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INVESTIGATING THE STRUCTURAL CONCRETE DESIGN PROFESSION IN GAZA STRIP

دراسة مهنة التصميم الإنشائي الخرساني في قطاع غزة

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بسم الله الرحمن الرحيم

"يرفع الله الذين امنوا منكم و الذين أوتوا العلم درجات و الله بما تعملون خبير"

صدق الله العظيم

Dedication

This work is dedicated to my parents and brothers for their endless support

Mohammad Abed Akrime Abu Aqleen

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- I would like to express my deepest appreciation to my supervisor Dr. Samir Shihada For his valuable contributions, encouragement, professional support and guidance.
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Abstract

Engineers work in public and private sectors after graduation. Promotion in their ranks and professional responsibilities is not subject to achievement of accredited qualifications. Engineers are not distinguished from their colleagues in the same specialty on the basis of skills and knowledge gained during their professional career. Since the engineering profession requires a high level of skills, engineers need to undergo special training programs and subjected to professional evaluations. These evaluations escalate in their requirements according to an engineer’s professional advancement and experience gained. As engineers gain more experience in a specific engineering specialty, they become experts in that specific field. The practice of structural engineering has a unique significant role relative to other design disciplines. Architectural, mechanical, and electrical system failures usually result in unattractiveness, poor functionality, discomfort, and/or inconvenience. A structural system failure almost always has more serious consequences; even in the best cases, there are often substantial costs associated with correcting what is or could become a life-threatening situation. This particular the study aims at assessing the current professional situation of "Structural Design Engineers" and "Design Reviewers" in Gaza strip, and identifying the role of related parties, and perusing international expertise in the qualification fields in order to devise a suitable systematic national qualification procedure, in addition to comparing the review process required for approving structural design documents in Gaza Strip case with those adopted in other countries.

It is expected that this study will contribute to generate a national professional engineering base in the field structural design. It is also anticipated that it would result in the establishment of national training and qualifying facilities to meet qualification requirements. It will also lead to upgrade structural design engineers' and structural reviewers' skills who work in the municipalities and Engineering Association auditing committees.

The results indicated that most of engineers who work in structural design filed suppose the following: There is an impact of university study on the structural concrete designer, the necessary of training and development policies availability for the structural concrete designer in the field of structural design, specifying and restricting educational and practical qualifications to practice the profession of structural designer. Also the

results indicated in regarding to evaluation of structural design auditing process in Gaza Strip that: One structural design reviewer in the auditing committee to review the structural plans is insufficient, specifying educational and practical qualifications to practice the profession of structural design reviewer, The importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer.

This study recommends conducting statistical information on the structural designer engineers in Palestine (numbers, ages, experience, skills, etc…..), setting qualification requirements for structural designers' engineers based on the prevailing condition in Gaza strip, examining the adequacy of ACI code for local situation, and conduct training and education programs to the structural designer engineers to improve their skills in the field of structural design, conducting training and education programs for structural designer engineers' to improve their skills.

ملخص البحث

يعمل المهندسون بعد تخرجهم في القطاعين العام والخاص، وحين يتدرجون في مسئولياتهم العملية فإن ذلك لا يخضع لمستويات تأهلية محددة، وفقاً لما يكتسبه المهندس في حياته العملية من مهارة ومعرفة بمهنته بحيث يتميز مستوى أداءه عن من سواه من الآخرين في نفس تخصصه، خاصة وأن المهن الهندسية تعتبر من المهن التي تحتاج إلى مهارة في أدائها مما يدعو إلى الانخراط في برامج تدريبية متخصصة وبالتالي إخضاع المهندس الممارس للمهنة إلى اختبارات مهنية تتدرج وفقاً لنضوجه المهني ومدى تطوره مع تقدم سنوات خبرته، وبالتالي تخصصه في مجال من مجالات الهندسة حتى يصبح خبيراً فيها، وفي الكثير من دول العالم يوجد سلم تأهيلي مهني للمهندسين استطاعت من خلاله هذه الدول تحقيق تنمية بشرية في المجالات الهندسية المختلفة حققت بها تقدماً علمياً وتقنياً، أسهمت إسهاماً واضحاً في التنمية والتميز في المجال الهندسي. تعتبر مهنة التصميم الإنشائي الخرساني أحد تلك المهن الهندسية التي تحتاج إلى مهارة في أدائه حيث أن ممارسة مهنة التصميم الإنشائي الخرساني يختلف كليا عن ممارسة أي مهنة هندسية أخري مثل الهندسة المعمارية، والهندسة الميكانيكية ، والهندسة الكهربائية و ذلك لأن المصمم الإنشائي الخرساني يقوم بتصميم النظام الإنشائي الأساسي لأي منشأ خرساني و في حالة حدوث خطأ في عملية التصميم الإنشائي ينجم عنه انهيار النظام الإنشائي الأساسي للمنشأ مما يؤدي إلي خسارة فادحة في الممتلكات والأرواح لا تقدر بثمن و هنا تكمن خطورة هذه المهنة مقارنة بالمهن الأخرى سواء أكانت هندسية أو غير ذلك، لأن المصمم الإنشائي الخرساني خطأه يؤدي إلي خسارة العديد من الأرواح. و من منطلق أهمية مهنة التصميم الإنشائي الخرساني فإن هذه الدراسة هدفت لتقييم الوضع المهني الراهن لمهنة التصميم الإنشائي الخرساني و مهنة التدقيق الإنشائي في قطاع غزة وتحديد الدور الذي تقوم به الجهات ذات العلاقة والوقوف على التجارب العالمية في مجال التأهيل وبرامج التدريب للمصمم الإنشائي الخرساني، بالإضافة إلي مقارنة عملية التدقيق الإنشائي للمخططات الإنشائية المتبعة في قطاع غزة مع تلك المتبعة في دول أخري و يتوقع أن تساهم هذه الدراسة في إيجاد قاعدة مهنية هندسية تساهم في تطوير مهنة التصميم الإنشائي الخرساني و مهنة التدقيق الإنشائي في قطاع غزة.

نتائج البحث أشارت إلي أن غالبية المهندسين الذين يعملون في مجال التصميم الإنشائي يرون التالي: أن هناك تأثير للدراسة الجامعية على المصمم الإنشائي الخرساني، و ضرورة وجود برامج تدريبية للمصمم الإنشائي في مجال التصميم الإنشائي، وتحديد وتقييد المؤهلات العلمية و العملية المطلوبة لممارسة مهنة التصميم الإنشائي يسهم في تطوير مهنة التصميم الإنشائي في قطاع غزة. و كذلك النتائج أشارت فيما يخص تقييم عملية مراجعة وتدقيق المخططات الإنشائية في قطاع غزة أن وجود مدقق واحد في لجنة التدقيق لمراجعة المخططات الإنشائية في نقابة المهندسين غير كافي، و ضرورة وضع معايير تحدد مؤهلات المدقق الإنشائي العلمية والعملية ، و أهمية تقديم مذكره حسابية للتدقيق توضح الكود التصميمي المستخدم و نظرية التصميم من قبل المصمم الإنشائي.

الدراسة توصي بعمل إحصائية شاملة عن المصممين الإنشائيين بفلسطين، وتحديد المؤهلات العلمية و العملية لممارسة مهنة التصميم و التدقيق الإنشائي تلاءم الظروف السائدة في قطاع غزة، و إقامة دورات تدريبه لمصمم الإنشائي الخرساني لتطوير مهاراته في مجال التصميم الإنشائي الخرساني،و اختبار مدي ملائمة الكود التصميم الأمريكي للتطبيق في قطاع غزة بناء علي الدراسة فإنه الأكثر استخداما وشيوعا بين المصممين الإنشائيين الذين يعملون في القطاع.

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List of Abbreviations

FE	Fundamentals of Engineering
EIT	Engineer-In-Training
EI	Engineer Intern
P.E.	Professional Engineer
S.E.	Structural engineering
NCEES	The National Council of Examiners in Engineering and Surveying
EC	Engineering Council
UK	United Kingdom
CPD	Continuing Professional Development
BC	British Columbia
APEGBC	Association of Professional Engineers and Geoscientist of BC
IStructE	The Institution of Structural Engineers
E.E.A	Egyptian Engineering Association
CSA	Canadian Structural Association
UBC	Uniform Building Code
IBC	International Building Code
ASCE	American Society of Civil Engineer
ACI	The American Concrete Institute
BS	British Standard
SWS	Shear Wall System
MRFS	Moment Resisting Frame System
COS	Combined System
SAP	Structural Analysis Program
ETABS	Extended Tall Building Analysis System
SAFE	Structural Analysis by Finite Element

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Chapter 1

Introduction

1.1 Introduction

The construction sector in Gaza strip is one of the key economic sectors and is the main face motivating the Palestinian National Authority economy.

Upon establishment of the Palestinian National Authority and assuming its powers over Palestinian territories in 1994, the construction sector has witnessed noticeable expansional activities. So, it is necessary to heed this sector in Gaza strip by studying the main factors affecting it.

There are three main aspects that directly contribute to excellence in construction of any structure; namely the design process of the structure, construction in the field and finally materials technology.

This research will mainly focus on investigating the professional structural design engineer's tasks, their qualifications, in addition to qualifications of structural design review engineers.

Design process is the basic task of structural engineering, which is relating numerical quantities of physical forces to physical configuration of force resisting elements.

Structural engineering is concerned with structural analysis and design of buildings, bridges and other structures. This involves calculating the stresses and forces that act upon or arise within a structure, and designing the structure to successfully resist these forces and stresses. Resistance to wind and seismic loadings, especially performance near resonant frequencies which affect the overall stability of structure. Other design concerns such as durability and cost are also considered.

In addition to design of new buildings, structural engineers may design seismic retrofit for an existing structure to mitigate undesirable performance during earthquakes occurrence.

Before becoming a practicing engineer, civil engineers generally complete college or higher educational requirements followed by several years of practical experience.

In most countries around the world, there is no one typical career path for structural professional engineers. Most engineering graduates start with jobs of low responsibilities and as they prove their competence, they are given more and more responsibility tasks, but within each subfield of civil engineering, and even within different segments of markets within each branch, the details of career can vary.

Professional engineer is the term used for registered or licensed engineers in some countries, including the United States and Canada.

In other words, a structural professional engineer is the person having specific qualifications and experience in the field of structural engineering and is duly registered with competent statutory or local authority. Structural professional engineer is not only a person who can carry out the design process only, but also the person who can carry out the design review process of structural documents for any structural project as a member of review committee for the local authorities such as the Associations of Engineering and municipalities.

Becoming a member of review committee for the local authorities is not an easy thing. Structural professional engineers must first meet special qualifications according to the countries they are working in. The purpose of reviewing structural documents is to enhance public safety. It provides also an independent overview of the primary structural system by reviewing structural design concepts and structural system integrity. The design review can be undertaken once the structural plans and supporting documents are complete to get them approved by local authorities.

The titles "Structural Design Engineer" and "Design Reviewer" are not legally protected in Gaza strip. This encourages a lot of unqualified structural design engineers to perform structural analysis and design for many structures. Consequently, and in large number of cases, results in uneconomical design on one extreme and insufficient design on the other, especially when the designs are checked up by poorly-oriented design reviewers.

1.2 Research problem

1. There are no specific procedures and requirements for registration and regulation of professional engineers in Gaza strip. Thus, any civil engineer can carry out structural design of any magnitude leading, in large number of cases, to uneconomical designs on one extreme or insufficient designs on the other.
2. Training needs are to be stated for structural engineers to cope with the new design codes, especially engineers who graduated before long periods of time.
3. Lack of experience of design reviewers in a large number of observed cases.
4. Assigning one structural engineer to carry out the whole reviewing process of structural documents, in spite of different design codes used by the structural designers, due to unavailability of national design code.

1.3 Research Objectives

1. Investigating the qualification requirements for structural concrete engineers based on the prevailing conditions in Gaza strip, and the experience gained by reputable institutions in the developed countries.
2. To Identify, suitable qualification requirements for structural concrete engineers working as design reviewers.
3. Comparing the review process required for approving structural design documents in Gaza Strip case with those adopted in other countries.
4. Recommending a solid design code to control the design and construction of reinforced concrete projects in Gaza strip.
5. Specifying training needs for structural concrete engineers in Gaza strip to cope with change in design codes/ standards, and to be on the top of their field.
6. Proposing a mechanism for implementing the outcome of the research.

Chapter 2
Literature Review

2.1 The structural design process

In structural engineering, structural design is an iterative process of applying engineering mechanics and past experience to create a functional, economic, and, most importantly, safe structures for the public to enjoy. Using structural analysis techniques and conforming to design specifications, the design engineer works to create a solution that is to everyone's benefit. Structural design as a process has evolved to its modern refinement through hard lessons learned from various structural failures. Structures are divided into two major categories, viz reinforced concrete structures, and steel frame structures. Structural design is an expression of an understanding of the flow of forces. The flow of forces is initially understood diagrammatically and mathematically. Based on this scientific understanding, sketches of members and connections are developed. Structural design which is highly expressive of the flow of forces is also associated with modern architectural design. Structural design includes accommodation for the practicalities of construction, including on site assembly, shop assembled components, accessibility, and maintenance. In its broadest sense, design is defined as the act of creating ideas for useful things. In structural engineering, these useful things are generally bridges, buildings, and other structures. Engineers generally regard the act of designing as a process; this can be broken down into the following four component activities [1]:

1. Definition of what the structure is required to do, often referred to as "design criteria".
2. Creation of a new idea for the structure, often called a "design concept".
3. Validation of the design concept, i.e., demonstration that it can satisfy the design criteria.
4. Refinement of the design concept, i.e., producing a description of the design that is biddable and buildable.

2.1.1 Definition

A complete set of design criteria includes requirements related to:

- Safety
- Function, and
- Cost

As well as requirements related to:

- Society
- The environment, and
- Culture

Definition of design criteria is primarily an exercise in gathering and organizing facts. With regard to safety, function, and cost, this activity can be relatively straightforward. On a bridge design project, for example, defining design criteria could be a simple as defining the geographic features to be crossed, highway alignment, and an applicable design standard. In general, however, design criteria are complex, in response to demands from owners and users for projects that address important environmental, social, and cultural concerns. In many cases, criteria related to these issues cannot realistically be expressed in quantitative terms.

2.1.2 Creation

Creation of design concepts is, as its name implies, a creative activity. What distinguishes engineering design from creative activities in other fields is that scientific principles figure prominently in the body of existing ideas that is brought to bear in the creative process. Whatever the field, the creative process is a highly individual activity. All other things being equal, the quality of a given design concept depends on both the quality of the conceptual raw material that is used in the creative process (the body of existing ideas that is readily available to designers), as well as the quality of thinking that is used by designers in the generation of new ideas from this raw material [1].

2.1.3 Validation

At some point in the design process, designers must convince themselves and their clients that the design satisfies the design criteria. In most cases, it is also necessary to show that the proposed concept is in some sense better than other potential solutions.

Given the cost, size, and complexity of civil engineering projects, it is not feasible to demonstrate this using the finished product after construction, or even using a fully refined design. Rather, the “goodness” of a given concept must be established while the concept is still in a relatively preliminary state. This is the primary purpose of the third activity, stated before. Validating a rough concept is a complex and challenging task, not only because the definitions of the design is incomplete, but also because important criteria often cannot be adequately dealt with in quantitative terms, or are in conflict with each other. In such cases, particularly when social or aesthetic impacts are involved, engineers tend to defer to owners or users [1]. The history of civil engineering clearly shows, however, that such an approach often produces average results, and that better solutions are often produced by engineers who have developed a strong sense of what makes a design “good” [2].

2.1.4 Refinement

Contractors require a description of a given design that is sufficiently detailed to allow them to bid it and build it. The effort required to transform a valid design concept into a final design is considerable. It is, however, a relatively straightforward activity. Refinement of concepts generally involves analysis and dimensioning of components, neither of which places high demands on creativity [1].

Refinement is nevertheless important. Putting insufficient reinforcement into a concrete beam, for example, can lead to its collapse. Fundamentally, though, it is less important than activities 1 through 3, in the sense that if a valid design concept does not exist, refinement alone cannot generate it. If a concept exists but is fundamentally flawed, no amount of refinement can rescue it [2].

2.2 Structural engineering

Is the science and art of designing and making, with economy and elegance, buildings, bridges, frameworks, and other similar structures so that they can safely resist the forces to which they may be subjected. A structural engineer is accordingly a person who practices structural engineering. His work as such may include [1]:

- Design (initiating ideas, feasibility analysis, technical supervision, safety of finished structures, converting an architect's visions into functional reality and the like).
- Management of projects, personnel, finances, materials and production.

- Construction.
- Maintenance, and ultimately demolition.
- Risk assessment for public protection, defining and maintaining safety standards and the carrying out of structural integrity assessments.
- Acting in a "watchdog" role by ensuring compliance with National Building Regulations, planning and safety legislation.
- Research and teaching

Structural engineers are responsible for applying engineering principles to ensure that loss of life and damage to property during the lifetime of a structure due to the instability or lack of strength, serviceability or durability of a structure or part thereof is within acceptable and legal limits. Structural engineers need to provide safe and effective solutions with a high degree of certainty to demanding structural requirements where the constraints are often complex and sometimes conflicting.

The tasks associated with structural engineering vary in complexity. Accordingly different skills are required for different tasks [2].

2.3 Registration and Regulation of Professional Structural Engineers

In this section, registration and regulation of professional structural engineers in different countries will be summarized.

2.3.1 In the United States

In the United States, registration or licensure of structural designer Professional Engineers is performed by the individual states. Each registration or license is valid only in the state in which it is granted. Many structural designer Professional Engineers maintain licenses in several states for this reason, and comity between states can make it easy to obtain a license in one state based on licensure in another state without going through the full application process.[3] The licensing procedure varies but the general process is outlined as follows, see figure (2.1): [4]

1. Graduate with a degree from an accredited four-year university program in engineering.

2. Complete a standard Fundamentals of Engineering (FE) written examination, which tests applicants on breadth of understanding of basic engineering principles, and optionally some elements of an engineering specialty. Completion of the first two steps typically qualifies for certification in the U.S. as an Engineer-In-Training (EIT), sometimes also called an Engineer Intern (EI) [5].
3. Accumulate a certain amount of engineering experience under the supervision of a Professional Engineer (P.E). In most states the requirement is four years, but in others the requirement is lower.
4. Complete a written Principles and Practice in Engineering (P.E) examination, testing the applicant's knowledge and skills in a chosen engineering discipline (mechanical, electrical, civil, for example), as well as engineering ethics.

There is a fairly large range in exam pass rates for these exams (FE and PE), but the pass rate for repeat test takers is significantly lower.[3] In a few states it is still possible for an individual to bypass Step 1, and apply to take the registration examinations as long as a P.E. will sponsor the applicant, and work experience can be substituted for academic experience. The years of experience may also vary; for instance, in California it is possible to take a Principles and Practice in Engineering examination with only two years of experience after a bachelor's degree, or one year of experience after graduate school. In Nevada, college graduates are eligible to take the Principles and Practice exam immediately after graduation and passing the EIT, before acquiring the required experience. [4]

Recognizing this, ten states currently have specific provisions in place that distinguish structural engineers from professional engineers in other disciplines: California, Hawaii, Idaho, Illinois, Nebraska, Nevada, New Mexico, Oregon, Utah, and Washington. However, there is considerable variation among these jurisdictions in the qualifications that are required for structural engineering (S.E.) licensure [5]:

- Idaho, New Mexico, and Washington require at least two years of structural engineering experience for S.E. licensure, over and above the experience required for P.E. licensure. California requires three additional years.
- California, Oregon (beginning in October 2005), and Washington each require the National Council of Examiners in Engineering and Surveying (NCEES)

Structural II examination and a state-specific Structural III examination for S.E. licensure, in addition to any examination passed for P.E. licensure.

- Idaho and Nevada require the NCEES Structural I and Structural II examinations for S.E. licensure, in addition to the NCEES Civil examination that is required for P.E. licensure.
- All others require only the NCEES Structural I and Structural II examinations for S.E. licensure, except that New Mexico does not require any examinations for those who have four years of structural engineering experience after P.E. licensure in that state.

