kuwait Municipality don't perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labors, and labor	AC27	3.61	1.072	49	12	29.68	76	25
Many owners and investors have no trust in the supervision capabilities of the engineering offices	AC28	3.66	.948	33	10	25.88	72	20
Neglecting of testing of building materials and concrete by certified testing centers during projects execution	AC29	3.83	.975	16	7	25.48	78	11
Most owners and investors don't care to fulfill the demands of energy conservation in buildings because due to the low cost of electricity, and weakness of regulations and enforcement	AC30	3.45	1.017	25	39	29.49	68	40
Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy	AC31	4.10	.988	3	14	24.09	87	5
Unclear and inadequate procedures of review of building plans at Municipality	AC32	3.58	1.186	42	17	33.10	81	31
There is no government controlled inspection on building at construction sites	AC33	3.71	.767	10	45	20.68	72	18
To reduce the cost of construction and to finish work quickly, many private projects are not executed as per professional standards and proper workmanship	AC34	4.27	.776	2	6	18.18	85	2
Workers at Kuwait Municipality don't care to use comprehensive checklists to review plans, and monitor projects to faithfully fulfill their work requirements	AC35	3.48	1.065	38	29	30.63	68	38
Absence of community awareness in building regulations and nature tasks of Municipality	SC1	3.47	1.048	15	40	30.16	62	39
Delay of issuing and enforcing legal court rules based on violation cases	SC2	3.61	1.232	20	21	34.13	71	26
Low monetary value of penalty by Municipality law (max. 500 k.d. = 1000 £)	SC3	3.91	1.016	6	22	25.99	85	10
No deterrent punishments for violators	SC4	4.29	.750	5	1	17.47	85	1
Weak of power of law in enforcing correction decisions of violations	SC5	4.00	1.020	12	11	25.53	86	6
Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	SC6	3.73	1.214	22	8	32.56	79	16

Appendix B

Mean Average Rating for Impact Factors

Table 6.2: Mean Average Rating for Impact Factors - Public Safety

Part of building code	Impact Factor (1- Public Safety)	Ref	Mean	Standard deviation	Ranking: Design or Plan Review	Ranking: Const./ Maintenance or Site Inspection	Coefficients of Variations	Severity index	Overall Ranking
legal	Inexistence of many of BC requirements (because of the law)	**IL1**	3.69	0.49	**41**	**7**	13.18	74.12	**18**
legal	Not taking into account the changes in building technology in current law	**IL2**	3.47	0.75	**56**	**38**	21.55	71.76	**49**
legal	Inexistence of professional code of practice for engineering offices, contractors, and skilled labours (because of the law)	**IL3**	3.62	0.71	**52**	**12**	19.57	73.33	**29**
legal	Inexistence of building materials testing system (because of the law)	**IL4**	3.76	0.53	**18**	**4**	14.02	76.47	**8**
legal	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	**IL5**	3.61	0.71	**23**	**30**	19.67	72.94	**30**
Admin.	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	**IA1**	3.75	0.52	**35**	**1**	13.93	77.65	**10**
Admin.	lose and damage of documents and records of building projects at Kuwait Municipality	**IA2**	3.40	0.88	**59**	**47**	25.97	70.59	**53**
Admin.	Improper Municipality technical and managerial capabilities to follow up and control building and construction works	**IA3**	3.69	0.58	**36**	**6**	15.81	75.29	**15**
Admin.	Unclear and inadequate procedures of review of building plans at Municipality	**IA4**	3.53	0.72	**54**	**23**	20.28	73.33	**39**
Admin.	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	**IA5**	3.71	0.55	**17**	**16**	14.86	77.33	**14**
Admin.	Neglecting of testing of building materials and concrete by certified testing centres during projects execution	**IA6**	3.86	0.35	**5**	**2**	9.00	77.65	**1**
Admin.	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	**IA7**	3.82	0.41	**2**	**8**	10.83	75.29	**3**
Social	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	**IS1**	3.76	0.53	**4**	**14**	14.06	74.12	**7**
Social	Weak of power of law in enforcing correction decisions of violations	**IS2**	3.81	0.39	**6**	**5**	10.36	76.47	**4**
Social	No deterrent punishments for violators	**IS3**	3.76	0.51	**7**	**15**	13.49	76.47	**9**
Social	Absence of community awareness in building regulations and nature tasks of Municipality	**IS4**	3.60	0.69	**27**	**33**	19.16	76.47	**31**
Technical	Accessibility	**IT1**	3.49	0.80	**46**	**41**	22.95	74.12	**44**
Technical	Aluminium	**IT2**	3.72	0.63	**24**	**10**	17.01	76.47	**12**
Technical	Bilers/water heaters	**IT3**	3.68	0.66	**25**	**18**	17.85	76.47	**20**
Technical	Concrete and reinforce concrete works	**IT4**	3.60	0.66	**28**	**35**	18.34	75.29	**32**
Technical	Construction equipment	**IT5**	3.65	0.69	**12**	**31**	18.79	76.47	**22**
Technical	Demolition of buildings and facilities	**IT6**	3.62	0.71	**20**	**26**	19.60	75.29	**28**

Part of building code	Impact Factor (1- Public Safety)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
Technical	Electrical works	**IT7**	3.63	0.62	**40**	**19**	17.05	72.94	**25**
Technical	Elevators and conveying systems	**IT8**	3.39	0.89	**57**	**53**	26.38	72.94	**54**
Technical	Encroachments into public right of way	**IT9**	3.58	0.67	**33**	**34**	18.78	75.29	**35**
Technical	Energy conservation	**IT10**	3.42	0.76	**51**	**54**	22.15	74.12	**52**
Technical	Existing structures	**IT11**	3.26	0.89	**55**	**59**	27.15	69.41	**59**
Technical	Exterior walls	**IT12**	3.60	0.64	**29**	**28**	17.73	74.12	**33**
Technical	Gas piping installations	**IT13**	3.69	0.49	**15**	**20**	13.18	75.29	**19**
Technical	Glass and glazing	**IT14**	3.63	0.63	**19**	**29**	17.32	74.12	**26**
Technical	Gypsum board and plaster	**IT15**	3.49	0.77	**30**	**50**	22.18	72.94	**42**
Technical	Increase number of persons occupying housing unit	**IT16**	3.69	0.55	**14**	**21**	14.95	76.47	**16**
Technical	Interior environment	**IT17**	3.64	0.61	**37**	**17**	16.70	74.12	**23**
Technical	Interior finishes	**IT18**	3.74	0.48	**16**	**11**	12.86	76.47	**11**
Technical	Maintenance of drinking water cooler sets	**IT19**	3.49	0.73	**45**	**39**	20.91	72.94	**43**
Technical	Masonry	**IT20**	3.47	0.74	**42**	**48**	21.41	74.12	**48**
Technical	Mechanical systems	**IT21**	3.54	0.67	**47**	**32**	18.88	72.94	**38**
Technical	Parking	**IT22**	3.50	0.79	**43**	**42**	22.62	74.12	**41**
Technical	Plastic	**IT23**	3.48	0.69	**49**	**43**	19.71	75.29	**45**
Technical	Plumbing systems	**IT24**	3.33	0.86	**58**	**55**	25.75	71.76	**58**
Technical	Poor electric and lighting works during alteration, movement, and repairing	**IT25**	3.37	0.79	**50**	**57**	23.36	70.59	**55**
Technical	Property maintenance	**IT26**	3.59	0.65	**32**	**27**	18.13	76.47	**34**
Technical	Safeguards during construction	**IT27**	3.56	0.67	**22**	**40**	18.87	76.47	**36**
Technical	Sanitation of exterior property areas	**IT28**	3.63	0.63	**26**	**24**	17.26	77.65	**24**
Technical	Sewage disposal	**IT29**	3.62	0.62	**13**	**37**	17.12	75.29	**27**
Technical	Sheds and Car metal shed	**IT30**	3.66	0.59	**3**	**36**	16.02	74.12	**21**
Technical	Signs	**IT31**	3.71	0.57	**11**	**22**	15.44	78.82	**13**
Technical	Site preparation	**IT32**	3.52	0.78	**31**	**45**	22.11	72.94	**40**
Technical	Smoke detectors for houses	**IT33**	3.48	0.77	**38**	**49**	22.23	71.76	**46**
Technical	Soil and foundations	**IT34**	3.46	0.71	**48**	**46**	20.52	75.29	**50**
Technical	Solar systems	**IT35**	3.54	0.74	**21**	**44**	20.87	70.59	**37**
Technical	Sound transmission	**IT36**	3.48	0.73	**34**	**51**	21.00	72.94	**47**
Technical	Steel	**IT37**	3.35	0.87	**53**	**56**	25.88	69.41	**57**
Technical	Structural design	**IT38**	3.44	0.78	**44**	**52**	22.54	75.29	**51**