The above mentioned requirements are summarized in Figure (2.1)

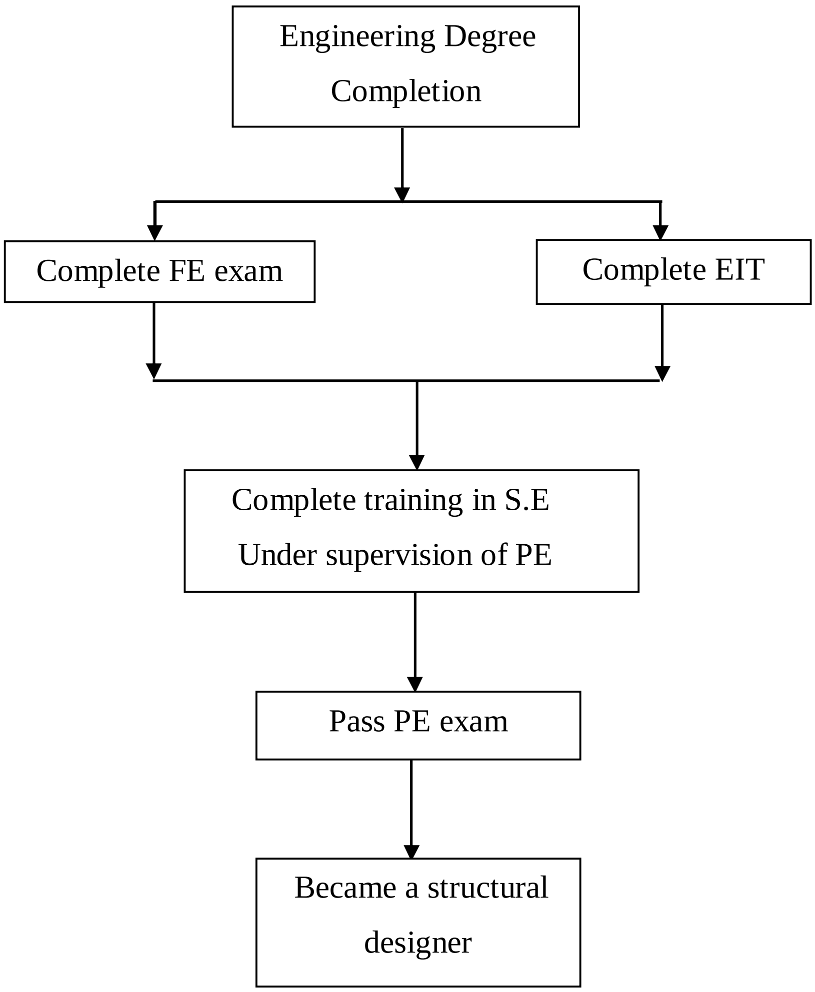

Figure (2.1) The licensing procedure flowchart to became structural designer in U.S. [4]

2.3.2 In the United Kingdom

There is no formal legal requirement within the UK for an engineer of any discipline to register to practice (except for engineering technicians working on aircraft engines, and a small panel of qualified dam engineers). There is, however, a general 'preference' within the engineering community for all engineers to be on the register of the EC of UK. Nevertheless, with or without this registration, anyone can call himself an engineer [6].

Within structural engineering, where there is a key responsibility for public safety, Chartered (i.e. professional) Structural Engineers are qualified properly through the Institution of structural engineers' membership procedures, and maintain their competence by submitting annual Continuing Professional Development (CPD) returns. This initial qualification plus annual maintenance of the competence leads on to the ability to be on a register for the professional design of structures, either under the government's highway regulations, or the government's building regulations [7].

Structural engineering can be performed at a number of levels. In the United Kingdom's, it would be inappropriate to require all structural engineers to demonstrate their competency at the highest level of structural engineering. It is accordingly necessary to look at two levels of structural engineering. It should be noted in this regard that the Institution of Structural Engineers is licensed by the United Kingdom's Engineering Council to determine whether or not persons are eligible for registration with the Council as Chartered Structural or Incorporated Structural Engineers. Candidates for Chartered Structural Engineers must demonstrate an ability to evaluate and develop effective solutions to structural design problems that are safe and fulfill their intended functions and be able to communicate design intentions. Candidates for Incorporated Structural Engineers must, on the other hand, demonstrate an ability to interpret instructions into practical structural designs and details. An examination of the differences in the institution's examinations between corporate membership (Chartered Structural Engineer) and associate membership (Incorporated Structural Engineer) indicate that the fundamental differences between these two types of engineers can be summarized in Table (2.1) as follows:

Table (2.1) Fundamental differences between Chartered and Incorporated Structural Engineer [8].

Description	Chartered Structural Engineer	Incorporated Structural Engineer
Understanding of structural engineering principles.	Understands core principles.	Understands fundamental principles.
Use of technology	Is able to locate and use new research and development to benefit their work.	Is able to apply appropriate technology in their work.
Problem solving	Is able to solve complex (unconventional) structural engineering problems.	Is able to solve common (conventional) engineering problems.

The competencies required for Incorporated Structural Engineers are the same as that for Chartered Structural Engineers, except that competencies are assessed at a lower level. The Joint Structural Division is of the view that demonstration of competencies in respect of the abovementioned unit standards could permit engineers to demonstrate their competencies as Structural Engineers and Structural Engineering Technologists, which would be indicative of having the ability to independently design the following structures in areas not subject to seismic activity can be summarized in Table (2.2) as follows:

Table (2.2) competencies in respect of the abovementioned unit standards could permit engineers to demonstrate their competencies as Structural Engineers [8].

DESIGNATION	TYPE OF STRUCTURES WHICH MAY BE DESIGNED	LIMITATIONS PLACED ON SPECIFIED ELEMENTS
Structural Engineer	All types of structures including residential, institutional, commercial and industrial buildings, towers, bridges, culverts and mining and containment structures	Nil
Structural Engineering Technologist	One family a house which may be separated or linked horizontally but not linked vertically and has its own access and do not share any common space.	Span of floor slab $\leq$ 7m. All structural elements fall within the scope of B.S codes of practices.

Contd. Table (2.2) competencies in respect of the abovementioned unit standards could permit engineers to demonstrate their competencies as Structural Engineers [8].

DESIGNATION	TYPE OF STRUCTURES WHICH MAY BE DESIGNED	LIMITATIONS PLACED ON SPECIFIED ELEMENTS
	Residential buildings not exceeding 2 stories in height.	Span of floor slab ≤ 7m. Storey height ≤ 6m. All structural elements fall within the scope of B.S codes of practices.
	Retail premises, commercial and institutional buildings not exceeding 2 stories	Span of floor slab ≤ 7m. Storey height ≤ 6m. Steel roof span ≤ 25m Timber roof span ≤ 10m All structural elements fall within the scope of national or JSD codes of practices.
	Commercial, agricultural and institutional storage facilities and warehousing not exceeding one storey.	Cranes which are frequently subjected to the safe working load and are normally subjected to loads which are relatively close to the safe working load. Storey height ≤ 6m. Steel roof span ≤ 25m Timber roof span ≤ 10m All structural elements fall within the scope of national codes of practices.
	Reinforced concrete framed buildings, irrespective of occupancy, not exceeding 5 stories	Span of floor slab ≤ 7m. Storey height ≤ 6m. Steel roof span ≤ 25m Timber roof span ≤ 10m All structural elements fall within the scope of national codes of practices.
	Freestanding and retaining walls	Walls falling within the scope of national codes of practices.

Notes: Span is the horizontal distance between the face of supports.

Storey height is the vertical distance between upper surface of a floor slab / surface bed and the underside of a floor / eaves beam/ roof truss / purlin beam

2.3.3 In Canada

In Canada, regulation and registration are accomplished through a self governing body that is given the power to register and discipline engineers as well as regulate the field of engineering in their province, such as Professional Engineers of Ontario. Many of these associations are also responsible for regulating other related professions. A candidate for Structural Engineer must [9]:

1. Be registered as a professional engineer in BC.
2. Demonstrate six years of significant post graduation structural engineering experience, including two years in responsible charge of significant engineering work.
3. Nominate four referees who must complete the Designated Structural Engineer reference form and submit it directly to APEGBC. Candidates will send the reference forms to each referee, with a copy of the account of their experience. Referees should be registered or licensed professional engineers or chartered engineers practicing in the field of structural engineering and should have a detailed knowledge of the applicant’s work. Normally, at least one of the referees should not be employed in the same firm as the candidate.
4. Demonstrate a commitment to continuing professional development.
5. Have completed one of the following requirements:
    a. Successfully complete the Interim Oral Examination.
    b. Be eligible for license, having passed examination as a Structural Engineer in an approved U.S. jurisdiction (S.E.) license holders who have completed the Structural II and Structural III examinations in other U.S. jurisdictions will also be considered); or
    c. Have successfully completed the Washington State Structural III examination; or
    d. Have successfully completed the IStructE Chartered Membership examination.
6. Successfully complete the BC Codes and Practices Examination.
7. Pay all associated fees and dues.

2.3.3.1 The Process: detailed flowchart, timing, order of examinations

Depending on each candidate's background, the process of qualifying for structural engineer can take up to one year or more to complete. This is dependent on the volume of applications, timing of each individual application relative to the examination schedules, and timely and correct submissions by referees and candidates. Please note that the examinations can be taken in any order, to accommodate candidates who wish to complete the process in as short a time as possible, as shown in Figure (2.2) [9].

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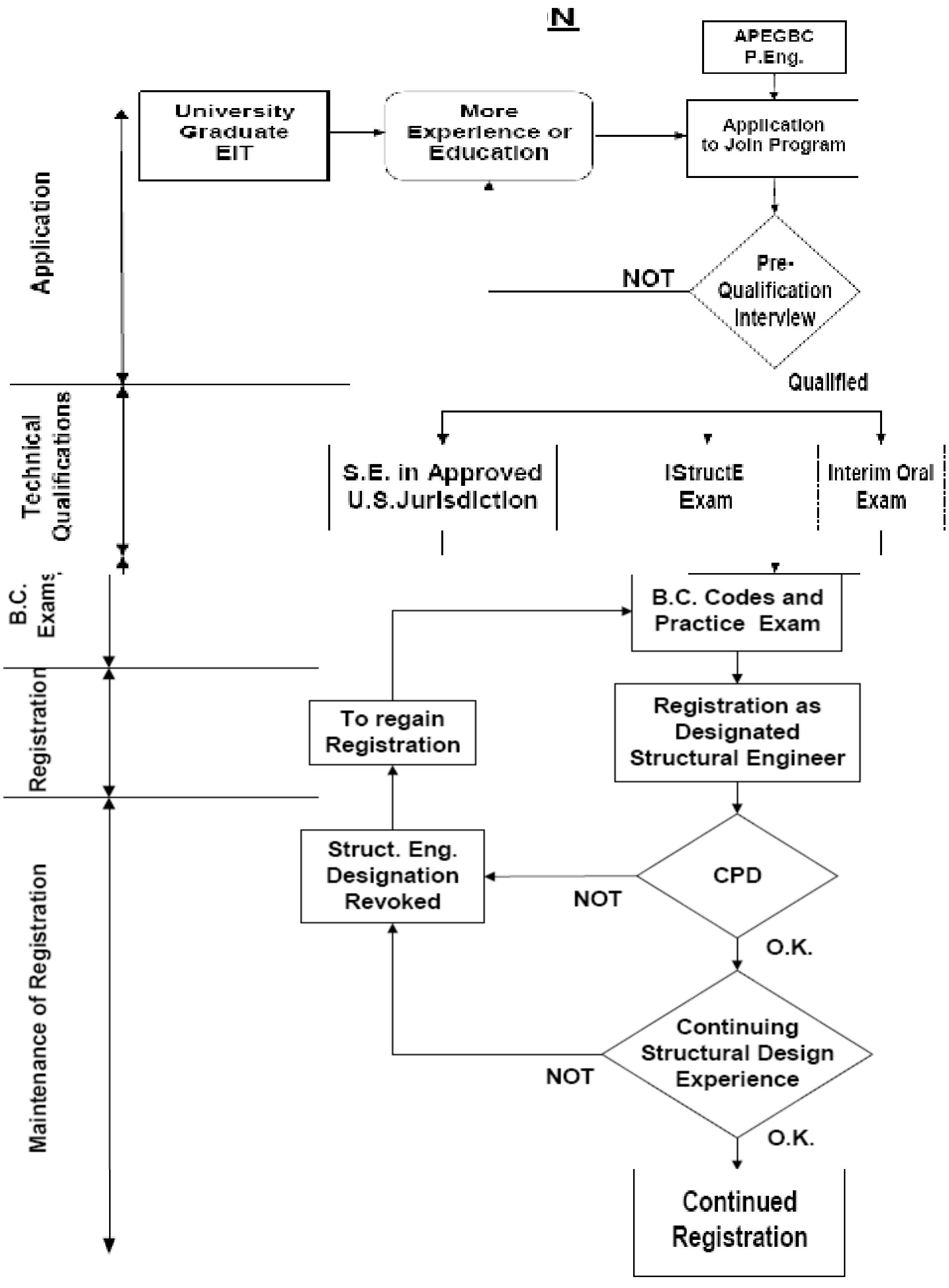

Figure (2.2) Structural Engineer qualification process flowchart in Canada [9].

2.3.4 In Egypt

In Egypt, regulation and registration are accomplished through a self governing body, that is given the power to register and discipline engineers as well as regulate the field of engineering in their province, and engineers are not allowed to work in other fields.

Also, it is against the law to practice the structural design engineering work without permission from the E.E.A. The recently graduated engineers start their engineering work in the engineering association according to an accredited division during their training period. Throughout this time the engineers are overseen by specialist category engineers. The registration process in Egypt is different than other developed countries where the structural engineers pass four categories in promotion as followed [10]:

- The Structural Engineer Category.
- The Structural Practicing Engineer Category.
- The Structural Specialist Engineer Category.
- The Structural Consultant Engineer Category.

The whole process of qualification of structural designer engineers in Egypt is clearly illustrated in Figure (2.3).

2.3.4.1 The structural engineer category [10]

- The structural engineer is the one who is registered by the engineering association after his graduation immediately.
- He is not allowed to practice the structural engineering works or take technical decision on his responsibility without completing an Engineer in Training program under the direction of structural practice engineer category (This is normally a two-year program).
- The structural engineer should pass a practical exam in structural design accredited from the E.E.A then he is promoted to structural practicing engineer category

2.3.4.2 The structural practicing engineer category [10]

- This category is granted to the structural engineer who completes his training according to the E.E.A regulations and passes the accredited engineering council exam besides having a promoting decision to this category.
- He continues practicing this avocation during this category for not less than five years, so as to be assured that he participated in projects and engineering works which qualified him to be promoted as a specialist engineer category.

2.3.4.3 The fundamentals of getting over the structural engineer category to be a structural practicing engineer category

- The engineer should apply to E.E.A with all documents which showing all the engineering works and projects in structural design field of the pervious two years that are signed off by his mentor.
- The special committee studies his application and accomplished data according to the province of regulations with an execution of the accredited exam from association council, to finish the wanted studying of this application, and gives its recommendation within two month from the exam execution.
- The association council studies the application and the special committee recommendation within one month since the remittance date. The association council has the right to accept or reject the application with justification.

2.3.4.4 The structural specialist engineer category [11]

- This category is granted to the engineer who spends at least five years period in the structural practicing engineer category after getting over the E.E.A council provisions that issues a decision from association council to be promoted as specialist engineer category.
- The structural specialist engineer category is considered as the third category where engineer starts his complete efforts of this avocation.
- He continues practicing the avocation in this category for not less than eight years, so as to be assured that he participated in projects and engineering works which qualified him to promote as a specialist engineer.

2.3.4.5 The fundamentals of getting over the structural practice engineer category to be a structural specialist engineer category

- After engagement as structural practice engineer actually for at least five years period, he applies a written application to the engineering association with special promotion forum that showing in details the most important technical engineering tasks which he already implanted.
- Special committee studies his application and accomplished data with execution an interview for applicant, after finishing of studying his application the committee gives it's recommendation within two month from the interview execution.
- The E.E.A council studies the application and the special committee recommendation within one month since the remittance date.
- The E.E.A council has the right to accept or reject the application with justification for rejection reasons, and decide the minimum extra period that he should spent as practicing engineer.

2.3.4.6 The structural consultant engineer category [11]

- This category is granted to the engineer who spends at least eight years in the structural specialist engineer category after getting over the association council provisions, which issues a decision to be promoted as a consultant engineer.

2.3.4.7 The fundamentals to get over the structural specialist engineer category to the structural consultant engineer category

- After engagement as structural specialist engineers for at least eight years, the structural specialist engineer applies to the E.E.A filling a special form, showing in details all the engineering works and technical activities that implemented by him during that period. The application should support by all the documents and patterns needed.
- Special committee study this application and interview the applicant to give their recommendation to the engineers' council within three months from remittance date of application.

- The E.E.A council studies the application and the special committee recommendation within three months since the remittance date.
- The E.E.A council has the right to accept or reject the application with justification for rejection reasons, and decide the minimum extra period that he should spent as a specialist engineer

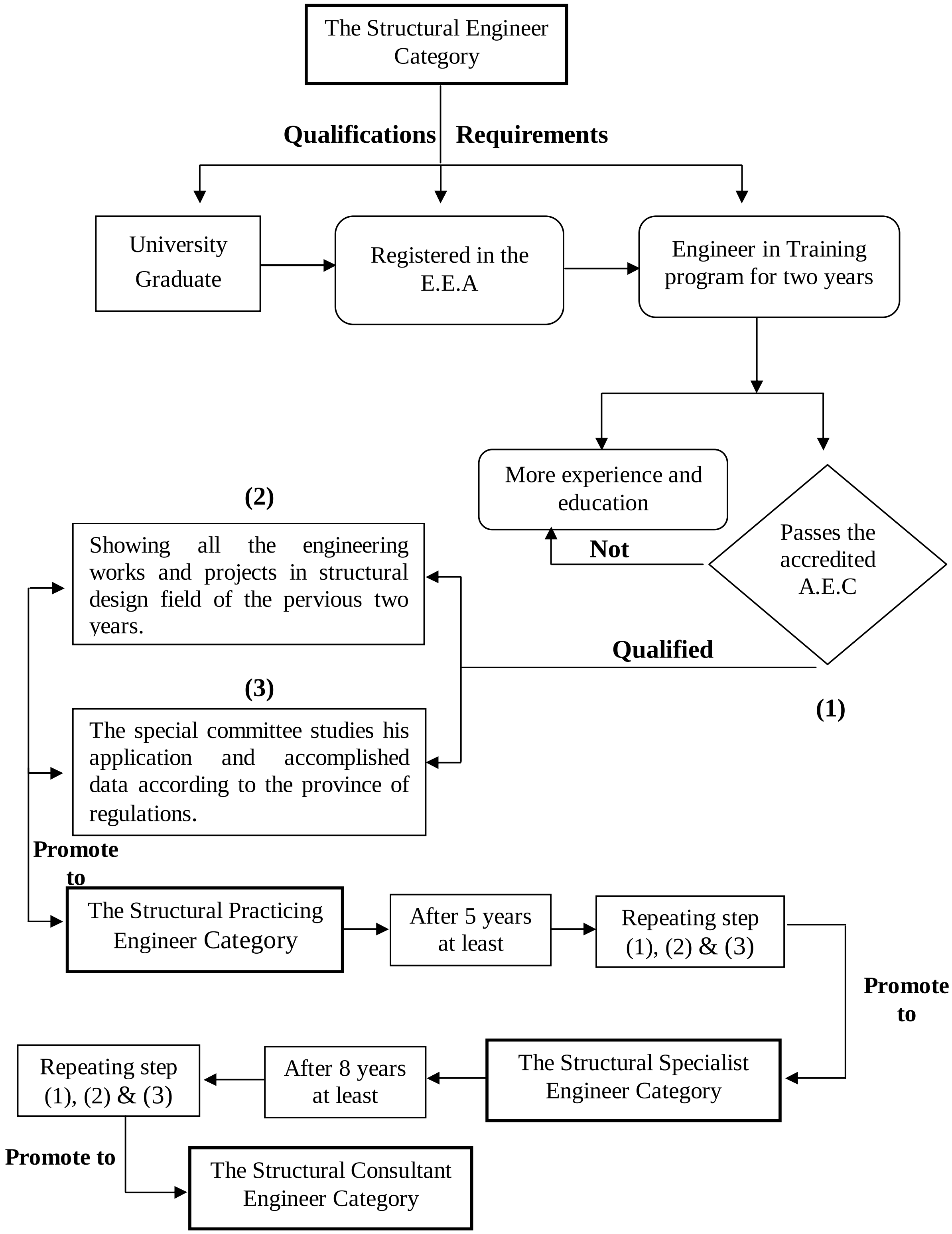

Figure (2.3) Structural Engineer qualification process in Egypt [11].

2.4 Intent of structural design review

The purpose of the structural concept review is to enhance public safety. As one element in a quality management process, it provides an independent overview of the primary structural system by reviewing structural design concepts and structural system integrity. Structural concept review is undertaken by an independent or dependent experienced structural engineer according to countries specification to determine if the structural system is sound, the documents appear to be complete, the design parameters are relevant and the structural members are appropriately sized and detailed. Except for some smaller projects as outlined below, concept review applies to all structural designs including new buildings, alterations and additions to existing buildings, structural components and structures other than buildings [12].

2.5 Structural design reviewers & review process

In this section, design reviewers qualifications' and review process of structural documents in different countries will be summarized.

2.5.1 In the United States

The practice of structural engineering in the U.S. today for many licensed professionals includes involvement with review, by others, of projects they have designed as well as reviews of designs developed by other engineers. These project reviews take many forms and can occur at any phase of the project preplanning, design, construction or completion.

Reviews are sometimes conducted for internal purposes only while others occur as a result of requirements outside of the individual's company. Some project reviews are mandated by either state or local codes and statues while others are conducted voluntarily at the request of a client, owner, or other interested party [13].

Engineers performing structural review shall meet the following qualifications [13]:

- Education in Civil/structural engineering.
- Have the license and the seal of structural professional engineer in U.S
- Industrial, military, Federal, State, or other directly related background that has provided specialized experience in Civil/Structural Engineering and have a minimum of 7-10 years of relevant structural experience.

- State Professional Registration in either Civil or Structural Engineering, or completion of Professional Registration within four years of accepting Federal employment position covered by this Standard.

In U.S the reviewing process of structural plans are subjected to the following criteria shown in Figure (2.4)

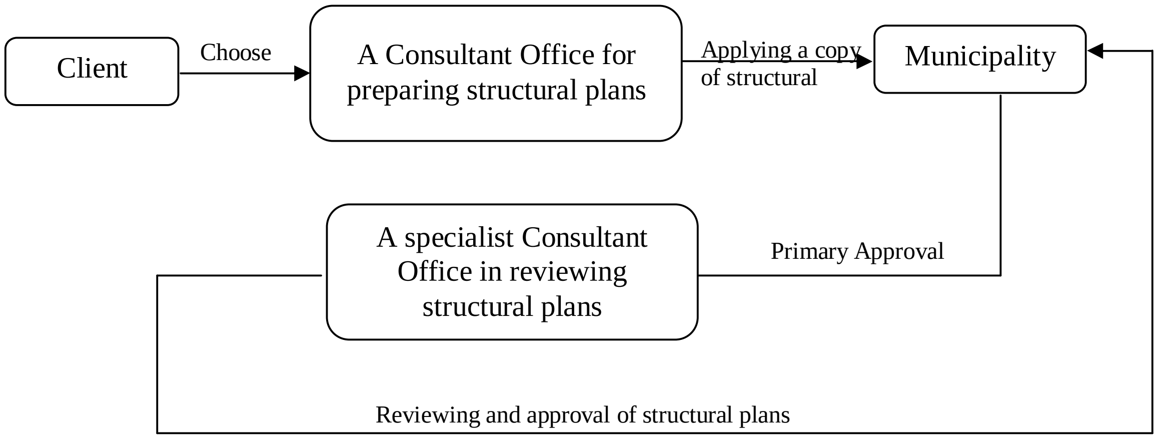

Figure (2.4) Reviewing process of structural documents in U.S. [14].

2.5.2 In the United Kingdom

The practice of charted structural engineers in UK involves the reviewing of structural documents which are designed by other structural engineers. The design review in UK can be undertaken during the design process with independent reviews at various stages of design development to be checked and accredited by the local authorities. Engineers performing structural review shall meet the following qualifications [15]:

- Be a registered professional engineer in UK
- Have a minimum of 10 years of relevant structural experience.
- Be independent of the project's structural design team and not be involved in the development of original design concept, preliminary design, detailed design or preparation of construction documents.

In U.K the reviewing process of structural plans are subjected to the following criteria shown in Figure (2.5).

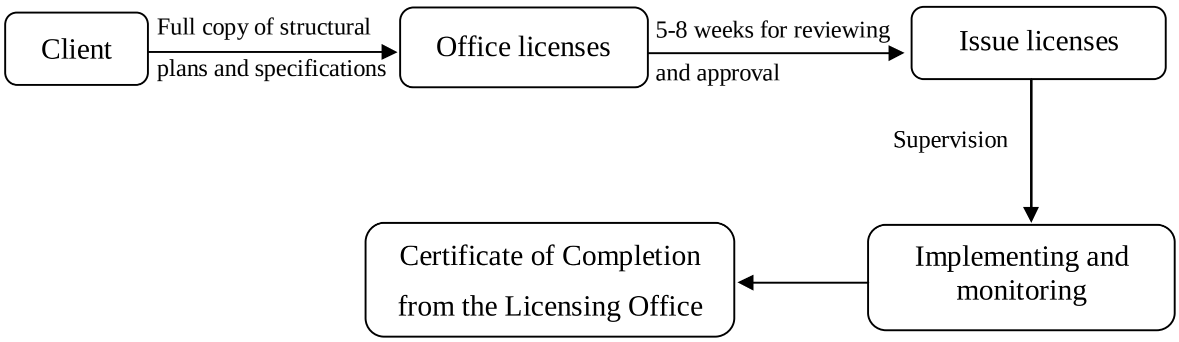

Fig (2.5) Reviewing process of structural documents in United Kingdom [15] Kingdom

2.5.3 In Canada

The reviewing process is subjected to the provisions of Canadian regulations. As a first step in the process, the reviewer should assemble all the original instructions, basic data, amendments, clarifying instructions, specific design assumptions and information on the performance. Reviewers should understand the mandate and the conditions under which the review is to be carried out. At this stage, it may be desirable to have written instructions that specify or outline the mandate. If the mandate is accepted, reviewers have an obligation to carry out the review on factual and technical grounds, strictly within the terms of the mandate, but keeping in mind the overriding principle of public interest. Reviewers must be temperate in their judgment and must assume responsibility for their opinions, while giving appropriate credit to the work of other engineers [16].

Senior engineers are often asked to review a design prepared by another engineer. If reviewers find that design changes are necessary, they should inform the design engineer of these findings and the reasons for the recommended changes. During the design stage, reviewers, (who are acting as the client’s agent in this case) and engineers may agree on changes to the engineers’ proposal. However, design engineers must not agree to any change or alternative suggested by reviewers that could result in an unworkable installation, be in conflict with the relevant codes, or create a risk of damage or injury[17].

In Canada the reviewing process of structural plans are subjected to the following criteria shown in Figure (2.6).

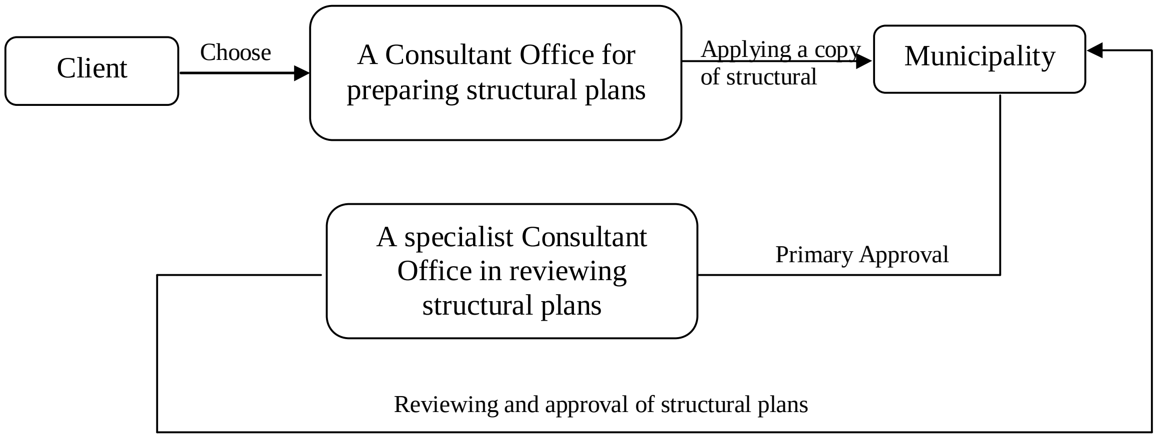

Figure (2.6) Reviewing process of structural documents in Canada [17].

2.5.4 In Egypt

In Egypt the reviewing processes of structural plans are subjected to the following criteria shown in Figure (2.7).

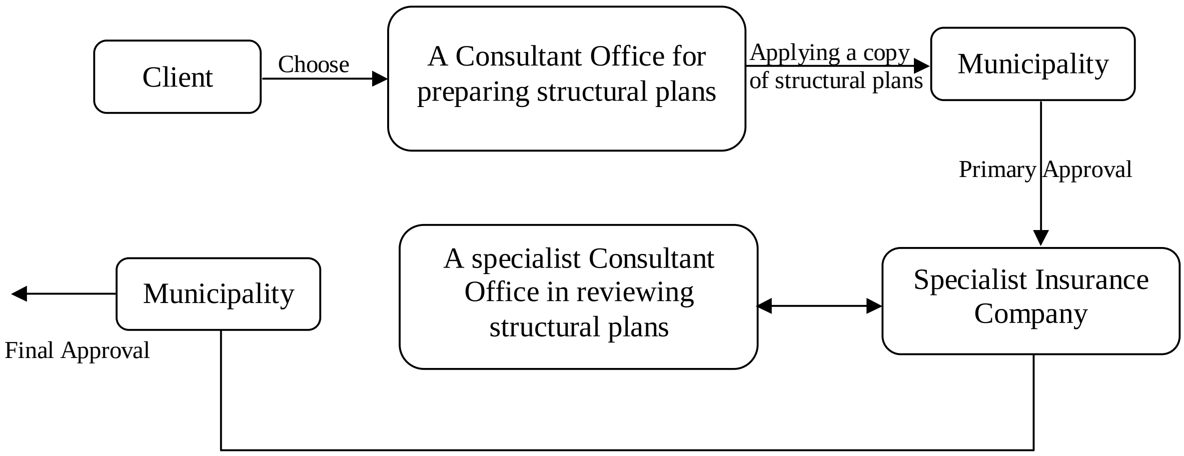

Figure (2.7) Reviewing process of structural documents in Egypt

Engineers performing structural review shall meet the following qualifications:

- Be a registered as specialist or consultant engineer categories in the Egyptians engineering association.
- Have a minimum of 8-10 years of relevant structural experience.

2.5.5 Current situation In Gaza strip

The following points will summarize the current situation of reviewing process clearly in Gaza strip:

- The client chooses suitable consultant office for preparing structural plans.
- The consultant office prepares the required structural plans and the submitting a copy to Engineering Association.
- The review can be undertaken once the structural plans and supporting documents are complete, and then approved by the reviewing committee.
- After approving the structural plans by Engineering Association the consultant office submits a final copy of structural plans to the municipality to obtain final approval.

In Gaza strip the reviewing processes of structural plans are subjected to the following criteria shown in Figure (2.8).

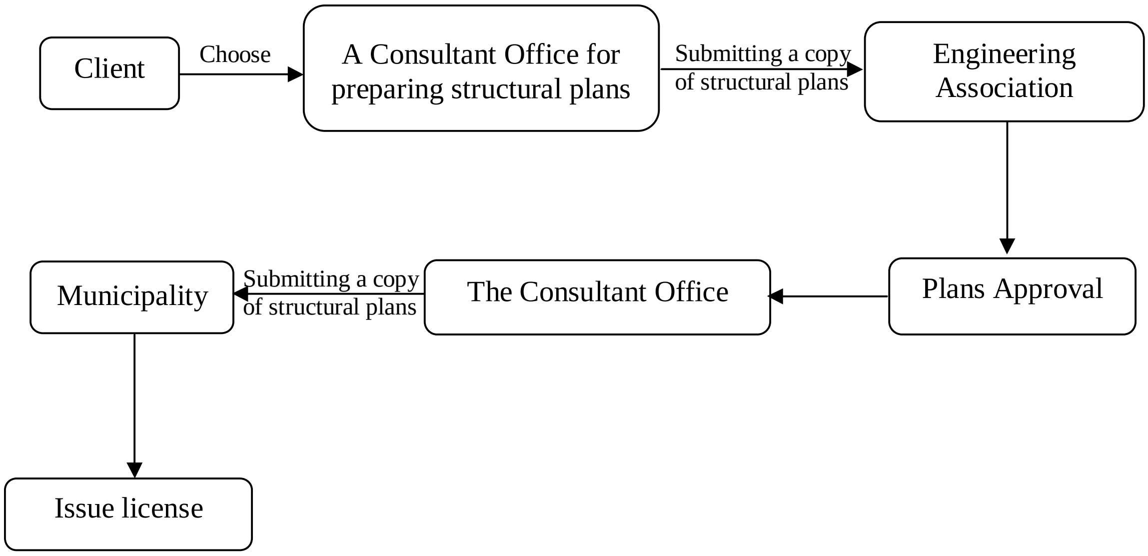

Fig (2.8) Reviewing process of structural documents in Gaza strip

Chapter 3

Research Methodology

This chapter describes the methodology that was used in this research. The adopted methodology to accomplish this study uses the following techniques: review of literature related to Investigating the structural concrete design profession in Gaza strip, the information about the research design, research population, research sample size, research location, questionnaire design, statistical data analysis, content validity and pilot study.

3.1 Research strategy

Research strategy can be defined as the way in which the research objectives can be realized. There are two types of research strategies, namely quantitative and qualitative research, quantitative research is objective in nature and objective measurement of the problem while qualitative research is subjective in nature. In this research the quantitative and qualitative approaches will be conducted because it is a way of measurement problem [18].

3.2 Research Design

Research design is an action plan for obtaining answers to the questions being studied. It is a method for getting from "here" to "there" where "here" may be defined as initial set of questions to be answered, and "there" is some set of conclusion or answers about these questions. Between "here" and "there" a number of major steps may be founded including the collection and a number of major steps may be founded including the collection and analysis of relevant data [18].

The research design normally specifies which type from the various types of research approaches to be considered and how the researcher plans to implement scientific control over the factors. Figure (3.1) summaries the research designs.

Step1:

Define the problem to be studied and the research question to be addressed.

Step 2:

Literature review

Developing a theoretical framework

Formulating hypotheses to be tested.

Step 3:

Selecting a research design

Specifying the population

Specifying the method to measure the research variables

Selecting the sample size

Finalizing the research plan

Conducting a pilot study and making revision

Step 4:

Collecting data

Preparing the data for analysis

Step 5:

Analyzing the data through statistical analysis

Interpreting the results

Step 6:

Communicating the findings

Promoting their utilization

Fig (3.1) Steps involved in conducting an investigation [18].

The first phase of the research thesis proposal included identifying and defining the problems and establishment objective of the study and development research plan. The second phase of the research included a summary of the comprehensive literature review. The third phase of the research included a field survey which was conducted with viewpoint of structural designers. The fourth phase of the research focused on the modification of the questionnaire design, through distributing the questionnaire to pilot study. The purpose of the pilot study was to test and prove that the questionnaire questions are clear to be answered in a way that help to achieve the target of the study. In addition, it was important to ensure that all information received from structural designers would be useful in achieving the research objective. The questionnaire was modified based on the results of the pilot study [18].

The fifth phase of the research focused on distributing questionnaire. This questionnaire was used to collect the required data in order to achieve the research objective. Seventy three questionnaires were distributed to the research population but seventy questionnaires were received. The sixth phase of the research was data analysis and discussion. Statistical Package for the Social Sciences, (SPSS) was used to perform the required analysis. The final phase includes the conclusions and recommendations. Figure (3.2) shows the methodology flowchart, which leads to achieve the research objective.

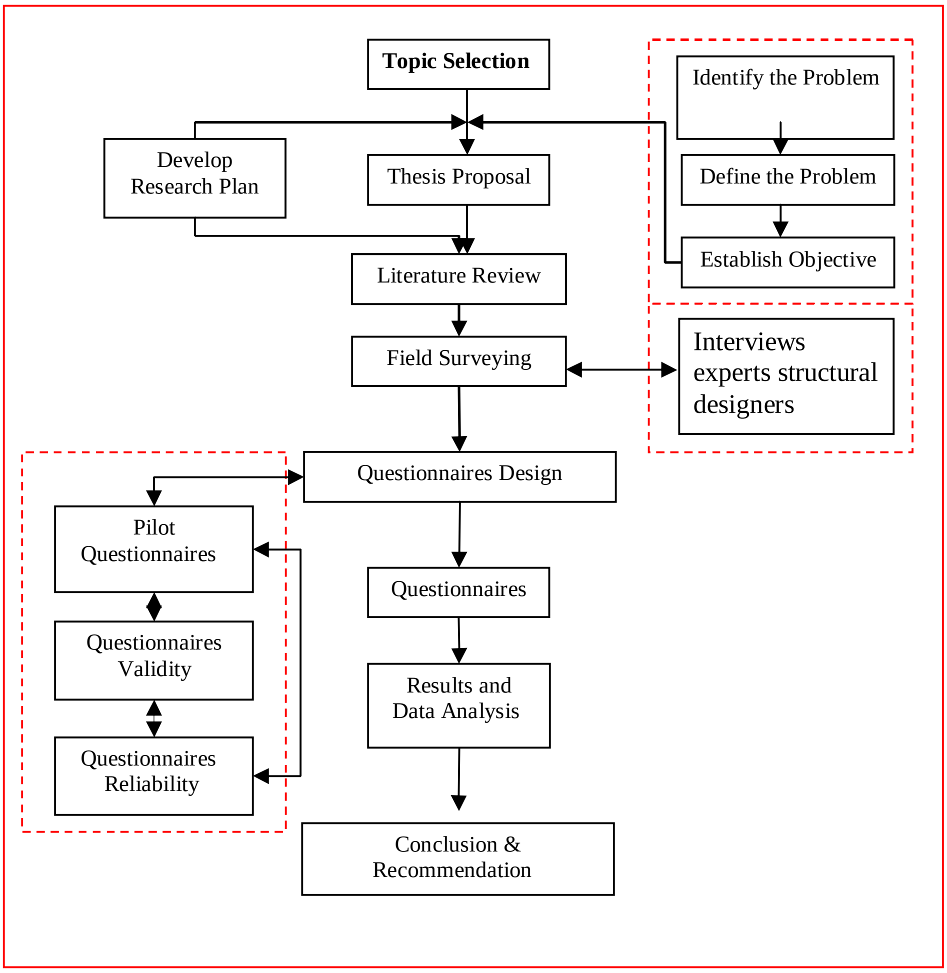

Figure (3.2) Methodology flow chart [18].

3.3 Research Population

The term refers to aggregate or totality of all objects, subjects or members that conform to set of specifications. The population of this research includes public owner, engineering consulting office, International Agency (UNDP, UNRW, Etc…) and NGOs whom work in the structural design field.

This research targets 137 structural designers working in the structural concrete design profession in Gaza strip.

3.4 Sample Size Determination

We can define the sampling as the process of selecting representative units of a population for the study in research investigation. The objective of the sampling is to provide a practical means of enabling the data collection and processing the components of the research to be carried out whit ensuring that the sample provides a good representation of the population. A sample is a small proportion of a population selected for observation and analysis. The samples were selected randomly from the population.