Part of building code	Impact Factor (1- Public Safety)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
Technical	Structural tests and inspections	IT39	3.36	0.89	39	58	26.40	71.76	56
Technical	Swimming pools	IT40	3.69	0.58	10	25	15.63	77.65	17
Technical	Type of construction	IT41	3.83	0.46	9	3	12.01	80.00	2
Technical	Weather condition such humidity , dust and wind condition	IT42	3.80	0.46	8	9	12.06	76.47	6
Technical	Wood	IT43	3.81	0.53	1	13	13.92	77.65	5

Table 6.3: Mean Average Rating for Impact Factors - Public Health

Part of building code	Impact Factor (2- Public Health)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
legal	Inexistence of many of BC requirements (because of the law)	IL1	3.25	.826	55	56	25.40	61.18	55
legal	Not taking into account the changes in building technology in current law	IL2	3.14	.879	58	59	28.01	61.18	58
legal	Inexistence of professional code of practice for engineering offices, contractors, and skilled labours (because of the law)	IL3	3.17	.968	56	55	30.59	55.29	56
legal	Inexistence of building materials testing system (because of the law)	IL4	3.44	.696	45	50	20.20	63.53	45
legal	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	IL5	3.32	.871	53	53	26.22	65.88	53
Admin.	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	IA1	3.39	.677	49	44	20.00	62.35	49
Admin.	lose and damage of documents and records of building projects at Kuwait Municipality	IA2	3.03	1.084	59	58	35.80	57.65	59
Admin.	Improper Municipality technical and managerial capabilities to follow up and control building and construction works	IA3	3.33	.848	52	54	25.49	60.00	52
Admin.	Unclear and inadequate procedures of review of building plans at Municipality	IA4	3.14	.950	57	57	30.26	56.47	57
Admin.	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	IA5	3.47	.610	38	49	17.56	68.24	38
Admin.	Neglecting of testing of building materials and concrete by certified testing centres during projects execution	IA6	3.38	.733	50	51	21.69	66.25	50
Admin.	Municipality, Fire-fighting and Electricity are not performing periodical inspection after	IA7	3.64	.516	6	21	14.16	71.76	6

Part of building code	Impact Factor (2- Public Health)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
	linking electricity and building occupancy								
Social	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	IS1	3.57	.586	16	27	16.40	64.71	16
Social	Weak of power of law in enforcing correction decisions of violations	IS2	3.53	.549	23	28	15.56	70.59	23
Social	No deterrent punishments for violators	IS3	3.51	.644	30	30	18.35	68.24	30
Social	Absence of community awareness in building regulations and nature tasks of Municipality	IS4	3.49	.675	35	31	19.35	72.94	35
Technical	Accessibility	IT1	3.44	.782	46	48	22.76	68.24	46
Technical	Aluminium	IT2	3.52	.636	25	33	18.05	67.06	25
Technical	Bilers/water heaters	IT3	3.71	.554	1	2	14.95	70.59	1
Technical	Concrete and reinforce concrete works	IT4	3.51	.611	28	46	17.42	70.59	28
Technical	Construction equipment	IT5	3.62	.582	11	47	16.08	75.29	11
Technical	Demolition of buildings and facilities	IT6	3.69	.496	3	22	13.46	72.94	3
Technical	Electrical works	IT7	3.48	.653	36	18	18.75	67.06	36
Technical	Elevators and conveying systems	IT8	3.42	.750	47	42	21.89	67.06	47
Technical	Encroachments into public right of way	IT9	3.55	.567	18	39	15.98	68.24	18
Technical	Energy conservation	IT10	3.53	.567	21	29	16.05	70.59	21
Technical	Existing structures	IT11	3.32	.683	54	52	20.58	62.35	54
Technical	Exterior walls	IT12	3.46	.656	40	38	18.98	67.06	40
Technical	Gas piping installations	IT13	3.49	.586	34	43	16.78	69.41	34
Technical	Glass and glazing	IT14	3.56	.551	17	41	15.48	67.06	17
Technical	Gypsum board and plaster	IT15	3.47	.671	39	40	19.33	67.06	39
Technical	Increase number of persons occupying housing unit	IT16	3.59	.575	14	11	16.02	70.59	14
Technical	Interior environment	IT17	3.45	.654	43	34	18.96	67.06	43
Technical	Interior finishes	IT18	3.63	.525	10	35	14.46	71.76	10
Technical	Maintenance of drinking water cooler sets	IT19	3.45	.707	44	24	20.51	64.71	44
Technical	Masonry	IT20	3.45	.756	42	25	21.92	65.88	42
Technical	Mechanical systems	IT21	3.37	.718	51	45	21.28	62.50	51
Technical	Parking	IT22	3.49	.672	32	6	19.23	69.41	32
Technical	Plastic	IT23	3.51	.694	27	3	19.76	68.24	27
Technical	Plumbing systems	IT24	3.51	.716	31	14	20.42	69.41	31
Technical	Poor electric and lighting works during alteration, movement, and repairing	IT25	3.54	.610	19	12	17.21	70.59	19
Technical	Property maintenance	IT26	3.54	.567	20	23	16.03	70.59	20
Technical	Safeguards during construction	IT27	3.51	.611	29	26	17.42	67.06	29