Statistical equations were used in order to calculate the sample size for the Structural designers. Equation 3.1 was used to determine the sample size of the unlimited population (Creative Research System, 2001):

$$SS = \frac{Z^2 * P * (1-P)}{C^2} \qquad \text{Equation 3.1}$$

Where SS = Sample size

Z = Z value (e.g. 1.96 for 95% confidence level)

P = percentage picking choice, expressed as a decimal (0.50 used for sample size needed)

C = margin of error (8%)

$$SS = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.08^2} = 150 \text{ Structural designers}$$

Correction for Finite Population:

$$SS_{new} = \frac{SS}{1+\frac{SS-1}{POP}} \qquad \text{Equation 3.2}$$

Where POP is the population = 137 match the of structural designers in this research

$$SS_{new} = \frac{150}{1+\frac{150-1}{137}} = 71.85 \approx 72$$

The targeted 73 structural designers were selected according to Equation 3.2.

To ensure good representation of each stratum, the Percent of valid respondents to No. of distributed questionnaires shown in Table (3.1)

Table (3.1) Classification of sample size.

Number of (population)	139
Number of samples	73
Number of distributed questionnaires	73
Number of respondents	70
Number of valid respondents	70
Percent of valid respondents to No. of distributed questionnaires	0.96

3.5 Research Location

The research was carried out in the Gaza Strip.

3.6 Pilot Study

It is customary practice that the survey instrument should be piloted to measure its validity and reliability and test the collected data. The pilot study was conducted by distributing the prepared questionnaire to panels of experts having experience in the same field of the research to have their remarks on the questionnaire.

Based on previous research the minimum questionnaire number must be greater than twenty, distributed to experts structural designers.

Twenty five experts representing two panels were contacted to assess the questionnaires validity. The panel, which consisted of twenty five experts (structural designers), was asked to verify the validity of the questionnaires topics and its relevance to the research objective. Experts comments and suggestions were collected and evaluated carefully. All the suggested comments and modifications were discussed with the study's supervisor before taking them into consideration. At the end of this process, some minor changes, modifications and additions were introduced to the questions and the final questionnaire was constructed.

3.6.1 Questionnaire Design and Content

According to the review of literature and after interviewing experts who were dealing with the subject at different levels, all the information that could help in achieving the study objectives were collected, reviewed and formalized to be suitable for the study survey and after many stages of brain storming, consulting, amending, and reviewing executed by the researcher with the supervisor, a questionnaire was developed with closed questions.

The questionnaire was designed in the Arabic language (Annex 1), as most members of the target population were unfamiliar with the English language and to be more understandable. An English version was attached in (Annex 1). Unnecessary personal data, complex and duplicated questions were avoided. The questionnaire was provided with a covering letter which explained the purpose of the study, the way of responding, the aim of the research and the security of the information in order to encourage high response. The questionnaire design was composed of five sections to accomplish the aim of the research, as follows:

1. The first section contained General Information (Personal information, Information about the employer of the structural designer).
2. The second section contained the Qualification of the structural concrete designers, divided into four main subsections as follows:
    - The first subsection (field) was about the impact of university study on the structural concrete designer.
    - The second subsection (field) was about the training and development policies for the structural concrete designers in the field of structural design.
    - The third subsection (field) was about the training needs for the structural concrete designers in the field of structural design (to what degree you believe that the following training programs are necessary)
    - The fourth subsection (field) was about the educational and practical qualifications to practice the profession of structural concrete designe (to what degree you believe that the following provisions and regulations are necessary)
3. The third section was about the applications on the factors affecting the performance of structural designers.
4. The fourth section was about the evaluation of structural design auditing process.

3.6.2 Validity of the Research

Validity refers to the degree to which an instrument measures what it is supposed to be measuring. Validity has a number of different aspects and assessment approaches. There are two ways to evaluate instrument validity: content validity and statistical validity, which include criterion-related validity and construct validity.

3.6.2.1 Content Validity of the Questionnaire

Content validity test was conducted by consulting two groups of experts. The first was requested to evaluate and identify whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem. The other was requested to evaluate whether that the instrument used was valid statistically and that the questionnaire was designed well enough to provide relations and tests between variables. The two groups of experts did agree that the questionnaire was valid and suitable enough to measure the concept of interest with some amendments.

3.6.2.2 Statistical Validity of the Questionnaire

To insure the validity of the questionnaire, two statistical tests are applied. The first test is Criterion-related validity test (Pearson test) which measures the correlation coefficient between each paragraph in one field and the whole field. The second test is structure validity test (Pearson test) that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of similar scale.

Criterion Related Validity

Internal consistency of the questionnaire is measured by a scouting sample, which consisted of twenty five questionnaires, through measuring the correlation coefficients between each paragraph in one field and the whole filed. Table (3.2) through table (3.6) shown, the correlation coefficient and P-value for each field paragraph. As show the P-values are less than 0.05 or 0.01,so the correlation coefficients of this field are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to measure what it was set for.

A. The impact of university study on the structural concrete designer.

Pearson correlation coefficient was calculated between each impact of university study of the questionnaire. Table 3.2 shows the Pearson correlation coefficients between the items of the impact of university study on the structural concrete designer and average of the related section; coefficients donated significance at 0.05 levels. The Pearson correlation coefficients were calculated for all impacts, The Pearson correlation coefficient is ranging from 0.425 to 0.727 and P-value is less than significant value of 0.05 see (Table 3.3.). These results show that there is positive relationship between the impact of university study on the structural concrete designer therefore the questionnaire is valid for this group of the impact of university study.

Table (3.2) Pearson correlation coefficients between the impact of university study on the structural concrete designer and their total average mean.

No.	Expression	Correlation	p-value	Significant level
1	Increasing the number of design courses during university study raises the level of the designer.	0.727	0.000	**
2	Increasing the number of university courses clarifies the structural design process.	0.425	0.034	*
3	Increasing the number of university courses contributes to understanding of the structural design process.	0.766	0.000	**
4	Supports to teaching more than one design code in the structural design field during the university study.	0.605	0.001	**
5	Supports the allocation of a special department of "structural design" at the university.	0.727	0.000	**
6	You felt the lack of output from the teaching way during the studying period relies on structural design field.	0.533	0.006	**
7	The practical application of the structural design during the university study raises the level of structural designer	0.496	0.012	*

Contd. Table (3.2) Pearson correlation coefficients between the impact of university study on the structural concrete designer and their total average mean.

No.	Expression	Correlation	p-value	Significant level
8	Offering special courses in structural design using computer applications during the university study raises the level of structural designer.	0.472	0.017	*
9	Holding training courses for the structural design programs using computer application during the university study raises the level of the structural designer.	0.611	0.001	**

***   Correlation coefficient is significant at the α = 0.05**
*** *   Correlation coefficient is significant at the α = 0.01**

B. Training and development policies for the structural concrete designer in the field of structural design

Table 3.3 shows the Pearson correlation coefficients between the items of training and development policies for the structural concrete designer in the field of structural design and average of the related section; coefficients denoted significance at 0.05 levels. The Pearson correlation coefficients were calculated for all impacts, The Pearson correlation coefficient is ranging from 0.43 to 0.708 and P-value is less than significant value of 0.05 see (Table 3.3.) These results show that there is positive relationship between training and development policies for the structural concrete designer in the field of structural design therefore the questionnaire is valid for this group of training and development policies.

Table (3.3) Pearson correlation coefficients between training and development policies for the structural concrete designer in the field of structural design and their total average mean.

No.	Expression	Correlation	p-value	Significant level
1	Determining the level of skills of the structural designer in the field of structural concrete design.	0.650	0.000	**
2	Holding special training courses to refine and increase the skills of the structural designer in the field of structural concrete design.	0.446	0.025	*
3	The existence of appropriate training programs and can be applied in the structural concrete design field.	0.566	0.003	*

Contd. Table (3.3) Pearson correlation coefficients between training and development policies for the structural concrete designer in the field of structural design and their total average mean.

No.	Expression	Correlation	p-value	Significant level
4	Encourage the structural designer to enter the training programs.	0.708	0.000	**
5	Mandated policy of training for the Structural designer in structural concrete design field.	0.564	0.003	**
6	Mandated policy of training for the organizations which work in the field of structural concrete design	0.504	0.010	**
7	Methods for determination of performance after the completion of training.	0.690	0.000	**
8	Learning from self experience and the past experience of others.	0.508	0.009	**
9	Learning from the best performance among others.	0.430	0.032	*
10	Reviewing the mistakes and problems you are facing during profession practice as structural concrete designer and developing appropriate solutions for them.	0.593	0.002	**
11	Training on structural engineering analysis, where the order includes structural project elements sorted, so as to ensure the economic and technical aspects.	0.432	0.031	*
12	Training in structural engineering design and the use of approved structural systems.	0.437	0.029	*

*** Correlation coefficient is significant at the α = 0.05**
*** * Correlation coefficient is significant at the α = 0.01**

C. Training needs for the structural concrete designer in the field of structural

Table 3.4 shows the Pearson correlation coefficients between the items of training needs for the structural concrete designer in the field of structural and average of the related section; coefficients donated significance at 0.05 levels. The Pearson correlation coefficients were calculated for all impacts, The Pearson correlation coefficient is ranging from 0.467 to 0.731 and P-value is less than significant value of 0.05 see (Table 3.3.) These results show that there is positive relationship between of training needs for the structural concrete designer in the field of structural therefore the questionnaire is valid for this group of training needs for the structural concrete designer.

Table (3.4) Pearson correlation coefficients between training needs for the structural concrete designer in the field of structural and their total average mean.

No.	Expression	Correlation	p-value	Significant level
1	Professional and technical skills to the structural designer in the field of design, such as learning of new codes to increase and improve performance in the field of structural design.	0.731	0.000	**
2	Analysis and design of earthquake resisting systems.	0.549	0.005	**
3	Analysis and design of wind load resisting systems.	0.432	0.031	*
4	Analysis and design of bridges.	0.591	0.002	**
5	Analysis and design of water structures such as water reservoirs of all kinds.	0.473	0.017	*
6	Evaluation of existing structures and the extent to sustain the applied loads.	0.569	0.003	**
7	Strengthening of existing structures to make them bear the additional loads.	0.513	0.009	**
8	Computer applications and assistance programs in the field of design.	0.467	0.019	*

*** Correlation coefficient is significant at the $\alpha = 0.05$**

*** * Correlation coefficient is significant at the $\alpha = 0.01$**

D. Educational and practical qualifications to practice the profession of structural designer.

Table 3.5 shows the Pearson correlation coefficients between the items of educational and practical qualifications to practice the profession of structural designer and average of the related section; coefficients donated significance at 0.05 levels. The Pearson correlation coefficients were calculated for all impacts, The Pearson correlation coefficient is ranging from 0.399 to 0.864 and P-value is less than significant value of 0.05 see (Table 3.5.) These results show that there is positive relationship between of training needs for the structural concrete designer in the field of structural therefore the questionnaire is valid for this group of educational and practical qualifications to practice the profession of structural designer.

Table (3.5) Pearson correlation coefficients between educational and practical qualifications to practice the profession of structural designer and their total average mean.

No.	Expression	Correlation	p-value	Significant level
1	The structural design profession is only permitted for the engineers enrolled in the Engineers Association.	0.438	0.028	*
2	The structural designer practices his engineering work, which provided for his testimony, according to the record in Engineers Association.	0.436	0.030	*
3	Recently graduated engineers start practicing the work as structural designer after completing engineering in training program under the direction of licensed engineer.	0.422	0.036	*
4	Passing an exam to practice the profession under the supervision of the Engineers Association to promote to practice the profession of structural designer.	0.627	0.001	**
5	Supervises a specialized committee from the association to prepare the exam questions to practice the profession.	0.864	0.000	**
6	Supervises a specialized committee from the association is to prepare the exam questions.	0.578	0.002	**

Contd. Table (3.5) Pearson correlation coefficients between educational and practical qualifications to practice the profession of structural designer and their total average mean.

No.	Expression	Correlation	p-value	Significant level
7	Questions are comprehensive and diverse for the structural elements, which faces the structural designer.	0.399	0.048	*
8	Prohibits recently graduated engineers and who have not completed the training provided by the Engineers Association of practicing the profession of structural designer to practice the profession.	0.403	0.046	*
9	Rating engineers enrolled in the Engineers Association based on their design experience and the projects which they have designed.	0.423	0.035	*

*** Correlation coefficient is significant at the α = 0.05**
*** * Correlation coefficient is significant at the α = 0.01**

E. Evaluation of structural design auditing process

Table 3.6 shows the Pearson correlation coefficients between the items of Evaluation of structural design auditing process and average of the related section; coefficients donated significance at 0.05 levels. The Pearson correlation coefficients were calculated for all impacts, The Pearson correlation coefficient is ranging from 0.41 to 0.847 and P-value is less than significant value of 0.05 see (Table 3.6.) These results show that there is positive relationship between of training needs for the structural concrete designer in the field of structural therefore the questionnaire is valid for this group of educational and practical qualifications to practice the profession of structural designer.

Table (3.6) Pearson correlation coefficients between evaluation of structural design auditing process and their total average mean

No.	Expression	Correlation	p-value	Significant level
1	Setting a criteria to determine the scientific and practical qualifications for structural design reviewer	0.574	0.003	**
2	Approval of Structural drawings through the Engineers Association is sufficient for the safety of structure.	0.688	0.000	**

Contd. Table (3.6) Pearson correlation coefficients between evaluation of structural design auditing process and their total average mean

No.	Expression	Correlation	p-value	Significant level
3	One structural design reviewer in the auditing committee to review the structural plans is insufficient.	0.550	0.004	**
4	One structural design reviewer is unable to understand all the known design codes, and structural design systems.	0.709	0.000	**
5	Structural plans auditing takes a long time due to the existence of one structural design reviewer.	0.414	0.040	*
6	Structural plans auditing take a long time due to the existence of one structural design reviewer who is unfamiliar with all design codes.	0.604	0.001	**
7	Structural auditing results are satisfactory for the structural designer, generally.	0.662	0.000	**
8	Structural design reviewer in the Engineers Association focuses on the basic structural elements.	0.599	0.002	**
9	The importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer.	0.823	0.000	**
10	Find the form and contents of the calculation sheet required by the Audit Committee sometimes exaggerated.	0.410	0.042	*
11	The existence of a clear calculation sheet , facilitates and accelerates the process of auditing the structural plans by the audit committee	0.847	0.000	**
12	Structural design review by special auditing committee relieves the responsibility of structural designer.	0.753	0.000	**
13	Structural designer is held responsible, in all cases, for the structural design which he has designed.	0.629	0.001	**
14	Structural design auditing by another engineer working in another office before adoption.	0.493	0.012	*

*** Correlation coefficient is significant at the α = 0.05**

*** * Correlation coefficient is significant at the α = 0.01**

Structure Validity of the Questionnaire

Structure validity is the second statistical test that is used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of Likert scale.

As shown in Table (3.7) for all fields, the significance values are less than 0.05 or 0.01, so the correlation coefficients of all the fields are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the fields are valid to be measured what it was set for to achieve the main aim of the study .

Table (3.7) Structure validity of the questionnaire test

No	Section	Correlation	p-value	Significant level
1	The impact of university study on the structural concrete designer	0.696	0.000	**
2	Training and development policies for the structural concrete designer in the field of structural design	0.846	0.000	**
3	Training needs for the structural concrete designer in the field of structural design	0.791	0.000	**
4	Educational and practical qualifications to practice the profession of structural designer	0.866	0.000	**
5	Evaluation of structural design auditing process	0.716	0.000	**

*** Correlation coefficient is significant at the $\alpha = 0.05$**
*** * Correlation coefficient is significant at the $\alpha = 0.01$**

3.7 Reliability of the Research

The reliability of an instrument is the degree of consistency which measures the attribute; it is supposed to be measuring . The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient It is difficult to return the scouting sample of the questionnaire-that is used to measure the questionnaire validity to the same respondents due to the different work conditions to these samples. Therefore two tests can be applied to the scouting sample in order to measure the consistency of the questionnaire. The first test is the Half Split Method and the second is Cronbach's Coefficient Alpha.

3.7.1 Half Split Method

This method depends on finding Pearson correlation coefficient between the means of odd questions and even questions of each field of the questionnaire. Then, correcting the Pearson correlation coefficients can be done by using Spearman Brown correlation coefficient of correction. The corrected correlation coefficient (consistency coefficient) is computed according to the following equation:

Consistency coefficient = $2r/(r+1)$, where r is the Pearson correlation coefficient. The normal range of corrected correlation coefficient $(2r/ r+1)$ is between 0.0 and + 1.0. As shown in table (3.8), all the corrected correlation coefficients values are between 0.0 and +1.0 and the significant (α) is less than 0.05 so all the corrected correlation coefficients are significance at $\alpha = 0.05$. It can be said that according to the Half Split method, the dispute causes group are reliable.

Table (3.8) Half Split Coefficient Method.

No.	Section	Correlation	corrected correlation coefficient	p-value	Significant level
1	The impact of university study on the structural concrete designer	0.6872	0.8146	0.000	**
2	Training and development policies for the structural concrete designer in the field of structural design	0.6587	0.7943	0.000	**
3	Training needs for the structural concrete designer in the field of structural design	0.7246	0.8403	0.000	**
4	Educational and practical qualifications to practice the profession of structural designer	0.7055	0.8273	0.000	**
5	Evaluation of structural design auditing process	0.6959	0.8207	0.000	**
6	All sections	0.7015	0.8245	0.000	**

*** Correlation coefficient is significant at the $\alpha = 0.05$**
*** * Correlation coefficient is significant at the $\alpha = 0.01$**

3.7.2 Cronbach's Alpha Coefficient

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's alpha coefficient value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. As shown in Table (3.9), the Cronbach's alpha coefficient was calculated for the first field of the impact of university study on the structural concrete designer, the second field of training and development policies for the structural concrete designer in the field of structural design, the third field of training needs for the structural concrete designer in the field of structural design, the fourth field of Educational and practical qualifications to practice the profession of structural designer, the fifth field Evaluation of structural design auditing process. The results were in the range from 0.8267 and 0.8857. This range is considered high; the result ensures the reliability of the questionnaire.

Table (3.9) Cronbach's alpha coefficient.

No.	Section	No. of Items	Cronbach's coefficient alpha
1	The impact of university study on the structural concrete designer	9	0.8358
2	Training and development policies for the structural concrete designer in the field of structural design	12	0.8267
3	Training needs for the structural concrete designer in the field of structural design	8	0.8857
4	Educational and practical qualifications to practice the profession of structural designer	8	0.8601
5	Evaluation of structural design auditing process	14	0.8795
6	All sections	51	0.8694

Thereby, it can be said that the researcher proved that the questionnaire was valid, reliable, and ready for distribution for the population sample.

3.8 Data Measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there is an appropriate methods that can be applied and not others. In this research, interval scales were used. Based on Likert scale Table (3.10) , we have the following:

Table (3.10) Likert scale

Importance degree	scale
Strongly agree	5
Agree	4
Neutral	3
Disagree	2
Strongly disagree	1

The interviewers were asked to provides their opinions on viewpoint of structural designers by scores 1 to 5, where "1" represent the strongly disagree and "5" represent the strongly agree to determine the relative ranking of the factors; these scores were then transformed to importance indices based on the formula.

Formula Relative importance Index = $\frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$

Where W is the weighting given to each factor by the respondent, ranging from 1 to 5, (n_1 = number of respondents for strongly disagree, n_2 = number of respondents for disagree, n_3 = number of respondents for neutral, n_4 = number of respondents for agree, n_5 = number of respondents for strongly agree). A is the highest weight (i.e 5 in the study) and N is the total number of samples. The relative importance index ranges from 0 to 1.

3.9 Data Analysis

The questionnaire quantitative statistical analysis was done by using the Statistical Package for the Social Sciences (SPSS) and the following statistical analyses were used:

1. Frequencies and percentages
2. Pearson Correlation Coefficient for data
3. Spearman brown formula
4. Relative important formula
5. One sample t test

CHAPTER 4

Results

Data Analysis and Discussion

This chapter describes the results that have been obtained from 72 questionnaires. For this purpose the statistical package for social sciences SPSS was used. The information about the sample size, response rate and qualification of the structural concrete designer requirements in Gaza strip. It is also includes the ranking of the impact of university study on the structural concrete designer items, training and development policies for the structural concrete designer in the field of structural design items, training needs for the structural concrete designer in the field of structural design items, educational and practical qualifications to practice the profession of structural designer items and Evaluation of structural design auditing process items. It includes the relationship between groups and correlation coefficients between the groups.

4.1 One-Sample Kolmogorov-Smirnov Test

Kolmogorove- Smirnov test will be used to identify if the data follow normal distribution or not. This test is considered necessary in case testing hypotheses as most parametric test stipulate data to be normality distributed.

Test results as shown in Table (4.1), clarify that the significant level calculated are greater than 0.05 (sig.>0.05), this in turn denotes that data follow normal distribution, and so parametric test must be used.

Table (4.1)1-Sample Kolmogorov-Smirnov Test.

Contents	Kolmogorov-Smirnov Z	P-value
The impact of university study on the structural concrete designer	1.013	0.256
Training and development policies for the structural concrete designer in the field of structural design	0.924	0.36
Training needs for the structural concrete designer in the field of structural design	1.063	0.208
Educational and practical qualifications to practice the profession of structural designer	0.538	0.935
Evaluation of structural design auditing process	0.996	0.274

Part one: General Information

4.2 First/Personal information

4.2.1 Sex.

Table.(4.2) shows the results of sex of respondents' structural designers. The results demonstrate that 95.7% from respondents' structural designers were male, and 4.3% as shown in Fig (4.1).

Table (4.2) Sex

Sex	Frequency	percent
Male	67	95.7
Female	3	4.3
Total	70	100.0

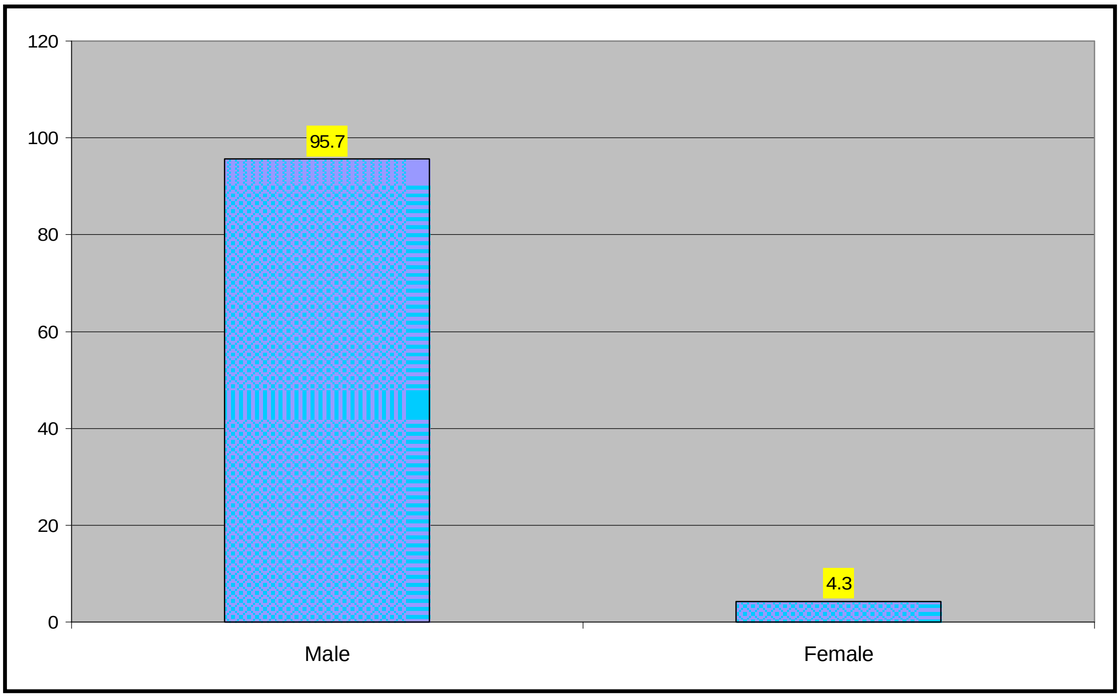

Fig (4.1) Sex of Respondents'

4.2.2 Graduation place (according to the latest attained scientific degree).

Table (4.3) shows the results of graduation place of respondents' structural designers. The results demonstrate that 31.4% of structural designer engineers in Gaza strip graduated from " National University (Gaza Strip)" , 20.0% of structural designer engineers in Gaza strip graduated from " National University (Waste Bank)", 34.3% of structural designer engineers in Gaza strip graduated from "ARAB Universities", 8.6%

of structural designer engineers in Gaza strip graduated from "Western University (Europe - U.S.)", 4.3% of structural designer engineers in Gaza strip graduated from "Soviet Union Universities", and 1.4% of structural designer engineers in Gaza strip graduated from "Other destinations" which include south Asia universities as shown in Fig (4.2).

Table (4.3) Graduation place

Graduation place	Frequency	percent
National University (Gaza Strip)	22	31.4
National University(West Bank)	14	20.0
ARAB Universities	24	34.3
Western University (Europe - U.S.)	6	8.6
Soviet Union Universities	3	4.3
Other	1	1.4
Total	70	100.0

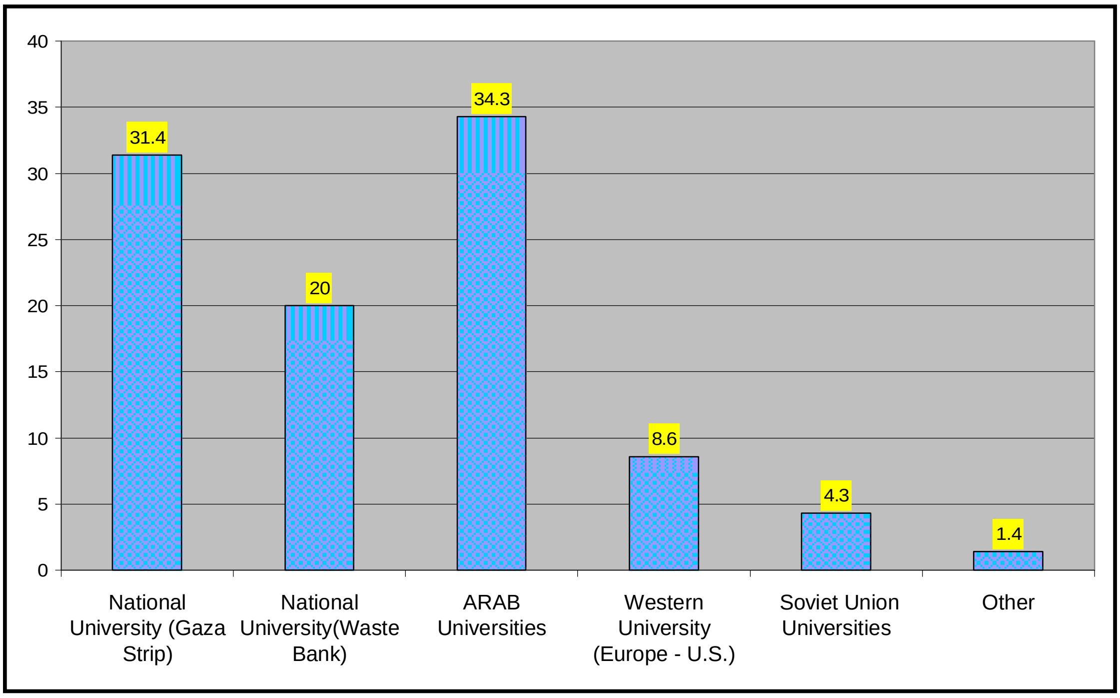

Fig (4.2) Respondents' graduation place

4.2.3 Year of graduation.

Table (4.4) shows year of graduation of respondents' structural designers. The results demonstrate that, 5.7% from the respondents graduated in " 1975-1980", %20.0 from the respondents graduated in "1981-1985", %15.7 from the respondents graduated in "1986-1990", 15.7% from the respondents graduated in "1991-1995", 32.9% from the respondents graduated in "1996-2001", and 10.0% from the respondents graduated in " 2002-Until Now" as shown in Fig (4.3) .

Table (4.4)Year of graduation

Year of graduation	Frequency	percent
Before1975	0	0.0
1975-1980	4	5.7
1981-1985	14	20.0
1986-1990	11	15.7
1991-1995	11	15.7
1996-2001	23	32.9
2002-Until Now	7	10.0
Total	70	100.0

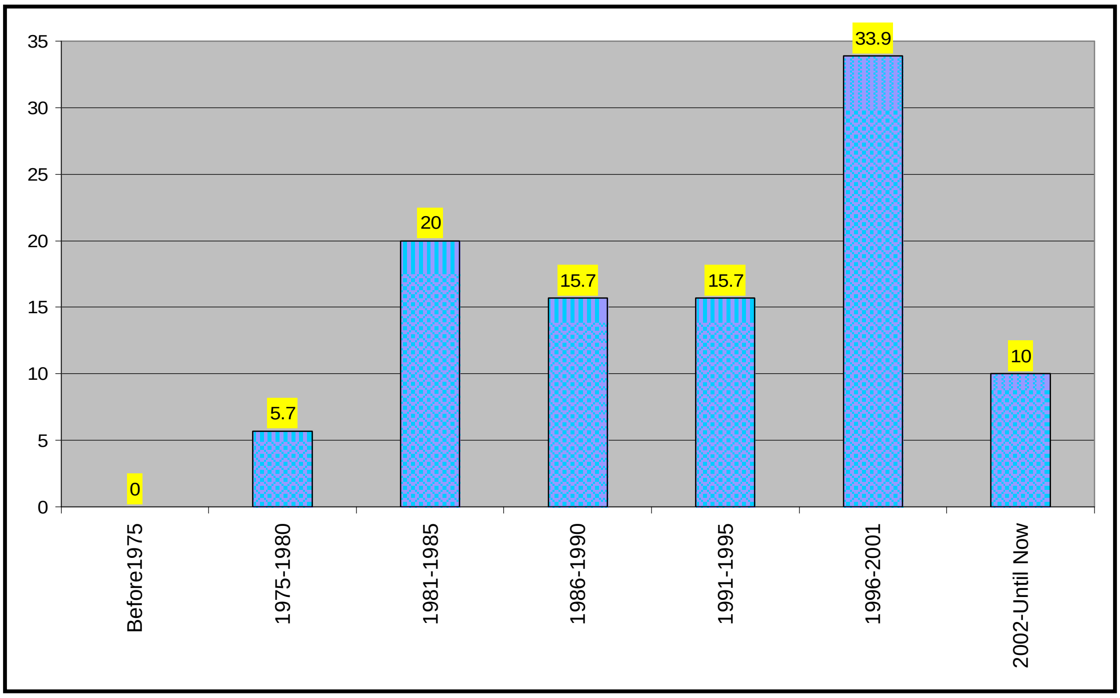

Fig (4.3) Respondents' graduation year

4.2.4 Scientific qualifications.

Table (4.5) shows scientific qualifications holders of respondents' structural designers. The results indicate that, 70.0% from the respondents were bachelor holders, 17.1% from the respondents were Master holders, and 12.9% from the respondents were PhD holders, as shown in Fig (4.4) .

Table (4.5) Scientific qualifications

scientific qualifications	Frequency	percent
Bachelor's Degree	49	70.0
Master's Degree	12	17.1
Ph.D. Degree	9	12.9
Total	70	100.0

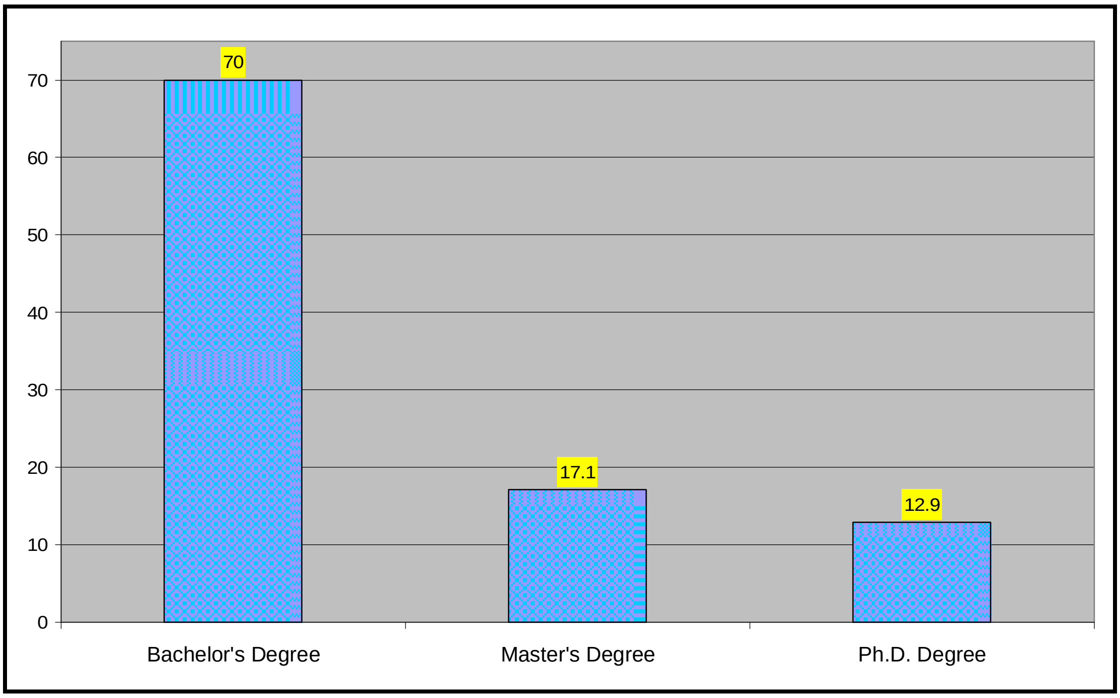

Fig (4.4) Respondents' scientific qualification

4.2.5 Years of practical experience.

Table (4.6) demonstrates the years of experience for research respondents. The results show that 5.7% of the respondents have experience "less than 5 years", 22.9% of the respondents have experience between "5-10 years", 18.6% of the respondents have experience between "11-15 years", 21.4% of the respondents have experience between "16-20 years", and 312.4% of the respondents have experience "more than 20 years" as shown in Fig (4.5) .

Table (4.6) Years of practical experience

Years of practical experience	Frequency	percent
Less than 5 years	4	5.7
5-10 years	16	22.9
11-15 years	13	18.6
16-20 years	15	21.4
More than 20 years	22	31.4
Total	70	100.0

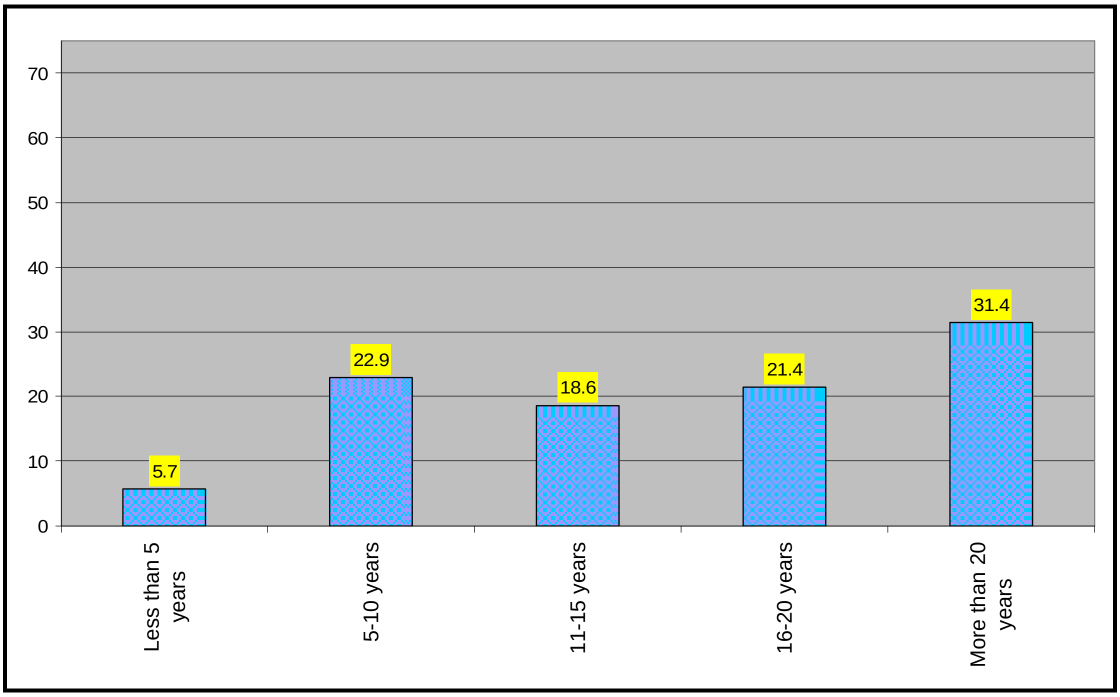

Fig (4.5) Respondents' practical experience

4.2.6 Job practicing place.

Table (4.7) shows job practicing place of respondents' structural designers. The results show that 76.7% of the respondents had worked as local structural designer, 18.9% of the respondents had worked as regional structural designer, 3.3% of the respondents had worked as international structural designer, and 1.12% the respondents had worked as regional structural designer as shown in Fig (4.6) .

Table (4.7) Job practicing place

Job practicing place	Frequency	percent
Local	69	76.7
Regional	17	18.9
International	3	3.3
have not work	1	1.1
Total	90	100.0

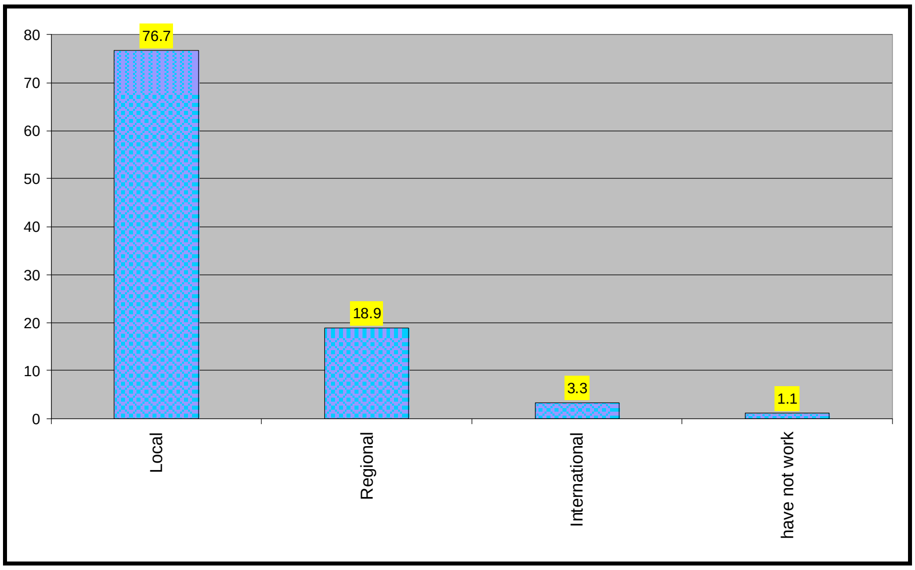

Fig (4.6) Respondents' job practicing place

4.2.7 Number of structural projects.

Table (4.8) shows number of structural projects that respondents had designed during work as structural designer. The results show that 5.7% of the respondents had designed between "1-5 projects", 4.3% of the respondents had designed between "6-10 projects", and 90.0% the respondents had designed between "more than 11 projects" as shown in Fig (4.7) .