Part of building code	Impact Factor (2- Public Health)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
Technical	Sanitation of exterior property areas	**IT28**	3.59	.618	**13**	**17**	17.20	71.76	**13**
Technical	Sewage disposal	**IT29**	3.63	.563	**9**	**7**	15.50	70.59	**9**
Technical	Sheds and Car metal shed	**IT30**	3.63	.610	**8**	**4**	16.81	72.94	**8**
Technical	Signs	**IT31**	3.65	.574	**5**	**5**	15.72	72.94	**5**
Technical	Site preparation	**IT32**	3.58	.639	**15**	**13**	17.82	68.24	**15**
Technical	Smoke detectors for houses	**IT33**	3.48	.709	**37**	**8**	20.37	71.76	**37**
Technical	Soil and foundations	**IT34**	3.39	.706	**48**	**37**	20.82	70.00	**48**
Technical	Solar systems	**IT35**	3.49	.656	**33**	**32**	18.79	70.59	**33**
Technical	Sound transmission	**IT36**	3.53	.594	**22**	**9**	16.83	71.76	**22**
Technical	Steel	**IT37**	3.46	.635	**41**	**36**	18.37	67.06	**41**
Technical	Structural design	**IT38**	3.52	.636	**26**	**10**	18.06	72.94	**26**
Technical	Structural tests and inspections	**IT39**	3.52	.624	**24**	**15**	17.70	71.76	**24**
Technical	Swimming pools	**IT40**	3.64	.532	**7**	**16**	14.62	76.47	**7**
Technical	Type of construction	**IT41**	3.67	.538	**4**	**1**	14.68	77.65	**4**
Technical	Weather condition such humidity , dust and wind condition	**IT42**	3.61	.540	**12**	**19**	14.97	74.12	**12**
Technical	Wood	**IT43**	3.69	.484	**2**	**20**	13.10	75.29	**2**

Table 6.4: Mean Average Rating for Impact Factors - Public Welfare

Part of building code	Impact Factor (3- Public Welfare)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
legal	Inexistence of many of BC requirements (because of the law)	IL1	2.86	.745	52	46	26.08	50.59	50
legal	Not taking into account the changes in building technology in current law	IL2	3.07	.752	15	22	24.54	61.18	15
legal	Inexistence of professional code of practice for engineering offices, contractors, and skilled labours (because of the law)	IL3	2.77	.913	54	57	32.96	51.76	57
legal	Inexistence of building materials testing system (because of the law)	IL4	2.84	.976	40	56	34.40	51.76	53
legal	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	IL5	2.76	.933	48	59	33.80	54.12	58
Admin.	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	IA1	2.84	.883	43	55	31.06	56.47	52
Admin.	lose and damage of documents and records of building projects at Kuwait Municipality	IA2	2.75	.996	51	58	36.15	57.65	59
Admin.	Improper Municipality technical and managerial capabilities to follow up and control building and construction works	IA3	2.88	.815	57	25	28.31	55.29	49
Admin.	Unclear and inadequate procedures of review of building plans at Municipality	IA4	2.85	.850	59	26	29.86	55.29	51
Admin.	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don’t perform their responsibilities properly in controlling and following local construction works	IA5	3.00	.827	44	11	27.58	57.65	31
Admin.	Neglecting of testing of building materials and concrete by certified testing centres during projects execution	IA6	2.92	.878	33	53	30.06	52.50	41
Admin.	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	IA7	3.00	.887	14	51	29.58	54.12	30
Social	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	IS1	3.00	.774	25	30	25.78	54.12	29
Social	Weak of power of law in enforcing correction decisions of violations	IS2	2.99	.825	37	23	27.63	58.82	32
Social	No deterrent punishments for violators	IS3	3.03	.866	31	12	28.57	61.18	22
Social	Absence of community awareness in building regulations and nature tasks of Municipality	IS4	3.09	.901	36	2	29.16	63.53	13
Technical	Accessibility	IT1	3.11	.837	13	13	26.96	60.00	11
Technical	Aluminium	IT2	2.88	.899	58	16	31.23	51.76	48
Technical	Bilers/water heaters	IT3	3.11	.770	12	17	24.78	58.82	10
Technical	Concrete and reinforce concrete works	IT4	2.91	.857	50	27	29.46	60.00	43
Technical	Construction equipment	IT5	3.23	.759	2	7	23.53	64.71	2
Technical	Demolition of buildings and facilities	IT6	3.17	.748	5	8	23.57	60.00	5

Part of building code	Impact Factor (3- Public Welfare)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
Technical	Electrical works	**IT7**	**2.80**	**.865**	55	**52**	30.87	48.24	**55**
Technical	Elevators and conveying systems	**IT8**	**3.02**	**.901**	20	**31**	29.81	55.00	**23**
Technical	Encroachments into public right of way	**IT9**	**3.22**	**.735**	3	**5**	22.83	60.00	**3**
Technical	Energy conservation	**IT10**	**3.09**	**.926**	6	**32**	29.92	57.65	**12**
Technical	Existing structures	**IT11**	**3.16**	**.784**	18	**3**	24.84	62.35	**7**
Technical	Exterior walls	**IT12**	**3.01**	**.770**	23	**36**	25.61	55.00	**28**
Technical	Gas piping installations	**IT13**	**2.94**	**.809**	41	**37**	27.53	51.76	**39**
Technical	Glass and glazing	**IT14**	**2.81**	**.870**	49	**54**	30.99	48.24	**54**
Technical	Gypsum board and plaster	**IT15**	**3.13**	**.772**	8	**14**	24.67	57.65	**8**
Technical	Increase number of persons occupying housing unit	**IT16**	**2.88**	**.799**	53	**33**	27.76	51.76	**47**
Technical	Interior environment	**IT17**	**2.80**	**.896**	56	**50**	32.01	50.59	**56**
Technical	Interior finishes	**IT18**	**3.04**	**.846**	7	**49**	27.84	56.47	**21**
Technical	Maintenance of drinking water cooler sets	**IT19**	**2.91**	**.867**	42	**41**	29.83	52.94	**44**
Technical	Masonry	**IT20**	**3.01**	**.868**	38	**15**	28.85	56.47	**27**
Technical	Mechanical systems	**IT21**	**2.92**	**.808**	47	**20**	27.70	55.29	**42**
Technical	Parking	**IT22**	**2.97**	**.814**	34	**28**	27.41	57.65	**36**
Technical	Plastic	**IT23**	**3.02**	**.821**	22	**29**	27.21	56.47	**25**
Technical	Plumbing systems	**IT24**	**3.06**	**.822**	17	**24**	26.89	57.65	**16**
Technical	Poor electric and lighting works during alteration, movement, and repairing	**IT25**	**2.93**	**.767**	39	**47**	26.19	54.12	**40**
Technical	Property maintenance	**IT26**	**2.96**	**.783**	28	**48**	26.44	56.47	**38**
Technical	Safeguards during construction	**IT27**	**3.02**	**.734**	21	**34**	24.32	58.82	**24**
Technical	Sanitation of exterior property areas	**IT28**	**2.98**	**.795**	30	**35**	26.64	58.82	**33**
Technical	Sewage disposal	**IT29**	**3.12**	**.805**	9	**18**	25.78	61.18	**9**
Technical	Sheds and Car metal shed	**IT30**	**3.05**	**.813**	19	**21**	26.64	60.00	**17**
Technical	Signs	**IT31**	**2.96**	**.849**	27	**42**	28.67	57.65	**37**
Technical	Site preparation	**IT32**	**2.98**	**.860**	24	**43**	28.87	57.65	**34**
Technical	Smoke detectors for houses	**IT33**	**2.91**	**.822**	45	**38**	28.26	58.82	**45**
Technical	Soil and foundations	**IT34**	**3.04**	**.802**	11	**45**	26.35	57.65	**19**
Technical	Solar systems	**IT35**	**2.89**	**.886**	46	**39**	30.64	60.00	**46**
Technical	Sound transmission	**IT36**	**3.07**	**.805**	26	**9**	26.26	62.35	**14**
Technical	Steel	**IT37**	**3.04**	**.788**	35	**10**	25.90	62.35	**20**
Technical	Structural design	**IT38**	**3.16**	**.856**	16	**4**	27.07	64.71	**6**

Part of building code	Impact Factor (3- Public Welfare)	Ref	Mean	Standard deviation	Ranking		Coefficients of Variations	Severity index	Overall Ranking
					Design or Plan Review	Const./ Maintenance or Site Inspection			
Technical	Structural tests and inspections	**IT39**	**3.04**	**.899**	10	**44**	29.53	60.00	**18**
Technical	Swimming pools	**IT40**	**2.97**	**1.068**	32	**40**	35.91	57.65	**35**
Technical	Type of construction	**IT41**	**3.01**	**1.063**	29	**19**	35.33	61.18	**26**
Technical	Weather condition such humidity , dust and wind condition	**IT42**	**3.20**	**.855**	4	**6**	26.73	62.35	**4**
Technical	Wood	**IT43**	**3.61**	**.635**	1	**1**	17.58	69.41	**1**

Appendix C

Selection of Impact Variables for Questionnaire Two

Ref.	Potential Impact Factor	Experts					Mean
		1st	2nd	3rd	4th	5th	
LC1	Inexistence of law to prepare and enforce Building Codes to safeguard minimum requirement of public health, safety and general welfare	5	2	4	4	3	72
LC2	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	5	4	3	4	5	84
LC3	Inexistence of building materials testing system (because of the law)	4	5	4	3	5	84
LC4	Major obstacle to approve standard building specifications for Kuwait is the none existence of related article in Municipality laws	2	4	2	5	4	68
LC5	Major obstacle to approve system of building methods for Kuwait is the none existence of related article in Municipality laws	4	4	3	5	2	72
LC6	Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	5	4	4	5	4	88
LC7	More laws and codes and the resulting conflict among them	2	5	2	5	4	72
LC8	Not taking into account the changes in building technology in current law	3	5	5	4	5	88
LC9	Lack many of the technical requirements in building regulations in Kuwait	5	4	3	4	5	84
LC10	Unavailable laws to prevent the monopoly of lands, which led to increase of land price and misuse of lands and real estates	5	2	4	5	3	76
LC11	Unclear regulations texts	3	5	2	3	4	68
LC12	Unconstitutional decisions to collect fees	4	3	3	4	4	72
LC13	Weak regulations by Municipality Council	3	5	2	2	2	56
LC14	Weak regulations from National Parliament	4	3	3	4	4	72
AC1	Administrative procedures at Municipality are the main obstacles to implement and enforce regulations and laws	1	4	3	5	1	56
AC2	Assigning many additional tasks for engineers of the technical department	3	4	3	3	5	72
AC3	Building decisions and regulations were created without proper study which affect the investors	3	4	3	3	3	64
AC4	Conflict in issuing the licenses among Ministry of Trade and Municipality	4	5	2	4	3	72
AC5	Difficulty in implementing some matters	3	5	3	4	3	72
AC6	lose and damage of documents and records of building projects at Kuwait Municipality	5	4	4	5	4	88
AC7	Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible of direct communication with citizens	3	4	4	3	4	72
AC8	It is hard to obtain specific information from Municipality, Kuwait Fire Department, Ministry of Electricity and Ministry of Public Work	4	2	4	4	4	72
AC9	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	4	3	5	5	5	88
AC10	Many participating organizations in administration of building	2	5	3	3	3	64

Ref.	Potential Impact Factor	Experts					Mean
		1st	2nd	3rd	4th	5th	
	process						
AC11	None of the government organizations performed their tasks of updating the construction requirements related to the use of latest construction materials or methods	3	5	3	3	3	68
AC12	Procedures of following and monitoring of building and construction works at Municipality are not clear and not with satisfying performance		2	1	5	4	48
AC13	Conflict and unclear area of expertise of organizations participated in administration of building process	5	2	4	5	3	76
AC14	Design and supervision engineers from engineering offices usually get licenses by Municipality, but they are not tested technically to know their abilities	3	3	3	3	4	64
AC15	Improper Municipality technical and managerial capabilities to follow up and control building and construction works	5	5	4	3	5	88
AC16	Many construction problems are due to unclear professional practice and workmanship standards	2	5	5	2	4	72
AC17	Municipality Council members don't have the necessary technical education or qualification in preparing the building regulations	2	4	3	5	4	72
AC18	Small contractors usually get licenses by Municipality, but they are not tested technically resulting in engineering problems	4	4	3	5	2	72
AC19	Unsuitable qualification of workforce at Municipality departments	3	5	2	3	4	68
AC20	Weak workforce at Municipality departments	2	2	5	2	4	60
AC21	Weak legal departments at Municipality branches at governorates	3	3	2	2	2	48
AC22	Weak reimbursements for workers at Municipality	3	3	2	2	2	48
AC23	Weak technical and financial capabilities at Municipality branches at governorates	3	3	2	2	2	48
AC24	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don’t perform its responsibilities properly in controlling and following local construction works	3	4	4	5	5	84
AC25	Difficulties facing Municipality technical workforce in acquiring correct data and information to implement and check what have been done on the site with issued licenses	3	3	4	4	4	72
AC26	It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control	5	2	4	5	3	76
AC27	Kuwait Municipality don’t perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labors, and labor	2	3	5	3	4	68
AC28	Many owners and investors have no trust in the supervision capabilities of the engineering offices	4	4	4	2	4	72
AC29	Neglecting of testing of building materials and concrete by certified testing centers during projects execution	5	3	4	5	4	84
AC30	Most owners and investors don't care to fulfill the demands of energy conservation in buildings because due to the low cost of electricity, and weakness of regulations and enforcement	3	3	5	4	2	68

Ref.	Potential Impact Factor	Experts					Mean
		1st	2nd	3rd	4th	5th	
AC31	Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy	5	4	3	5	4	84
AC32	Unclear and inadequate procedures of review of building plans at Municipality	5	3	5	4	4	84
AC33	There is no government controlled inspection on building at construction sites	3	3	5	2	2	60
AC34	To reduce the cost of construction and to finish work quickly, many private projects are not executed as per professional standards and proper workmanship	4	4	4	3	4	76
AC35	Workers at Kuwait Municipality don’t care to use comprehensive checklists to review plans, and monitor projects to faithfully fulfill their work requirements	3	4	4	4	4	76
SC1	Absence of community awareness in building regulations and nature tasks of Municipality	5	5	3	4	4	84
SC2	Delay of issuing and enforcing legal court rules based on violation cases	5	3	4	3	4	76
SC3	Low monetary value of penalty by Municipality law (max. 500 k.d. = 1000 £)	2	5	3	3	3	64
SC4	No deterrent punishments for violators	4	5	4	4	4	84
SC5	Weak of power of law in enforcing correction decisions of violations	3	4	5	5	4	84
SC6	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	5	4	4	4	5	88