Table (4.8) Number of structural projects

Number of structural projects	Frequency	percent
1-5 projects	4	5.7
6-10 projects	3	4.3
More than 11 projects	63	90.0
Total	70	100.0

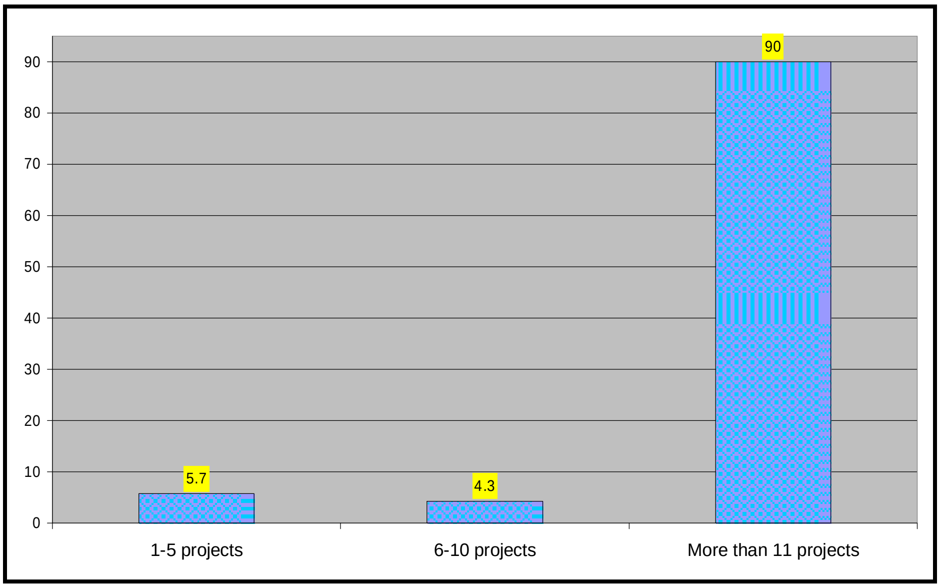

Fig (4.7) Number of structural projects executed by respondents'

4.2.8 Total value in dollars of structural projects (last five years) designed for surveyed sample (where M=Million in $).

Table (4.9) illustrates the results of total value in dollars for structural projects designed by respondents in the last five years. The results show that 8.6% of the respondents had designed structural projects of value less than 0.25M $, 4.3% of the respondents had designed structural projects of value between 0.25M-less than 0.5M$, 5.7% of the respondents had designed structural projects of value between 0.5M-less than 1 M $", 34.3% of the respondents had designed structural projects of value between 1M-5M $, and 47.1% of the respondents had designed structural projects of value more than 5M $ as shown in Fig (4.8).

Table (4.9) Total value in dollars of structural projects (where M=Million in $).

Total value in dollars of structural projects (where M=Million in $).	Frequency	percent
Less than 0.25 Million $	6	8.6
0.25- less than 0.5 Million $	3	4.3
0.5- less than 1 Million $	4	5.7
1- less than 5 Million $	24	34.3
More than 5 Million $	33	47.1
Total	70	100.0

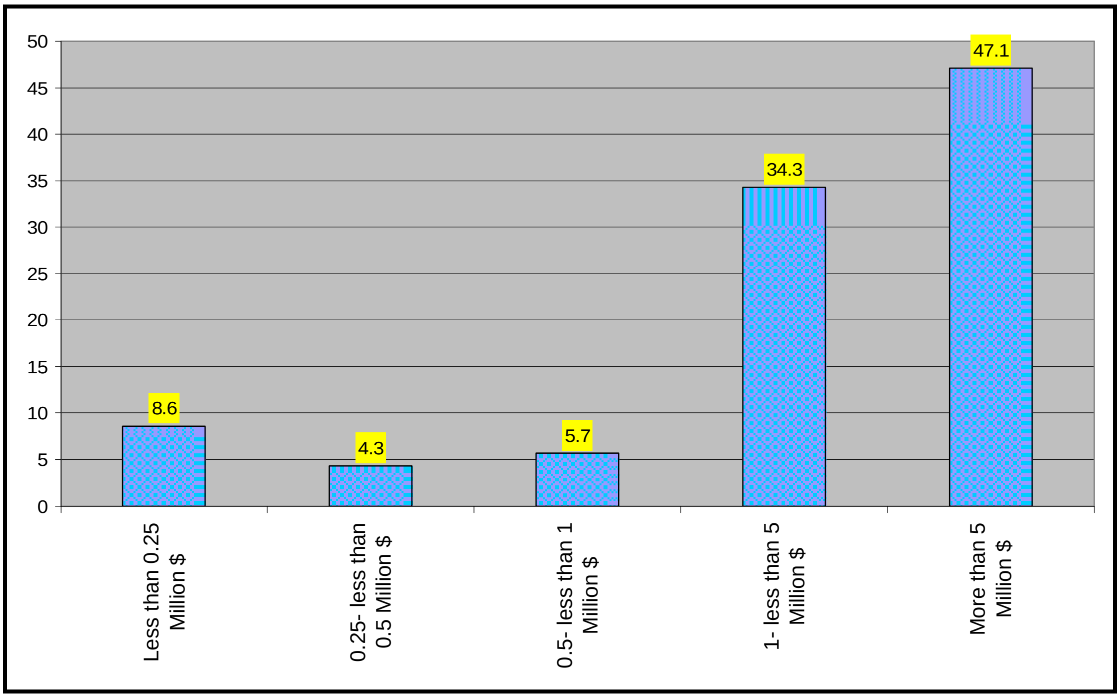

Fig (4.8) Total value in dollars of structural projects designed by respondents'

4.3 Second/ Information about the organization you work in as structural designer.

4.3.1 Organization type.

Table (4.10) shows the results of organization description of the respondents' structural designers. The results show that 5.9% of the respondents structural designers were of public owner organizations, 79.4%, were consulting office structural designers, 10.3%, were international agency structural designers and 4.4% non-governmental organizations structural designers.

Table (4.10) Organization type

Organization type.	Frequency	percent
Public owner	4	5.9
Engineering consulting office	54	79.4
International Agency (UNDP, UNRW, Etc…)	7	10.3
NGOs	3	4.4
Total	68	100.0

4.3.2 Types of the designed projects

Table (4.11) shows the results the types of structural projects designed by respondents' organization. The results demonstrate that 36.1% of the designed projects were buildings of (1-5) floors, 36.7% of the designed projects were buildings of (more than 5) floors, and 27.2% of the designed projects were others which include water tanks, domes, and steel truss.

Table (4.11) Types of the designed projects

Types of the designed projects.	Frequency	percent
Buildings of (1-5) floors	61	36.1
Buildings of (more than 5) floors	62	36.7
Others	46	27.2
Total	169	100.0

4.3.3 The average annual value of structural projects designed by the structural design organization (where M=Million in $).

Table (4.12) illustrates the results of average annual value of structural projects designed by the structural design organization. The results show that 8.6% of the respondents worked with structural design organization, who designed projects of value less than 0.25M $, 10.0% of the respondents worked with structural design organization, who designed projects of value between 0.25M-less than 0.5M $, 25.7% of the respondents worked with structural design organization, who designed projects of value between 0.5M-less than 1M $, 30.0% of the respondents worked with structural design organization, who designed projects of value between 1M-5M $, and 25.7% of the respondents worked with structural design organization, who designed projects of value more than 5M $.

Table (4.12) The average annual value of structural projects

The average annual value of structural projects which you have designed though your organization.	**Frequency**	**percent**
Less than 0.25 Million$	6	8.6
0.25- less than 0.5 Million$	7	10.0
0.5- less than 1 Million$	18	25.7
1- less than 5 Million$	21	30.0
More than 5 Million$	18	25.7
Total	70	100.0

4.3.4 Organization experience in structural design work

Table (4.13) shows the results of the organization experience in structural design work. The results indicate that 5.7% of respondent were working for organization that, had experience less than 5 years, 8.6% of respondent were working for organization that, had experience between 5-10 years, 32.9% of respondent were working for organization that, had experience between 11-15 years, 34.3% of respondent were working for organization that, had experience between 16-20 years, and 18.6% of respondent were working for organization that, had experience are more than 20 years.

Table (4.13) Organization experience in structural design work

Organization experience in structural design work	**Frequency**	**percent**
Less than 5 years	4	5.7
5-10 years	6	8.6
11-15 years	23	32.9
16-20 years	24	34.3
More than 20 years	13	18.6
Total	**70**	**100.0**

Part two: Qualification of the structural concrete designer

4.4 First/General.

4.4.1 Number of structural concrete design courses you've studied during the university study period.

Table (4.14) shows the number of structural concrete design courses studied by respondents' structural designers during the university study period. The results demonstrate that 71.4% of the respondents studied less than 4 courses, 21.4% of the respondents studied between 5-6 courses, and 7.1% of the respondents studied more than 7 courses.

Table (4.14) Number of structural concrete design courses

Number of structural concrete design courses	Frequency	percent
Less than 4 coursers	50	71.4
5-6 courses	15	21.4
More than 7 courses	5	7.1
Total	70	100.0

4.4.2 The structural design code studied

Table (4.15) shows the structural design code type which was studied by respondents' structural designers during the university study period. The results indicate that 9.0% of the respondents had studied EURO code during the university study period, 20.0% of the respondents had studied CSA code during the university study period, 4.0% of the respondents had studied BS code during the university study period, 49.0% of the respondents had studied ACI code during the university study period, 7.0% of the respondents had studied ARAB code during the university study period, 9.0% of the respondents had studied Syrian code during the university study period, and 20.0% of the respondents had studied Egyptian code during the university study period.

Table (4.15) The structural design code

The structural design code	Frequency	percent
EURO	9	9.0
CSA	2	2.0
BS	4	4.0
ACI	49	49.0
ARAB Code	7	7.0
Egyptian	20	20.0
Syrian	9	9.0
Other	0	0.0
Total	100	100.0

4.4.3 The Building code

Table (4.16) shows the structural design code type which was studied by respondents' structural designers during the university study period. The results show that 42.4% of the respondents had studied UBC code during the university study period, 9.1% of the respondents had studied IBC code during the university study period, 28.3% of the respondents had studied ASCE code during the university study period, 17.2% of the respondents had studied Arab code during the university study period, and 3.0% of the respondents had studied others code during the university study period like Chinese building code.

Table (4.16)The Building code type

The Building code type	Frequency	percent
UBC	42	42.4
IBC	9	9.1
ASCE	28	28.3
Arab code	17	17.2
Others (specify)	3	3.0
Total	99	100.0

4.5 The impact of university study on the structural concrete designer

Table (4.17) show the mean , relative important index, the results of one sample test and the respondent of the sample for each items of "**The impact of university study on the structural concrete designer**" which were as follows:

1. The relative important index for the respondent of the sample in expression " Holding training courses for the structural design programs using computer application during the university study raises the level of the structural designer" equal 0.889 and ranked first.
2. The relative important index for the respondent of the sample in expression "The practical application of the structural design during the university study raises the level of structural designer" equal 0.869 and ranked second.
3. The relative important index for the respondent of the sample in expression " Offering special Courses in structural design using computer applications during the university study raises the level of structural designer" equal 0.857 and ranked e third.
4. The relative important index for the respondent of the sample in expression "Increasing the number of design courses during university study raises the level of the designer" equal 0.840 and ranked fourth .

5. The relative important index for the respondent of the sample in expression "Increasing the number of university courses clarifies the structural design process" equal 0.840 and ranked fifth.
6. The relative important index for the respondent of the sample in expression " Increasing the number of university courses contributes to understanding of the structural design process" equal 0.834 and ranked sixth.
7. The relative important index for the respondent of the sample in expression "Supports the allocation of a special department of "structural design" at the university" equal 0.751 and ranked seventh.
8. The relative important index for the respondent of the sample in expression "Supports to teaching more than one design code in the structural design field during the university study "equal 0.746 and ranked eighth .
9. The relative important index for the respondent of the sample in expression " You felt the lack of output from the teaching way during the studying period relies on structural design field" equal 0.603 and ranked ninth.

For general the mean for all items of the impact of university study on the structural concrete designer is equal "4" and the relative important index equal 0.803, and the value of t test equal 23.162 which is greater than 1.99, and the p-value equal 0.000 which is less than 0.05 which means that there is a positive impact of university study on the structural concrete designer as shown in Table (4.17).

Table (4.17) Mean and ranking of the impact of university study on the structural concrete designer

No.	Expression	Mean	relative important index	T test	p-value	rank
9	Holding training courses for the structural design programs using computer application during the university study raises the level of the structural designer.	4.4	0.889	22.842	0.000	1
7	The practical application of the structural design during the university study raises the level of structural designer	4.3	0.869	20.989	0.000	2
8	Offering special Courses in structural design using computer applications during the university study raises the level of structural designer.	4.3	0.857	15.726	0.000	3

Contd. Table (4.17) Mean and ranking of the impact of university study on the structural concrete designer

No.	Expression	Mean	relative important index	T test	p-value	rank
1	Increasing the number of design courses during university study raises the level of the designer.	4.2	0.840	16.613	0.000	4
2	Increasing the number of university courses clarifies the structural design process.	4.2	0.840	16.613	0.000	5
3	Increasing the number of university courses contributes to understanding of the structural design process.	4.2	0.834	13.974	0.000	6
5	Supports the allocation of a special department of "structural design" at the university.	3.8	0.751	6.744	0.000	7
4	Supports to teaching more than one design code in the structural design field during the university study.	3.7	0.746	6.776	0.000	8
6	You felt the lack of output from the teaching way during the studying period relies on structural design field.	3.0	0.603	0.121	0.904	9

4.6 Training and development policies for the structural concrete designer in the field of structural design

Table (4.18) show the mean , relative important index, the results of one sample test and the respondent of the sample for each items of " **Training and development policies for the structural concrete designer in the field of structural design** " which were as follows:

1. The relative important index for the respondent of the sample in expression "Encourage the structural designer to enter the training programs" equal 0.854 and ranked first.
2. The relative important index for the respondent of the sample in expression " Reviewing the mistakes and problems you are facing during profession practice as structural concrete designer and developing appropriate solutions for them" equal 0.854 and ranked first.
3. The relative important index for the respondent of the sample in expression "Training on structural engineering analysis, where the order includes structural project elements sorted, so as to ensure the economic and technical aspects" equal 0.851 and ranked second.

4. The relative important index for the respondent of the sample in expression " Holding special training courses to refine and increase the skills of the structural designer in the field of structural concrete design" equal 0.849 and ranked third.
5. The relative important index for the respondent of the sample in expression "Training in structural engineering design and the use of approved structural systems" equal 0.837 and ranked fourth.
6. The relative important index for the respondent of the sample in expression "Learning from the best performance among others" equal 0.820 and ranked fifth .
7. The relative important index for the respondent of the sample in expression "Learning from self experience and the past experience of others" equal 0.803 and ranked sixth .
8. The relative important index for the respondent of the sample in expression "The existence of appropriate training programs and can be applied in the structural concrete design field" equal 0.791 and ranked seventh .
9. The relative important index for the respondent of the sample in expression " Determining the level of skills of the structural designer in the field of structural concrete design" equal 0.786 and ranked eighth.
10. The relative important index for the respondent of the sample in expression "Methods for determination of performance after the completion of training" equal 0.760 and ranked ninth .
11. The relative important index for the respondent of the sample in expression "Mandated policy of training for the Structural designer in structural concrete design field "equal 0.749 and ranked tenth .
12. The relative important index for the respondent of the sample in expression " Mandated policy of training for the organizations which work in the field of structural concrete design " equal 0.731 and ranked eleventh .

For general the mean for all items of training and development policies for the structural concrete designer in the field of structural design is equal "4.0" and the relative important index equal "0.807", and the value of t test equal 17.627 which is greater than 1.99, and the p-value equal 0.000 which is less than 0.05 that means all items in this group are important and the respondents agreed on these items to be considered for the development of structural designers in the field of structure design as shown in Table (4.18) .

Table (4.18) Mean and ranking of training and development policies for the structural concrete designer in the field of structural design

No.	Expression	Mean	relative important index	T test	p-value	rank
4	Encourage the structural designer to enter the training programs.	4.3	0.854	19.836	0.000	1
10	Reviewing the mistakes and problems you are facing during profession practice as structural concrete designer and developing appropriate solutions for them.	4.3	0.854	19.836	0.000	1
11	Training on structural engineering analysis, where the order includes structural project elements sorted, so as to ensure the economic and technical aspects.	4.3	0.851	18.072	0.000	2
2	Holding special training courses to refine and increase the skills of the structural designer in the field of structural concrete design.	4.2	0.849	18.907	0.000	3
12	Training in structural engineering design and the use of approved structural systems.	4.2	0.837	17.340	0.000	4
9	Learning from the best performance among others.	4.1	0.820	16.189	0.000	5
8	Learning from self experience and the past experience of others.	4.0	0.803	11.011	0.000	6
3	The existence of appropriate training programs and can be applied in the structural concrete design field.	4.0	0.791	9.716	0.000	7
1	Determining the level of skills of the structural designer in the field of structural concrete design.	3.9	0.786	11.295	0.000	8
7	Methods for determination of performance after the completion of training.	3.8	0.760	10.289	0.000	9
5	Mandated policy of training for the Structural designer in structural concrete design field.	3.7	0.749	8.027	0.000	10
6	Mandated policy of training for the organizations which work in the field of structural concrete design	3.7	0.731	7.431	0.000	11

4.7 Training needs for the structural concrete designer in the field of structural design.

Table (4.19) show the mean , relative important index, the results of one sample test and the respondent of the sample for each items for the field "**Training needs for the structural concrete designer in the field of structural design**" which were as follows:

1. The relative important index for the respondent of the sample in expression "Analysis and design of earthquake resisting systems" equal 0.866 and ranked first.
2. The relative important index for the respondent of the sample in expression " Computer applications and assistance programs in the field of design" equal 0.846 and ranked second.
3. The relative important index for the respondent of the sample in expression "Evaluation of existing structures and the extent to sustain the applied loads " equal 0.837 and ranked third .
4. The relative important index for the respondent of the sample in expression "Analysis and design of wind load resisting systems" equal 0.834 and ranked fourth.
5. The relative important index for the respondent of the sample in expression " Strengthening of existing structures to make them bear the additional loads" equal 0.820 and ranked fifth.
6. The relative important index for the respondent of the sample in expression " Analysis and design of water structures such as water reservoirs of all kinds" equal 0.794 and ranked sixth .
7. The relative important index for the respondent of the sample in expression "Professional and technical skills to the structural designer in the field of design, such as learning of new codes to increase and improve performance in the field of structural design" equal 0.777 and ranked seventh .
8. The relative important index for the respondent of the sample in expression "Analysis and design of bridges" equal 0.711 and ranked eighth .

For general the mean for all items of the training needs for the structural concrete designer in the field of structural design is equal "4.1" and the relative important index equal "0.811", and the value of t test equal 21.26 which is greater than 1.99, and the p-value equal 0.000 which is less than 0.05 which means that training needs for the structural concrete designer in the field of structural design are very important to structural designers as shown in Table (4.19) .

Table (4.19) Mean and ranking of training needs for the structural concrete designer in the field of structural design.

No.	Expression	Mean	relative important index	T test	p-value	rank
2	Analysis and design of earthquake resisting systems.	4.3	0.866	19.070	0.000	1
8	Computer applications and assistance programs in the field of design.	4.2	0.846	19.936	0.000	2
6	Evaluation of existing structures and the extent to sustain the applied loads.	4.2	0.837	20.234	0.000	3
3	Analysis and design of wind load resisting systems.	4.2	0.834	16.638	0.000	4
7	Strengthening of existing structures to make them bear the additional loads.	4.1	0.820	15.508	0.000	5
5	Analysis and design of water structures such as water reservoirs of all kinds.	4.0	0.794	11.588	0.000	6
1	Professional and technical skills to the structural designer in the field of design, such as learning of new codes to increase and improve performance in the field of structural design.	3.9	0.777	11.040	0.000	7
4	Analysis and design of bridges.	3.6	0.711	5.408	0.000	8

4.8 Educational and practical qualifications to practice the profession of structural designer.

Table (4.20) show the mean , relative important index, the results of one sample test and the respondent of the sample for each items for the field "**Educational and practical qualifications to practice the profession of structural designer**" which were as follows:

1. The relative important index for the respondent of the sample in expression "The structural design profession is only permitted for the engineers enrolled in the Engineers Association" equal 0.891 and ranked first.