Appendix D

Questionnaire One

Questionnaire to identify causes of insufficient minimum requirements of Building Codes on public health, safety and general welfare in Kuwait

Your Profession	❑ **Building Official in Municipality or Expert Department**	❑ **Construction Professional**
Experience in Construction (Years)	❑ **1-10 yrs**	❑ **More than 10 yrs**
What is your email (to receive summary report of the survey results)? Or you get the results from http://www.facebook.com/jasem.alfahad		

Dear Sir/ Madam

For the interest of scientific research, and to protect the rights of property (houses, buildings, and real estate) owners and citizens, we found that it is essential to investigate the effect of absence of building regulations on buildings projects. For achieving this purpose, we are conducting a field research to examine the performance of building projects. For a complete study, we understand the necessity of taking opinions of residents, owners, engineers, contractors, officials at Kuwait Municipality, The General Administration for Fire Fighting, The Ministry of Public Affairs, The General Institution for Housing Care, and all parties related and specialized in different building projects. We request you to answer the questionnaire by choosing the appropriate answers indicating your view concerning that matter. Your respond to the questionnaire will be treated confidentially for scientific research purposes, and for national interest to improve building and construction industry in Kuwait.

Please answer the following questions:

Please Select: [1: Strongly Agree (SA)], [2: Agree (A)], [3: Neither/Nor (N)], [4: Disagree (D)], [5: Strongly Disagree (SD)]

No	First: Legal/Technical System of Building Regulations & Codes in Kuwait	Likelihood Occurrence				
		SA	A	N	D	SD
1	Inexistence of law to prepare and enforce Building Codes to safeguard minimum requirement of public health, safety and general welfare	☐	☐	☐	☐	☐
2	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	☐	☐	☐	☐	☐
3	Inexistence of building materials testing system (because of the law)	☐	☐	☐	☐	☐
4	Major obstacle to approve standard building specifications for Kuwait is the none existence of related article in Municipality laws	☐	☐	☐	☐	☐
5	Major obstacle to approve system of building methods for Kuwait is the none existence of related article in Municipality laws	☐	☐	☐	☐	☐
6	Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	☐	☐	☐	☐	☐
7	More laws and codes and the resulting conflict among them	☐	☐	☐	☐	☐
8	Not taking into account the changes in building technology in current law	☐	☐	☐	☐	☐
9	Lack many of the technical requirements in building regulations in Kuwait	☐	☐	☐	☐	☐
10	Unavailable laws to prevent the monopoly of lands, which led to increase of land price and misuse of lands and real estates	☐	☐	☐	☐	☐
11	Unclear regulations texts	☐	☐	☐	☐	☐
12	Unconstitutional decisions to collect fees	☐	☐	☐	☐	☐
13	Weak regulations by Municipality Council	☐	☐	☐	☐	☐
14	Weak regulations from National Parliament	☐	☐	☐	☐	☐
No	**Second: Social System of Building Regulations & Codes in Kuwait**	**Likelihood Occurrence**				
		SA	**A**	**N**	**D**	**SD**
15	Absence of community awareness in building regulations and nature tasks of Municipality	☐	☐	☐	☐	☐
16	Delay of issuing and enforcing legal court rules based on violation cases	☐	☐	☐	☐	☐
17	Low monetary value of penalty by Municipality law (max. 500 k.d. = 1000 £)	☐	☐	☐	☐	☐
18	No deterrent punishments for violators	☐	☐	☐	☐	☐
19	Weak of power of law in enforcing correction decisions of violations	☐	☐	☐	☐	☐
20	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	☐	☐	☐	☐	☐

No	Third: Administration System of Building Regulations & Codes in Kuwait	Likelihood Occurrence				
		SA	A	N	D	SD
	(1) General Management	☐	☐	☐	☐	☐
21	Administrative procedures at Municipality are the main obstacles to implement and enforce regulations and laws	☐	☐	☐	☐	☐
22	Assigning many additional tasks for engineers of the technical department	☐	☐	☐	☐	☐
23	Building decisions and regulations were created without proper study which affect the investors	☐	☐	☐	☐	☐
24	Conflict in issuing the licenses among Ministry of Trade and Municipality	☐	☐	☐	☐	☐
25	Difficulty in implementing some matters	☐	☐	☐	☐	☐
26	lose and damage of documents and records of building projects at Kuwait Municipality	☐	☐	☐	☐	☐
27	Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible of direct communication with citizens	☐	☐	☐	☐	☐
28	It is hard to obtain specific information from Municipality, Kuwait Fire Department, Ministry of Electricity and Ministry of Public Work	☐	☐	☐	☐	☐
29	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	☐	☐	☐	☐	☐
30	Many participating organizations in administration of building process	☐	☐	☐	☐	☐
31	None of the government organizations performed their tasks of updating the construction requirements related to the use of latest construction materials or methods	☐	☐	☐	☐	☐
32	Procedures of following and monitoring of building and construction works at Municipality are not clear and not with satisfying performance	☐	☐	☐	☐	☐
	(2) Certification and qualification for Building Regulations & Codes	☐	☐	☐	☐	☐
33	Conflict and unclear area of expertise of organizations participated in administration of building process	☐	☐	☐	☐	☐
34	Design and supervision engineers from engineering offices usually get licenses by Municipality, but they are not tested technically to know their abilities	☐	☐	☐	☐	☐
35	Improper Municipality technical and managerial capabilities to follow up and control building and construction works	☐	☐	☐	☐	☐
36	Many construction problems are due to unclear professional practice and workmanship standards	☐	☐	☐	☐	☐
37	Municipality Council members don't have the necessary technical education or qualification in preparing the building regulations	☐	☐	☐	☐	☐
38	Small contractors usually get licenses from Municipality, but they are not tested technically resulting in engineering problems	☐	☐	☐	☐	☐
39	Unsuitable qualification of workforce at Municipality departments	☐	☐	☐	☐	☐
40	Weak workforce at Municipality departments	☐	☐	☐	☐	☐
41	Weak legal departments at Municipality branches at governorates	☐	☐	☐	☐	☐
42	Weak reimbursements for workers at Municipality	☐	☐	☐	☐	☐
43	Weak technical and financial capabilities at Municipality branches at governorates	☐	☐	☐	☐	☐
	(3) Plan Review, Site Inspection and Violations	☐	☐	☐	☐	☐
44	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don't perform their responsibilities properly in controlling and following local construction works	☐	☐	☐	☐	☐
45	Difficulties facing Municipality technical workforce in acquiring correct data and information to implement and check what have been done on the site with issued licenses	☐	☐	☐	☐	☐
46	It is incorrect to award all engineering supervision and inspection tasks to consultant offices without Municipality control	☐	☐	☐	☐	☐
47	Kuwait Municipality don't perform its responsibilities effectively to license, follow up, and monitor engineering offices, contractors, and skilled labours.	☐	☐	☐	☐	☐
48	Many owners and investors have no trust in the supervision capabilities of the engineering offices	☐	☐	☐	☐	☐
49	Neglecting of testing of building materials and concrete by certified testing centers during projects execution	☐	☐	☐	☐	☐
50	Most owners and investors don't care to fulfil the demands of energy conservation in buildings due to the low cost of electricity, and weakness of regulations and enforcement	☐	☐	☐	☐	☐
51	Municipality, Fire-fighting and Electricity departments are not performing periodical inspection after linking electricity and building occupancy	☐	☐	☐	☐	☐
52	Unclear and inadequate procedures of review of building plans at Municipality	☐	☐	☐	☐	☐
53	There is no government controlled inspection on building at construction sites	☐	☐	☐	☐	☐
54	To reduce the cost of construction and to finish work quickly, many private projects are not executed at per professional standards and proper workmanship	☐	☐	☐	☐	☐
55	Workers at Kuwait Municipality don't care to use comprehensive checklists to review plans, and monitor projects to faithfully fulfil their work requirements	☐	☐	☐	☐	☐