2. The relative important index for the respondent of the sample in expression "The structural designer practices his engineering work, which provided for his testimony, according to the record in Engineers Association" equal 0.854 and ranked second.
3. The relative important index for the respondent of the sample in expression "Passing a exam to practice the profession under the supervision of the Engineers Association to promote to practice the profession of structural designer" equal 0.826 and ranked third.
4. The relative important index for the respondent of the sample in expression "Recently graduated engineers start practicing the work as structural designer after completing engineering in training program under the direction of licensed engineer" equal 0.809 and ranked fourth .
5. The relative important index for the respondent of the sample in expression "Rating engineers enrolled in the Engineers Association based on their design experience and the projects which they have designed" equal 0.806 and ranked fifth.
6. The relative important index for the respondent of the sample in expression "Prohibits recently graduated engineers and who have not completed the training provided by the Engineers Association of practicing the profession of structural designer to practice the profession" equal 0.803 and ranked sixth .
7. The relative important index for the respondent of the sample in expression "Supervises a specialized committee from the association to prepare the exam questions to practice the profession" equal 0.791 and ranked seventh .
8. The relative important index for the respondent of the sample in expression "Questions are comprehensive and diverse for the structural elements, which faces the structural designer" equal 0.734 and ranked eighth.

For general the mean for all items of educational and practical qualifications to practice the profession of structural designer is equal "4.1" and the relative important index equal " 0.814" , and the value of T-test equal 15.983 which is greater than 1.99, and the p-value equal 0.000 which is less than 0.05 which means that most of respondents agreed that educational and practical qualifications are very important to practice the profession of structural designer as shown in Table (4.20).

Table (4.20) Mean and ranking of educational and practical qualifications to practice the profession of structural designer

No.	Expression	Mean	relative important index	T test	p-value	rank
1	The structural design profession is only permitted for the engineers enrolled in the Engineers Association	4.5	0.891	20.105	0.000	1
2	The structural designer practices his engineering work, which provided for his testimony, according to the record in Engineers Association.	4.3	0.854	18.906	0.000	2
4	Passing an exam to practice the profession under the supervision of the Engineers Association to promote to practice the profession of structural designer.	4.1	0.826	10.496	0.000	3
3	Recently graduated engineers start practicing the work as structural designer after completing engineering in training program under the direction of licensed engineer.	4.0	0.809	11.337	0.000	4
8	Rating engineers enrolled in the Engineers Association based on their design experience and the projects which they have designed.	4.0	0.806	10.546	0.000	5
7	Prohibits recently graduated engineers and who have not completed the training provided by the Engineers Association of practicing the profession of structural designer to practice the profession.	4.0	0.803	8.744	0.000	6
5	Supervises a specialized committee from the association to prepare the exam questions to practice the profession.	4.0	0.791	8.980	0.000	7
6	Questions are comprehensive and diverse for the structural elements, which faces the structural designer.	3.7	0.734	6.157	0.000	8

4.9 Qualification of the structural concrete designer summary.

Table (4.21) show the mean , relative important index, the results of one sample test and the respondent of the sample for each items for part two "**Qualification of the structural concrete designer**" which were as follows:

1. The relative important index for the respondent of the sample in expression " Educational and practical qualifications to practice the profession of structural designer" equal 0.814 and ranked first.
2. The relative important index for the respondent of the sample in expression " Training needs for the structural concrete designer in the field of structural design" equal 0.811 and ranked second.
3. The relative important index for the respondent of the sample in expression " Training and development policies for the structural concrete designer in the field of structural design" equal 0.807 and ranked third.
4. The relative important index for the respondent of the sample in expression " The impact of university study on the structural concrete designer" equal 0.803 and ranked fourth.

For general the mean for all items of the field equal"4.0" and the relative important index equal "0.808" , and the value of T-test equal 29.111 which is greater than 1.99, and the p-value equal 0.000 which is less than 0.05 which means hat most of respondents agreed to establish a system for structural concrete designer qualification in Gaza strip as shown in Table (4.21).

Table (4.21) Mean and ranking of qualification of the structural concrete designer

No.	Category	Mean	Relative important index	T test	p-value	rank
1	Educational and practical qualifications to practice the profession of structural designer	4.1	81.4	15.983	0.000	1
2	Training needs for the structural concrete designer in the field of structural design	4.1	81.1	21.260	0.000	2
3	Training and development policies for the structural concrete designer in the field of structural design	4.0	80.7	17.627	0.000	3
4	The impact of university study on the structural concrete designer	4.0	80.3	23.162	0.000	4
Total		4.0	80.8	29.111	0.000	

Part Three: applications on the factors affecting the performance of structural designer.

4.10 Structural design method you use in the process of calculating loads on concrete structure.

Table (4.22) shows the structural design method which used by respondents' structural designer. The results indicate that 86.6% of the respondents used the ultimate strength design method, and 13.4% of the respondents used the working stress method.

Table (4.22) Structural design method

Structural design method	Frequency	percent
Ultimate strength design	58	86.6
Working stress method	9	13.4
Other methods explain	0	0.0
Total	67	100.0

4.11 analysis and design codes for earthquake-resisting systems.

Table (4.23) shows the analysis and design codes for earthquake-resisting systems which used by respondents' structural designers. The results demonstrate that 48.3% of the respondents used UBC 1994, 1997, 13.5% of the respondents used IBC2000,2003, 2006, 32.6% of the respondents used ASCE99, 2002, 2005, and 5.6% of the respondents used Other methods which include Chinese 99 and BOCA 96.

Table (4.23) Analysis and design codes for earthquake-resisting systems.

Analysis and design codes for earthquake-resisting systems	Frequency	percent
UBC 1994 UBC 1997	43	48.3
IBC 2000 IBC 2003 IBC 2006	12	13.5
ASCE 99 ASCE 2002 ASCE 2005	29	32.6
Other methods explain	5	5.6
Total	89	100.0

4.12 Analysis and design codes for wind-resisting systems.

Table (4.24) shows the analysis and design codes for wind-resisting systems which used by respondents' structural designers. The results demonstrate that 51.8% of the respondents used UBC 1994, 1997, 9.6% of the respondents used IBC2000,2003, 2006, 32.5% of the respondents used ASCE99, 2002, 2005, and 6.0% of the respondents used Other methods Chinese 99 and BOCA 96.

Table (4.24) Analysis and design codes for wind-resisting systems

Analysis and design codes for wind-resisting systems	Frequency	percent
UBC 1994 UBC 1997	43	51.8
IBC 2000 IBC 2003 IBC 2006	8	9.6
ASCE 99 ASCE 2002 ASCE 2005	27	32.5
Other methods explain	5	6.0
Total	83	100.0

4.13 Structural systems for analysis and design of earthquake-resisting systems.

Table (4.25) shows structural systems for analysis and design of earthquake-resisting systems which used by respondents' structural designers. The results demonstrate that 68.5% of the respondents used shear walls system, 18.5% of the respondents used moment resisting frame systems, 12.0% of the respondents used combined systems, and 1.1% of the respondents used other systems explain.

Table No.(4.25) Structural systems for analysis and design of earthquake-resisting systems.

structural systems for analysis and design of earthquake-resisting systems.	Frequency	percent
Shear Walls System	64	69.5
Moment Resisting Frame Systems	17	18.5
Combined Systems	11	12.0
Other systems explain	0	1.1
Total	92	100.0

4.14 Structural systems for analysis and design of wind-resisting systems.

Table (4.26) shows structural systems for analysis and design of wind-resisting systems which used by respondents' structural designers. The results indicate that 70.0% of the respondents used shear walls system, 17.8% of the respondents used moment resisting frame systems, 12.2% of the respondents used combined systems.

Table (4.26) structural systems for analysis and design of wind-resisting systems

structural systems for analysis and design of wind-resisting systems	Frequency	percent
Shear Walls System	63	70.0
Moment Resisting Frame Systems	16	17.8
Combined Systems	11	12.2
Other systems explain	0	0.0
Total	90	100.0

4.15 special computer software used for structural design.

Table (4.27) shows special computer software for structural design which used by respondents' structural designers. The results demonstrate that 80.0% of the respondents are able to use special computer software for structural design, and 20.0% of the respondents are not able to use special computer software for structural design.

Table (4.27) special computer software for structural design.

special computer software for structural design.	Frequency	percent
Yes	56	80.0
No	14	20.0
Total	70	100.0

4.16 Computer software used for analysis of concrete structure.

Table (4.28) shows computer software used for analysis of concrete structure by respondents' structural designers. The results demonstrate that 16.3% of the respondents used SAP 2000 for analysis of concrete structure, 5.7% of the respondents used ETABS9 for analysis of concrete structure, 17.0% of the respondents used SAFE 8 for analysis of concrete structure, 27.0% of the respondents used STAAD-Pro for analysis of concrete structure, 26.2% of the respondents used prokon for analysis of concrete structure, and 7.8% of the respondents used other software which include CBM, MIDAS,CSI, and ALPLA.

Table (4.28) computer software used for analysis of concrete structure

computer software used for analysis of concrete structure	Frequency	percent
SAP 2000	23	16.3
ETABS9	8	5.7
SAFE 8	24	17.0
STAAD-Pro	38	27.0
Prokon	37	26.2
Other software explain	11	7.8
Total	141	100.0

4.17 computer software used for design of concrete structure.

Table (4.29) shows computer software used for analysis of concrete structure by respondents' structural designers. The results demonstrate that 16.5% of the respondents used SAP 2000 for design of concrete structure, 5.8% of the respondents used ETABS9 for design of concrete structure, 10.7% of the respondents used SAFE 8 for design of concrete structure, 24.0% of the respondents used STAAD-Pro for design of concrete structure, 25.6% of the respondents used Prokon for design of concrete structure, and 17.4% of the respondents used manual design for design of concrete structure.

Table (4.29) computer software used for design of concrete structure

computer software used for design of concrete structure	Frequency	percent
SAP 2000	20	16.5
ETABS9	7	5.8
SAFE 8	13	10.7
STAAD-Pro	29	24.0
Prokon	31	25.6
Manual design	21	17.4
Total	121	100.0

4.18 Using software in the structural design process contributes to the completion of design in a shorter period of time

Table (4.30) shows respondents' opinion in using software in the structural design process contributes to the completion of design in a shorter period of time. The results indicate that 64.3% of the respondents agrees that using software in the structural design process contributes to the completion of design in a shorter period of time, and 35.7% of the respondents agrees that using software in the structural design process sometimes contributes to the completion of design in a shorter period of time.

Table (4.30) Using software in the structural design process contributes to the completion of design in a shorter period of time

Using software in the structural design process contributes to the completion of design in a shorter period of time	Frequency	percent
Yes	45	64.3
No	0	0.0
Sometimes	25	35.7
Total	70	100.0

4.19 Using software in the structural design process contributes to achieve the results of the design in much precise way than those given by the manual design

Table (4.31) show that 52.9% from the samples agrees that the using software in the structural design process contributes to achieve the results of the design in much precise way than those given by the manual design, 11.4% from the samples agrees that the using software in the structural design process not contributes to achieve the results of the design in much précis way than those given by the manual design, and 35.7% from the samples agrees that the using software in the structural design process sometimes contributes to achieve the results of the design in much précis way than those given by the manual design

Table (4.31) Using software in the structural design process contributes to achieve the results of the design in much précis way than those given by the manual design

Using software in the structural design process contributes to the completion of design in a shorter period of time	Frequency	percent
Yes	37	52.9
No	8	11.4
Sometimes	25	35.7
Total	70	100.0

Part 4: Evaluation of structural design auditing process

Table (4.32) show the mean , relative important index, the results of one sample test and the respondent of the sample for each items for the field "**The impact of university study on the structural concrete designer**" which were as follows:

1. The relative important index for the respondent of the sample in expression " Setting a criteria to determine the scientific and practical qualifications for structural design reviewer" equal 0.894 and ranked first .
2. The relative important index for the respondent of the sample in expression " The importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer" equal 0.880 and ranked second.
3. The relative important index for the respondent of the sample in expression " Structural designer is held responsible, in all cases, for the structural design which he has designed" equal 0.874 and raked third.
4. The relative important index for the respondent of the sample in expression " The existence of a clear calculation sheet , facilitates and accelerates the process of auditing the structural plans by the audit committee" equal 0.846 and ranked fourth.
5. The relative important index for the respondent of the sample in expression " One structural design reviewer is unable to understand all the known design codes, and structural design systems" equal 0.829 and ranked fifth .
6. The relative important index for the respondent of the sample in expression " One structural design reviewer in the auditing committee to review the structural plans is insufficient" equal 0.806 and ranked sixth.
7. The relative important index for the respondent of the sample in expression " Structural plans auditing take a long time due to the existence of one structural design reviewer who is unfamiliar with all design codes" equal 0.786 and ranked seventh.
8. The relative important index for the respondent of the sample in expression " Structural plans auditing takes a long time due to the existence of one structural design reviewer" equal 0.769 and ranked eighth .
9. The relative important index for the respondent of the sample in expression " Structural design reviewer in the Engineers Association focuses on the basic structural elements" equal 0.763 and ranked ninth .

10. The relative important index for the respondent of the sample in expression " Structural auditing results are satisfactory for the structural designer ,generally " equal 0.717 and ranked tenth.
11. The relative important index for the respondent of the sample in expression " Find the form and contents of the calculation sheet required by the Auditing Committee sometimes exaggerated" equal 0.637 and ranked eleventh .
12. The relative important index for the respondent of the sample in expression " Approval of Structural drawings through the Engineers Association is sufficient for the safety of structure" equal 0.626 and ranked twelfth.
13. The relative important index for the respondent of the sample in expression " Structural design auditing by another engineer working in another office before adoption" equal 0.469 and ranked thirteenth .
14. The relative important index for the respondent of the sample in expression " Structural design review by special auditing committee relieves the responsibility of structural designer" equal 0.446 and ranked fourteenth .

For general the mean for all items of the field equal and the relative important index equal , and the value of t test equal which is greater than 1.99, and the p-value equal which is less than 0.05 which means that most of respondents structural designers agree on setting a criteria to upgrade structural design auditing process.

Table (4.32) Mean and ranking of evaluation of structural design auditing process.

No.	Expression	Mean	relative important index	T test	p-value	rank
1	Setting a criteria to determine the scientific and practical qualifications for structural design reviewer	4.5	0.894	22.084	0.000	1
9	The importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer.	4.4	0.880	18.795	0.000	2
13	Structural designer is held responsible, in all cases, for the structural design which he has designed.	4.4	0.874	22.254	0.000	3
11	The existence of a clear calculation sheet , facilitates and accelerates the process of auditing the structural plans by the auditing committee	4.2	0.846	16.636	0.000	4

Contd. Table (4.32) Mean and ranking of evaluation of structural design auditing process.

No.	Expression	Mean	relative important index	T test	p-value	rank
4	One structural design reviewer is unable to understand all the known design codes, and structural design systems.	4.1	0.829	14.365	0.000	5
3	One structural design reviewer in the auditing committee to review the structural plans is insufficient.	4.0	0.806	10.784	0.000	6
6	Structural plans auditing take a long time due to the existence of one structural design reviewer who is unfamiliar with all design codes.	3.9	0.786	9.882	0.000	7
5	Structural plans auditing takes a long time due to the existence of one structural design reviewer.	3.8	0.769	8.706	0.000	8
8	Structural design reviewer in the Engineers Association focuses on the basic structural elements.	3.8	0.763	8.672	0.000	9
7	Structural auditing results are satisfactory for the structural designer ,generally.	3.6	0.717	6.358	0.000	10
10	Find the form and contents of the calculation sheet required by the Auditing Committee sometimes exaggerated.	3.2	0.637	1.815	0.074	11
2	Approval of Structural drawings through the Engineers Association is sufficient for the safety of structure.	3.1	0.626	0.885	0.379	12
14	Structural design auditing by another engineer working in another office before adoption.	2.3	0.469	-4.667	0.000	13
12	Structural design review by special auditing committee relieves the responsibility of structural designer.	2.2	0.446	-6.684	0.000	14

4.18 The differences between population characteristics in regards to qualification of structural concrete designers, and evaluation of structural design auditing process.

The One-Way ANOVA procedure produces a one-way analysis of variance for the quantitative dependent variables by a single factor (independent) variable. Analysis of variance is used to test the null hypothesis which states, that several mean are equal. This null hypothesis investigated for the five major groups and single independent variable.

4.18.1 The differences due to scientific qualification with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.

One-Way ANOVA applied to test the major null hypothesis which states that, there is no significant difference in the mean value of the qualification of structural concrete designer categories, and evaluation of structural design auditing process category in structural design field due to scientific qualification at level $\alpha = 0.05$where ,results are shown in Table (4.33). This major null hypothesis is investigated for each group separately as follow:

Table (4.33) One-Way ANOVA (scientific qualification with qualification of structural concrete designer, and evaluation of structural design auditing process).

Scientific qualification	Average of mean				
	Bachelor's Degree	Master's Degree	Ph.D. Degree	F	α
The impact of university study on the structural concrete designer	4.0612	3.9907	3.8025	1.979	0.146
Training and development policies for the structural concrete designer in the field of structural design	4.0748	3.8819	4.0278	0.738	0.482
Training needs for the structural concrete designer in the field of structural design	4.1046	4.0000	3.8472	1.614	0.207
Educational and practical qualifications to practice the profession of structural designer	4.0459	4.0313	4.2639	0.604	0.549
Evaluation of structural design auditing process	3.7566	3.4286	3.6984	2.630	0.079

Hypothesis one:

There is no significant difference in mean value for the impact of university study on the structural concrete designer category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis one and the results are shown in Table (4.33). The results shows that, the value of α for the impact of university study on the structural concrete designer category is equal to 0.146 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for the impact of university study on the structural concrete designer category due to the scientific qualification of the respondents at level 0.05.

Hypothesis two:

There is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.33). The results shows that, the value of α for training and development policies for the structural concrete designer in the field of structural design category is equal to 0.482 this is greater than 0.05 that means the acceptance of the null hypothesis that states there is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to the scientific qualification of the respondents at level 0.05.

Hypothesis three:

There is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.33). The results shows that, the value of α for training needs for the structural concrete designer in the field of structural design category is equal to 0.207 this is greater than 0.05 that means the acceptance of the null hypothesis that states there is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to the scientific qualification of the respondents at level 0.05.

Hypothesis four:

There is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.33). The results shows that, the value of α for educational and practical qualifications to practice the profession of structural designer category is equal to 0.549 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to the scientific qualification of the respondents at level 0.05.

Hypothesis five:

There is no significant difference in mean value for Evaluation of structural design auditing process category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.33). The results shows that, the value of α for Evaluation of structural design auditing process category is equal to 0.549 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for educational Evaluation of structural design auditing process category due to the scientific qualification of the respondents at level 0.05.

4.18.2 The differences due to year of graduation with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.

One-Way ANOVA applied to test the major null hypothesis which states that, there is no significant difference in the mean value of the qualification of structural concrete designer categories, and evaluation of structural design auditing process category in structural design field due to year of graduation at level $\alpha = 0.05$, results are shown in Table (4.34). This major null hypothesis is investigated for each group separately as follow:

Table (4.34) One-Way ANOVA (year of graduation with qualification of structural concrete designer, and evaluation of structural design auditing process).

Year of graduation	Average of mean							
	1975-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	F	α
The impact of university study on the structural concrete designer	4.6389	4.0238	3.8485	3.9091	4.0048	4.1111	3.632	0.006
Training and development policies for the structural concrete designer in the field of structural design	4.4167	4.0536	3.7652	4.1212	3.9674	4.2976	1.802	0.125
Training needs for the structural concrete designer in the field of structural design	4.5313	4.0625	4.0000	4.1023	3.9022	4.2679	2.320	0.053
Educational and practical qualifications to practice the profession of structural designer	2.9063	4.3036	4.1591	4.3636	4.0380	3.7857	7.188	0.000
Evaluation of structural design auditing process	3.4286	3.7704	3.5519	3.7662	3.6863	3.8163	0.710	0.618

Hypothesis one:

There is no significant difference in mean value for the impact of university study on the structural concrete designer category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis one and the results are shown in Table (4.34). The results shows that, the value of α for the impact of university study on the structural concrete designer category is equal to 0.006 which is less than 0.05, this means the rejection of the null hypothesis that states there is no significant difference in mean value for the impact of university study on the structural concrete designer category due to the year of graduation of the respondents at level 0.05.