Thank you for your contribution to the success of this study

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Appendix F

Questionnaire Two

Questionnaire to identify impacts of insufficient minimum requirements of Building Codes on public health, safety and general welfare in Kuwait

Your Profession	❑ **Design or Plan Review**	❑ **Construction/ Maintenance or Site Inspection**
Experience in Construction (Years)	**1-10 yrs**	❑ **More than 10 yrs**
What is your email (to receive summary report of the survey results)? Or you get the results from http://www.facebook.com/jasem.alfahad		

Dear Sir/ Madam
For the interest of scientific research, and to protect the rights of property (houses, buildings, and real estate) owners and citizens, we found that it is essential to identify the impacts of insufficient Building codes on public health, safety and general welfare in Kuwait. In order to achieve this purpose, we are doing a research to follow up the performance deficiencies and inadequate codes and regulations to provide minimum health, safety and general welfare in Kuwait. For a complete study, we understand the necessity of taking opinions of design, plan review, construction, site inspection, and maintenance professionals. We request you to answer the questionnaire by choosing the appropriate answers indicating your view concerning that matter. Your respond to the questionnaire will be treated confidentially for scientific research purposes, and for national interest to improve building and construction industry in Kuwait.

Please answer the following questions:
Please Select: [1: No Impact], [2: Low Impact], [3: Impact], [4: High Impact]

No	Insufficiency of Building Regulations/Codes in Kuwait	What are the impacts on: Public Safety				Public Health				Public Welfare			
	First: Legal, Administration, & Social System of Building Regulations & Codes in Kuwait	1	2	3	4	1	2	3	4	1	2	3	4
1	Lack many of the technical requirements in building regulations in Kuwait	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	Not taking into account the changes in building technology in current law	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3	Inexistence of testing and certification system for building engineers, contractors, and skilled labours (because of the law)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	Inexistence of building materials testing system (because of the law)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	Ineffective cover of Insurance companies to preserve quality of building construction works (because of the law)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	Improper Municipality procedures to organize the works of consultant offices from preparing plans and engineering supervision on building projects	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7	lose and damage of documents and records of building projects at Kuwait Municipality	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8	Improper Municipality technical and managerial capabilities to follow up and control building and construction works	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9	Unclear and inadequate procedures of review of building plans at Municipality	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10	Building Department, Inspection Department, and Safety Department at Kuwait Municipality don’t perform their responsibilities properly in controlling and following local construction works	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11	Neglecting of testing of building materials and concrete by certified testing centres during projects execution	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12	Municipality, Fire-fighting and Electricity are not performing periodical inspection after linking electricity and building occupancy	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13	Ineffective engineering supervision and inspection tasks to prevent violations or cheatings	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14	Weak of power of law in enforcing correction decisions of violations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15	No deterrent punishments for violators	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
16	Absence of community awareness in building regulations and nature tasks of Municipality	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

No	Insufficiency of Building Regulations/Codes in Kuwait	What are the impacts on: Public Safety				Public Health				Public Welfare			
	Lack of building code requirements for design, construction & maintenance in Kuwait for the work of the following items:	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
17	Accessibility	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
18	Aluminium	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19	boilers/water heaters	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20	Concrete and reinforce concrete works	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
21	Construction equipment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
22	Demolition of buildings and facilities	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
23	Electrical works	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24	Elevators and conveying systems	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
25	Encroachments into public right of way	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26	Energy conservation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
27	Existing structures	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
28	Exterior walls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
29	Gas piping installations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
30	Glass and glazing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
31	Gypsum board and plaster	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
32	Increase number of persons occupying housing unit	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
33	Interior environment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
34	Interior finishes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
35	Maintenance of drinking water cooler sets	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
36	Masonry	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
37	Mechanical systems	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
38	Parking	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
39	Plastic	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
40	Plumbing systems	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
41	Poor electric and lighting works during alteration, movement, and repairing	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
42	Property maintenance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
43	Safeguards during construction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
44	Sanitation of exterior property areas	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
45	Sewage disposal	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
46	Sheds and Car metal shed	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
47	Signs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
48	Site preparation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
49	Smoke detectors for houses	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
50	Soil and foundations	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
51	Solar systems	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
52	Sound transmission	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
53	Steel	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
54	Structural design	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
55	Structural tests and inspections	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
56	Swimming pools	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
57	Type of construction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
58	Weather condition such humidity , dust and wind condition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
59	Wood	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Thank you for your contribution to the success of this study

Jasem Yousef Jasem AL-Fahad
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Appendix G

Contents of ICC BC framework

No.	Model Building Code
1	International Building Code
2	International Residential Code
3	International Energy Conversation Code
4	International Fuel Gas Code
5	International Fire Code
6	International Mechanical Code
7	International Property Maintenance Code
8	International Plumbing Code
9	International Privet Sewage Disposal Code
10	International Zoning Code
11	ICC Electrical Code Administrative Provisions
12	ICC Performance Building Code For Building Facilities

	1. INTERNATIONAL BUILDING CODE	20	aluminum
1	administration	21	masonry
2	definitions	22	steel
3	use and occupancy classification	23	wood
4	special use and occupancy	24	glass and glazing
5	general building heights and areas	25	gypsum board and plaster
6	type of construction	26	plastic
7	fire resistance rated construction	27	electrical
8	interior finishes	28	mechanical systems
9	fire protection systems	29	plumbing systems
10	means of egress	30	elevators and conveying systems
11	accessibility	31	special construction
12	interior environment	32	encroachments into public right of way
13	energy conservation	33	safeguards during construction
14	exterior walls	34	existing structures
15	roof assemblies and rooftop structures	35	signs
16	structural design	36	sign regulations
17	structural tests and inspections	37	sheds
18	soil and foundations	38	construction equipment
19	concrete	39	referenced standards

	2. INTERNATIONAL RESIDENTIAL CODE		
1	administration	29	part vii-plumbing
2	definitions	30	plumbing administration
3	building planning and construction	31	general plumbing requirements
4	building planning	32	plumbing fixtures
5	foundations	33	water heaters
6	floors	34	water supply and distribution
7	wall construction	35	sanitary drainage
8	wall covering	36	vents
9	roof -ceiling construction	37	traps
10	roof assemblies	38	part viii-electrical
11	chimneys and fireplaces	39	general requirements
12	part iv energy conservation	40	electrical definitions
13	energy efficiency	41	services
14	part v-mechanical	42	branch circuit and feeder requirements
15	mechanical administration	43	wiring methods
16	general mechanical system requirement	44	power and lighting distribution
17	heating and cooling equipment	45	devices and lighting fixtures
18	exhaust systems	46	appliance installation
19	duct systems	47	swimming pools
20	combustion air	48	class remote control
21	chimneys and vents	49	referenced standards
22	special fuel-burning equipment	50	radon control methods
23	bilers/water heaters	51	swimming pools, spas and hot tubs
24	hydronic piping	52	patio covers
25	special piping and storage systems	53	private sewage disposal
26	solar systems	54	existing building and structures
27	part vi - fuel gas	55	sound transmission
28	fuel gas	56	index

	3. INTERNATIONAL ENERGY CONVERSATION CODE	5	residential building design by component performance approach
1	administration and enforcement	6	simplified prescriptive
2	definitions	7	building design
3	design conditions	8	design by acceptable
4	residential building design by systems analysis and design of buildings utilizing renewable energy sources	9	referenced standards

	4. INTERNATIONAL FUEL GAS CODE	15	servomg appliances
1	code cover	16	equipped with draft
2	table of contents	17	hoods,category
3	preface	18	applianced, and
4	how to use the code	19	applianced listed
5	index	20	for use and type b
6	administration	21	vents(ifgs)
7	definitions	22	c exit terminals of mechanical draft and
8	general regulations	23	direct-vent venting
9	gas piping installations	24	systems (ifgs)
10	chimneys and vents	25	recommended procedure
11	specific appliances	26	for safety inspection of
12	referenced standards	27	an existing appliance
13	sizing and capacities of gas piping (ifgs)	28	installation (ifgs)
14	sizing of venting systems	29	index

	5. INTERNATIONAL FIRE CODE	27	hazardous materials-general provisions
1	administration	28	aerosols
2	definitions	29	combustible fibers
3	general precautions against fire	30	compressed gases
4	emergency planning and preparedness	31	corrosive materials
5	fire service features	32	cryogenic fluids
6	building services and systems	33	explosived and fireworks
7	fire-resistance-rated construction	34	flammable and-combustible liquids
8	interior finish, decorative materials and furnishings	35	flammable gases
9	fire protection systems	36	flammable solids
10	means of egress	37	highly toxic and toxic materials
11	aviation facilities	38	liquefied petroleum gases
12	dry cleaning	39	organic peroxides
13	combustible dust-producing operations	40	oxidizers
14	fire safety during construction and demolition	41	pyrophoric materials
15	flammable finishes	42	pyroxylin(cellulose
16	fruit and crop ripening	43	unstable (reactive)
17	fumigation and thermal inspecticida fogging	44	water-reactive solids and liquids
18	semiconductor fabrication facilities	45	referenced standards
19	lumber yards and woodworking fachilites	46	a board of appeals
20	manufacture of organic coatings	47	fire-flow requirements for building
21	industrial ovens	48	fire hydrant loations and distribution
22	service stations and repair garages	49	fire appartus access roads
23	high-piled combustible storage	50	hazard categories
24	tents and other membrane structure	51	hazard ranking
25	tire rebuilding and tire storage	52	cryogneic fluids-weight and volume equvalents
26	welding and other hot work	53	index

	6. INTERNATIONAL MECHANICAL CODE	10	boilers, water heaters and pressure vessels
1	administration	11	refrigeration
2	definitions	12	hydronic piping
3	general definitions	13	refrigeration and storage
4	ventilation	14	solar systems
5	exhaust systems	15	referenced standards
6	duct systems	16	combustion air openings and chimney connectorpass-throughs
7	combustion air	17	recommended permit fee
8	chimneys and vents	18	index
9	specific appliances, fireplaces and soled fuel burning equipment		

	7. INTERNATIONAL PROPERTY MAINTENANCE CODE	5	plumbing facilities and fixtures requirements
1	administration	6	mechanical and electrical requirements
2	definitions	7	fire safety requirements
3	general requirements	8	referenced standards
4	light, ventilation and occupancy limitations	9	

	8. INTERNATIONAL PLUMBING CODE	10	interceptors and separators
1	administration	11	storm drainage
2	definitions	12	special piping and storage systems
3	general regulations	13	referenced standards
4	fixtures, faucets and fixture fittings	14	plumbing permit fee schedule
5	water heaters	15	rates of rainfall for cities
6	water supply and distribution	16	gray water recycling systems
7	sanitary drainage	17	sizing of water piping system
8	indirect/special waste	18	structural safety
9	vents	19	vacuum drainage system

	9. INTERNATIONAL PRIVET SEWAGE DISPOSAL CODE	9	mound systems
1	administration	10	cesspools
2	definitions	11	residential wastewater systems
3	general regulations	12	inspections
4	site evaluation and requirements	13	no liquid saturated treatment systems
5	materials	14	referenced standards
6	soil absorption systems	15	system layout illustrations
7	pressure distribution systems	16	tables for distribution systems
8	tanks		

	10. INTERNATIONAL ZONING CODE	8	general provisions
1	administration	9	special regulations
2	definitions	10	sign regulations
3	use districts	11	nonconforming structures and uses
4	agricultural zones	12	conditional use
5	residential zones	13	planned unit development
6	commercial and commercial residential zones	14	referenced standards
7	factory/industrial zones	15	

	11. ICC ELECTRICAL CODE ADMINISTRATIVE PROVISIONS	7	service utilities
1	definitions	8	unsafe systems and equipment
2	organization and enforcement	9	violations
3	permits and fees	10	means of appeal
4	construction documents	11	electrical provisions
5	approval	12	referenced standards
6	inspections and testing		

12. ICC Performance Building Code for Building Facilities	
Part I - Administrative	**10 Interior Environment**
1 General Administrative Provisions	Climate and Building Functionality
Intent and Purpose	Indoor Air Quality
Scope	Airborne and Impact Sound
Administrative Provisions	Artificial and Natural Light
Acceptable Methods	**11 Mechanical**
2 Definitions	Heating, Ventilation and Air Conditioning
General	Equipment (HVAC)
Defined Terms	Refrigeration
3 Design Performance Levels	Piped Services
Minimum Performance	**12 Plumbing**
Use Groups	Personal Hygiene
Performance Groups	Laundering
Maximum Level of Damage to be Tolerated	Domestic Water Supplies
Magnitude of Events	Wastewater
4 Reliability and Durability	**13 Fuel Gas**
Reliability	Fuel Gas Piping and Vents
Durability	**14 Electricity**
Part II - Building	Electricity
5 Stability	**15 Energy Efficiency**
Structural Forces	Energy Efficiency
6 Fire Safety	**Part III – Fire**
Sources of Ignition	**16 Fire Prevention**
Limiting Fire Impact	Fire Prevention
7 Pedestrian Circulation	**17 Fire Impact Management**
Means of Egress	Fire Impact Management
Accessibility	**18 Management of People**
Transportation Equipment	Management of People
8 Safety of Users	**19 Means of Egress**
Hazardous Materials	Means of Egress
Hazards from Building Materials	**20 Emergency Notification, Access and Facilities**
Prevention of Falls	Emergency Notification, Access and Facilities
Construction and Demolition Hazard	**21 Emergency Responder Safety**
Signs	Emergency Responder Safety
Emergency Notification	**22 Hazardous Materials**
9 Moisture	Hazardous Materials
Surface Water	**Part IV - Appendices**
External Moisture	Appendix A Risk Factors of Occupancies and Use Groups
Internal Moisture	Appendix B Worksheet For Assigning Specific Structures To Performance Groups
	Appendix C Individually Substantiated Design Method
	Appendix D Qualification Characteristics for Design and Review of Performance-based Designs
	Appendix E Use Of Computer Models

Appendix H

Focus Group Details

<u>Focus Group Details</u>

The Gulf Knowledge Economy (2009) First Forum for Unified Building Codes in The Gulf. Kuwait

1. Key Points

The key points of the form were:

- The importance of the building codes
- The experiences of Kuwait building, energy and fire code; Saudi Building Code Project, and Arabic Code
- Current problems and obstacles to develop and implement codes in Kuwait
- The approach to develop and implement codes in Kuwait

2. Forum Introduction

- All the Arabian countries experiences are failed to develop or apply building codes due to the fact improper building code framework.
- In 1977, Authority of Industry established Standard Unified Committee. In 2005, the Committee approved **standard specification for Reinforce Concrete**. This specification is not mandatory. The Kuwaiti Chapter for American Concrete Institute tried to make this specification as a code, and enforced by the law but without success.

3. Inappropriate Building Codes in Kuwait

Most the building codes of the US, UK, Canada, Europe, and Australia are been tried and tested based on scientifically for sufficient time, and applied by many building officials, and construction professionals from different countries. However, some parts of these codes in particular the codes applied in countries where the weather is relatively cold are not suitable for Saudi Arabia and Arabian Gulf region where the weather is extremely hot and humid in particular in summer where the temperature reaches 50 centigrade. The soil conditions are another aspect need to amend these codes to adapt Saudi Arabia status.

4. Problems of Building Codes in Kuwait

- **Inappropriate other Countries codes implemented in Gulf countries which led deterioration of Concrete Structure**

It was found the European codes are not suitable for Saudi Arabia and Gulf environment. The concrete structures are been effected badly with deterioration of concrete due to the high humidity, high sulfide soil, and other factors.

- **Paints and Stucco Materials**

Some of the codes for Paints and Stucco Materials are not suitable for Saudi Arabia and Gulf environment. Paints specified for cold countries, are damages very fast, and not giving its proper service life.

- **Earthquakes Requirements**

The most important cause which initiates the Saudi building project is the problems of earthquakes. The Dead Sea Earthquake which affect the northern side of Saudi Arabia and effect severally many structures in particular huge military insulation that led the Saudi Government to think seriously to have its own codes. Most of the objectives of building codes project are dealing to develop earthquake codes.

5. Obstacles to Develop and Enforce Building Codes for Kuwait:

- There are no support from the leading government politically, and financially
- Lack of powerful administrative government to enforce building regulations; "The codes need Claws and nails".
- Some officials and businessmen have the intent and the well to avoid and not obey or follow rules
- The misunderstanding and false impression of the definition of codes
- The negative political status which affects the enforcement of building regulations up and down
- Poor enforcement of building regulations in particular after granting certificate of occupancy which led to many violations especially with the equipment of fire protection, by removing these equipment or poor maintenance of the support mechanical and electrical systems which lead failures of fire protection system.

- There is conflict and incorporation in issuing the licenses among Ministry of Trade and Municipality.
- There are many participating organizations in administration of building process.
- There are poor management at the relevant government institutions in the Building Regulations of the Municipality and other.
- There are weak technical and financial capabilities at Municipality branches at governorates.
- There are weak reimbursements for workers at Municipality.
- There are weak legal departments at Municipality branches at governorates.
- Incorporation of government organizations with Municipality by letting Kuwait Municipality to be responsible of direct communication with citizens
- Many participating organizations in administration of building process
- Weak legal departments at Municipality branches at governorates
- Weak reimbursements for workers at Municipality
- Weak technical and financial capabilities at Municipality branches at governorates
- Absence of society awareness and participation by community in regulation process
- Delay of issuing and enforcing legal court rules based on violation cases
- Low monetary value of penalty by Municipality law (max. 500 k.d. = 1000 £)
- No deterrent punishments for violators
- Weak power of law in enforcing correction decisions of violations
- Ineffective engineering supervision and inspection tasks to prevent violations or cheatings
- Kuwait laws have no clear objectives of BC.
- There is misunderstanding and ambiguity towards the definition of codes.
- The codes are misunderstood as standards, and specification of work procedure to execute the tasks.
- The specifications are usually included in the construction contracts.
- Any violation in specification is prosecuted by penalties articles in the contract.

- There is no group of believers to support the building codes in Kuwait
- Insufficient professional community
- There is **misunderstanding facts for the subject of building codes** in Arabian Gulf region. The codes are not standards, and not specification of work procedure to execute tasks. The specifications are usually included in the construction contracts. Any violation in specification is prosecuted by penalties articles in the contract.
- Many construction firms and professionals from the different six contents are been practice in many projects in Saudi Arabia and Arabian Gulf region. Many engineers obtain their education in Western Countries in particular The US, and the UK universities. Therefore, many engineers in Arabian Gulf region are graduated for universities in the US, that led these engineers to be loyal, and accommodate **for particular codes, standards, and specifications which are the one developed in the US.**
- The **inexistence of the infrastructure of construction standards** is the main problems for Arabian Gulf, and other Arabic countries to develop its unique code. The codes are usually developed based on standards which are usually referenced in the end of each code. These standards are developed based in particular soil and climate environment for particular rejoin in the world.

6. Solutions

- There are two schools or methodologies in how to run, sponsor and support to initiate in building codes project in Country. In the European countries usually government support and administer these projects, while in the US, the government gives the chance for non profit engineering and technical communities to hold this responsibility. One of the solutions in how to find **sponsor and initiate building codes project in Kuwait** is the use of the method of codes and engineering non profit societies in the US. These non profit societies are supported legally, politically, and financially by Federal government. The most factor initiate the codes project in Saudi Arabia is the support of the government and financing the project. Therefore, without the political and financial support from the government, it hard to set up building codes for a country in Arabian Gulf region.

- The code should be **written as legal document**. There is need for experts in law writing to develop the codes.

Appendix I

Calculations of Severity Indices

Part One:

Severity Indices are calculated using the following equation:

$$S.I. = \frac{\left(\sum_{i=1}^{i=n} w_i * f_i\right)}{n} * 100\%$$

Where:
S.I. = severity index
f_i = frequency of responses
w_i = weight of each rating
S.I. = total number of responses

The above equation is divided into two parts:

w_i, this the weight assigned to each rating in the ordinal scale and is calculated by:

w_i = (Rating in scale) / (Number of points in a scale)

w_1 = 1 / 5 = 0.20
w_2 = 2 / 5 = 0.40
w_3 = 3 / 5 = 0.60
w_4 = 4 / 5 = 0.80
w_5 = 5 / 5 = 1

Part Two: Example

An example for the calculations of the severity index is given below:

For cause or impact fator:

SPSS Data (frequency of responses)	
Strongly disagree	19.00
Disagree	10.00
Neither / Nor	15.00
Agree	14.00
Strongly agree	15.00
n	73.00

Excel Formula:

$\boxed{\text{severity index} = ((19*0.2+10*0.4+15*0.6+14*0.8+15*1)/73)*100 = 58.90\ \%}$