Hypothesis two:

There is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.34). The results shows that, the value of α for training and development policies for the structural concrete designer in the field of structural design category is equal to 0.125 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to the year of graduation of the respondents at level 0.05.

Hypothesis three:

There is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.34). The results shows that, the value of α for training needs for the structural concrete designer in the field of structural design category is equal to 0.053 this is greater than 0.05 which means the acceptance of the null hypothesis that states there is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to the year of graduation of the respondents at level 0.05.

Hypothesis four:

There is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.34). The results shows that, the value of α for educational and practical qualifications to practice the profession of structural designer category is equal to 0.000 which is less than 0.05 this means the rejection of the null hypothesis that states there is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to the year of graduation of the respondents at level 0.05.

Hypothesis five:

There is no significant difference in mean value for Evaluation of structural design auditing process category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.34). The results shows that, the value of α for Evaluation of structural design auditing process category is equal to 0.618, which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for educational Evaluation of structural design auditing process category due to the year of graduation of the respondents at level 0.05.

4.18.3 The differences due to experience with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.

One-Way ANOVA applied to test the major null hypothesis which states that, there is no significant difference in the mean value of the qualification of structural concrete designer categories, and evaluation of structural design auditing process category in structural design field due to experience at level α = 0.05, results are shown in Table (4.35). This major null hypothesis is investigated for each group separately as follow:

Table (4.35) One-Way ANOVA (experience with qualification of structural concrete designer, and evaluation of structural design auditing process).

Experience	**Average of mean**						
	Less than 5 years	**5-10 years**	**11-15 years**	**16-20 years**	**More than 20 years**	**F**	**α**
The impact of university study on the structural concrete designer	3.7222	4.2083	3.9744	3.8815	4.0455	2.526	0.049
Training and development policies for the structural concrete designer in the field of structural design	4.0000	4.2813	4.1410	3.9056	3.8902	2.008	0.104
Training needs for the structural concrete designer in the field of structural design	3.9688	4.1406	3.9712	3.9917	4.0966	0.475	0.754
Educational and practical qualifications to practice the profession of structural designer	3.5625	4.1719	4.1827	4.1750	3.9545	1.487	0.216
Evaluation of structural design auditing process	3.6964	3.8616	3.7418	3.7143	3.5260	1.368	0.255

Hypothesis one:

There is no significant difference in mean value for the impact of university study on the structural concrete designer category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis one and the results are shown in Table (4.35). The results shows that, the value of α for the impact of university study on the structural concrete designer category is equal to 0.049 which is less than 0.05

that means the rejection of the null hypothesis that states there is no significant difference in mean value for the impact of university study on the structural concrete designer category due to the year of graduation of the respondents at level 0.05.

Hypothesis two:

There is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.35). The results shows that, the value of α for training and development policies for the structural concrete designer in the field of structural design category is equal to 0.104 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to the year of graduation of the respondents at level 0.05.

Hypothesis three:

There is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.35). The results shows that, the value of α for training needs for the structural concrete designer in the field of structural design category is equal to 0.754 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to the year of graduation of the respondents at level 0.05.

Hypothesis four:

There is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.35). The results shows that, the value of α for educational and practical qualifications to practice the profession of structural designer category is equal to 0.216 which is greater than 0.05 that means the acceptance of the null hypothesis that states there is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to the year of graduation of the respondents at level 0.05.

Hypothesis five:

There is no significant difference in mean value for Evaluation of structural design auditing process category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.35). The results shows that, the value of α for Evaluation of structural design auditing process category is equal to 0.255 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for educational Evaluation of structural design auditing process category due to the year of graduation of the respondents at level 0.05.

4.18.4 The differences due to organization type with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.

One-Way ANOVA applied to test the major null hypothesis which states that, there is no significant difference in the mean value of the qualification of structural concrete designer categories, and evaluation of structural design auditing process category in structural design field due to experience at level $\alpha = 0.05$, where results are shown in Table (4.36). This major null hypothesis is investigated for each group separately as follow:

Table (4.36) One-Way ANOVA (organization type with qualification of structural concrete designer, and evaluation of structural design auditing process).

Organization	Average of mean					
	Public owner	**Engineering consulting office**	**International Agency**	**NGOs**	**F**	**α**
The impact of university study on the structural concrete designer	3.8889	3.9691	4.2698	4.2963	2.226	0.094
Training and development policies for the structural concrete designer in the field of structural design	4.1042	4.0262	4.0000	4.0556	0.041	0.989
Training needs for the structural concrete designer in the field of structural design	3.9063	4.0417	4.1607	4.2917	0.639	0.592
Educational and practical qualifications to practice the profession of structural designer	4.2813	4.0741	3.9464	3.8333	0.457	0.713
Evaluation of structural design auditing process	3.6786	3.6944	3.8878	3.4762	0.643	0.590

Hypothesis one:

There is no significant difference in mean value for the impact of university study on the structural concrete designer category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis one and the results are shown in Table (4.36). The results shows that, the value of α for the impact of university study on the structural concrete designer category is equal to 0.094 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for the impact of university study on the structural concrete designer category due to the year of graduation of the respondents at level 0.05.

Hypothesis two:

There is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.36). The results shows that, the value of α for training and development policies for the structural concrete designer in the field of structural design category is equal to 0.989 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for training and development policies for the structural concrete designer in the field of structural design category due to the year of graduation of the respondents at level 0.05.

Hypothesis three:

There is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.36). The results shows that, the value of α for training needs for the structural concrete designer in the field of structural design category is equal to 0.592 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for training needs for the structural concrete designer in the field of structural design category due to the year of graduation of the respondents at level 0.05.

Hypothesis four:

There is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to scientific qualification of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.36). The results shows that, the value of α for educational and practical qualifications to practice the profession of structural designer category is equal to 0.713

which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for educational and practical qualifications to practice the profession of structural designer category due to the year of graduation of the respondents at level 0.05.

Hypothesis five:

There is no significant difference in mean value for Evaluation of structural design auditing process category due to year of graduation of the respondents at level 0.05.

One-Way ANOVA applied to test the hypothesis two and the results are shown in Table (4.36). The results shows that, the value of α for Evaluation of structural design auditing process category is equal to 0.590 which is greater than 0.05 this means the acceptance of the null hypothesis that states there is no significant difference in mean value for educational Evaluation of structural design auditing process category due to the year of graduation of the respondents at level 0.05.

CHAPTER 5

Conclusions and Recommendations

5.1 Introduction

This chapter includes the conclusions and recommendation that would help in investigating the structural concrete design profession in Gaza Strip. The first objective of this study is to investigate the qualification requirements for structural concrete engineers based on the prevailing conditions in Gaza Strip, and the experience gained by reputable institutions in the developed countries. The second to identify suitable qualification requirements for structural concrete engineers working as design reviewers. The third to compare the review process required for approving structural design documents in Gaza Strip case with those adopted in some other countries. The fourth is to recommend a solid design code to control the design and construction of reinforced concrete projects in Gaza strip. The fifth is to specify training needs for structural concrete engineers in Gaza strip to cope with changes in design codes/ standards, and to be on the top of their field. The sixth objective is to propose a mechanism for implementing the outcome of the research.

5.2 Conclusions

This part of the research concludes the main findings as follows:

5.2.1 Qualification of the structural concrete designer

This part of thesis consist of 5 categories that influence the qualification of structural concrete designer.

5.2.1.1 The impact of university study on the structural concrete designer

This part of the research investigated the impact of university study on the structural concrete designer. Results indicated that the expression " Holding training courses for the structural design programs using computer application during the university study raises the level of the structural designer" has been ranked first by respondents structural designers as shown in Table (5.1). This indicates the high importance of holding training courses in developing the skills of structural designers in the field of structural design. and contributes to the completion of design in shorter periods of time. Using computer application contributes to solving complicated problems in field structural design. Using computer application contributes to achieving the results of the design in much prices way than given by manual design. The practical application of the structural design during the university study plays a major role in capacity building in the field of structural design to became professional structural designer. Also increasing the number of design courses during university study contributes to understanding and clarifying the design process, in addition to gainin more information about different types of structures and how to deal with such structures.

Table (5.1) The five most important impacts of university study on the structural concrete designer

The impact of university study on the structural concrete designer.	Mean	rank
Holding training courses for the structural design programs using computer applications during the university study raises the level of the structural designer.	4.4	1
The practical application of the structural design during the university study raises the level of structural designer	4.3	2
Offering special courses in structural design using computer applications during the university study raises the level of structural designer.	4.3	3
Increasing the number of design courses during university study raises the level of the designer.	4.2	4
Increasing the number of university courses clarifies the structural design process.	4.2	5

5.2.1.2 Training and development policies for the structural concrete designer in the field of structural design

Results indicated that the expression " Encourage the structural designer to undertake the training programs " and " Reviewing the mistakes and problems you are facing during profession practice as structural concrete designer and developing appropriate solutions for them". have been ranked first by respondents structural designer as shown in Table (5.2). This results indicate that the training of structural designers in the field of structure design is one of most important categories in the finding of this research. The structural designer engineers is found to have a good background on the training role in the development their skills in the structural design field but there are no policies in the organizations which work in the field of structural design for adopting the training as method for the development of structural designers engineers. The governmental organizations have limited vision toward the training and the role of training policy in the field of structural design.

Table (5.2) The six most important training and development policies for the structural concrete designer in the field of structural design

Training and development policies for the structural concrete designer in the field of structural design	**Mean**	**rank**
Encourage the structural designer to undertake the training programs.	4.3	1
Reviewing the mistakes and problems you are facing during profession practice as structural concrete designer and developing appropriate solutions for them.	4.3	1
Training on structural engineering analysis, where the order includes structural project elements sorted, so as to ensure the economic and technical aspects.	4.3	2
Holding special training courses to refine and increase the skills of the structural designer in the field of structural concrete design.	4.2	3
Training in structural engineering design and the use of approved structural systems.	4.2	4
Learning from the best performance among others.	4.1	5

5.1.2.3 Training needs for the structural concrete designer in the field of structural design.

This category included eleven training needs and investigated the most needed training programs for structural designers engineers. Table 5.3 shows the five most important training needs. Results indicated that the expression " Analysis and design of earthquake resisting systems". This indicates the high importance of holding training course in analysis and design of earthquake resisting systems. The respondents structural designers engineers are found to have inadequate background about analysis and design of structures resist earthquake forces.

Table (5.3) The five most important training needs for the structural concrete designer in the field of structural design.

Training needs for the structural concrete designer in the field of structural design.	**Mean**	**rank**
Analysis and design of earthquake resisting systems.	4.3	1
Computer applications and assistance programs in the field of design.	4.2	2
Evaluation of existing structures and the extent to sustain the applied loads.	4.2	3
Analysis and design of wind load resisting systems.	4.2	4
Strengthening of existing structures to make them bear the additional loads.	4.1	5

5.1.2.3 Educational and practical qualifications to practice the profession of structural designer.

Results indicated that the expression " The structural design profession is only permitted for the engineers enrolled in the Engineers Association " is ranked first by respondents structural designer and " The structural designer practices his engineering work, which provided for his testimony, according to the record in Engineers Association.". has been ranked in second position by respondents structural designer as shown in Table (5.4). This results indicates that most of respondents structural designers agree that regulation and registration should be accomplished through a self governing body, that is given the power to register and discipline engineers as well as regulate the field of engineering in their province, and engineers are not allowed to work in other fields. Results show that it is against the law to practice the structural design engineering work without permission from the Engineers Association in Gaza Strip. Results also have shown that structural designer is not allowed to practice the structural engineering works or make technical decisions on his responsibility without completing an Engineer in Training program under the direction of expert structural designer engineer, in addition to passing practical exam in structural design accredited from the Engineers Association in Gaza Strip.

Table (5.4) The most important five educational and practical qualifications to practice the profession of structural designer

Educational and practical qualifications to practice the profession of structural designer	Mean	rank
The structural design profession is only permitted for the engineers enrolled in the Engineers Association.	4.5	1
The structural designer practices his engineering work, which provided for his testimony, according to the record in Engineers Association.	4.3	2
Passing a exam to practice the profession under the supervision of the Engineers Association to promote to practice the profession of structural designer.	4.1	3
Recently graduated engineers start practicing the work as structural designer after completing engineering in training program under the direction of licensed engineer.	4.0	4
Rating engineers enrolled in the Engineers Association based on their design experience and the projects which they have designed.	4.0	5

5.2.2 Applications on the factors affecting the performance of structural designer.

5.2.2.1 Percentage of respondents structural designers that used structural design method in the process of calculating loads on concrete structure.

Table (5.5) shows the structural design method which used by respondents' structural designer. The results indicate that 86.6% of the respondents used the ultimate strength design method, and 13.4% of the respondents used the working stress method. This refer to that most of structural engineers who work in the structural design are new graduate from national Palestinian universities which teaching ultimate strength design method for their students.

Table (5.5) Percentage of respondents structural designers that used structural design method in the process of calculating loads on concrete structure.

Analysis and design code for earthquake-resisting systems.	**Percent value**		
	Ultimate strength design	**Working stress method**	**Other**
Respondents Structural designers	86.6%	13.4%	0

5.2.2.2 Percentage of respondents structural designers that used analysis and design codes for earthquake-resisting systems.

Table (5.6) shows the analysis and design codes for earthquake-resisting systems which used by respondents' structural designers. The results demonstrate that 28.6% of the respondents used UBC1994, 18.6 % of the respondents used UBC1997, 5.7% of the respondents used IBC2000, 5.7% of the respondents used IBC2003, 5.7% of the respondents used IBC2006, 21.4% of the respondents used ASCE-98, 10% of the respondents used ASCE-2002, and 10% of the respondents used ASCE-2005.

This results indicate that most structural designers engineers use UBC 1994, and UBC 1997 for analysis and design of earthquake resisting systems which considered as old codes. This refers to lack of holding training courses for structural designers engineers to cope with the new design codes, especially structural engineers who graduated before long time periods of time.

Table (5.6) Percentage of respondents structural designers that used analysis and design codes for earthquake-resisting systems in Gaza Strip.

Analysis and design code for earthquake-resisting systems.	**Percent value**							
	UBC 1994	**UBC 1997**	**IBC 2000**	**IBC 2003**	**IBC 2006**	**ASCE -98**	**ASCE-2002**	**ASCE -2005**
Respondents Structural designers	28.6%	18.6%	5.7%	5.7%	5.7%	21.4%	10%	10%

5.2.2.3 Percentage of respondents structural designers that used analysis and design codes for wind-resisting systems.

Table (5.7) shows the analysis and design codes for earthquake-resisting systems which used by respondents' structural designers. The results demonstrate that 28.6% of the respondents used UBC1994, 18.6 % of the respondents used UBC1997, 5.7% of the respondents used IBC2000, 5.7% of the respondents used IBC2003, 2.9% of the respondents used IBC2006, 21.4% of the respondents used ASCE-98, 8.6% of the respondents used ASCE-2002, and 8.6% of the respondents used ASCE-2005.

This results indicate that most structural designers engineers use UBC 1994, and UBC 1997 for analysis and design of wind resisting systems which considered as old codes. This refers to lack of holding training courses for structural designers engineers to cope with the new design codes, especially structural engineers who graduated before long time periods of time.

Table (5.7) Percentage of respondents structural designers that used analysis and design codes for wind-resisting systems in Gaza Strip.

Analysis and design code for Wind-resisting systems.	**Percent value**							
	UBC 1994	**UBC 1997**	**IBC 2000**	**IBC 2003**	**IBC 2006**	**ASCE-98**	**ASCE -2002**	**ASCE-2005**
Respondents Structural designers	28.6%	18.6%	5.7%	5.7%	2.9%	21.4%	8.6%	8.6%

5.2.2.4 Percentage of respondents structural designers that used structural systems for analysis and design of earthquake-resisting systems.

Table (5.8) shows structural systems for analysis and design of earthquake-resisting systems which used by respondents' structural designers. The results demonstrate that 91.4% of the respondents used shear walls system, 24.3% of the respondents used moment resisting frame systems, 15.5% of the respondents used combined systems, and

0.00% of the respondents used other systems. This results indicate that structural designers engineers in Gaza Strip use shear walls system as main earthquake. Also this refer to that most of structural engineers who work in the structural design are recently graduated from national Palestinian universities which teaching shear walls system for resisting earthquake.

Table (5.8) Percentage of respondents structural designers that used structural systems for analysis and design of earthquake-resisting systems in Gaza Strip.

Analysis and design code for earthquakes-resisting systems.	**Percent value**			
	SWS	**MRFS**	**COS**	**Other**
Respondents Structural designers	91.4%	24.3%	15.7%	0

5.2.2.5 Percentage of respondents structural designers that used structural systems for analysis and design of wind-resisting systems.

Table (5.9) shows structural systems for analysis and design of wind-resisting systems which used by respondents' structural designers. The results indicate that 90.0 % of the respondents used shear walls system, 22.9% of the respondents used moment resisting frame systems, 15.7% of the respondents used combined systems. This results indicate that structural designers engineers in Gaza Strip use shear walls system as main earthquake. Also this refer to that most of structural engineers who work in the structural design are recently graduated from national Palestinian universities which teaching shear walls system for resisting earthquake.

Table (5.9) Percentage of respondents structural designers that used analysis and design codes for wind-resisting systems in Gaza Strip.

Analysis and design code for Wind-resisting systems.	**Percent value**			
	SWS	**MRFS**	**COS**	**Other**
Respondents Structural designers	90.0%	22.9%	15.7%	0

5.2.2.6 Percentage of respondents structural designers that used computer software used for analysis of concrete structure.

Table (5.10) shows computer software used for analysis of concrete structure by respondents' structural designers. The results demonstrate that 32.9% of the respondents used SAP 2000 for analysis of concrete structure, 11.4% of the respondents used ETABS9 for analysis of concrete structure, 34.3% of the respondents used SAFE 8 for analysis of concrete structure, 54.30% of the respondents used STAAD-Pro for analysis of concrete structure, 52.9% of the respondents used Prokon for analysis of concrete structure, and 15.7% of the respondents used other software which include CBM, MIDAS,CSI, and ALPLA. The results indicate that STAAD-Pro is the most important, famous and easy program used by respondents structural designers engineers for analysis of concrete structure. Also this program enables them to analysis any structural system and update any change in the system during the process of analysis.

Table (5.10) Percentage of respondents structural designers that used computer software used for analysis of concrete structure.

computer software used for analysis of concrete structure	Percent value					
	SAP 2000	ETABS 9	SAFE 8	STAAD-Pro	Proken	Other
Respondents Structural designers	32.9%	11.4%	34.3%	54.3%	52.9%	15.7%

5.2.2.7 Percentage of respondents structural designers that used computer software used for design of concrete structure.

Table (5.11) shows computer software used for analysis of concrete structure by respondents' structural designers. The results demonstrate that 28.6% of the respondents used SAP 2000 for analysis of concrete structure, 10.0% of the respondents used ETABS9 for analysis of concrete structure, 18.6% of the respondents used SAFE 8 for analysis of concrete structure, 41.40% of the respondents used STAAD-Pro for analysis of concrete structure, 44.30% of the respondents used Prokon for analysis of concrete structure, and 30.0% of the respondents used other software which include CBM, MIDAS,CSI, and ALPLA. The results indicate that Prokon is the most important, famous and easy program used by respondents structural designers engineers for design of concrete structure. Because the program deals with all familiar code, in addition to the ease in for entering input data for any structural element, and the output results for any design structural element is precise and concise.

Table (5.11) Percentage of respondents structural designers that used computer software used for design of concrete structure.

computer software used for design of concrete structure	Percent value					
	SAP 2000	ETABS 9	SAFE 8	STAAD-Pro	Proken	Other
Respondents Structural designers	28.6%	10.0%	18.6%	41.4%	44.3%	30.0%

5.2.2.8 Percentage of respondents structural designers that used special computer software used for structural design.

Table (5.12) shows special computer software for structural design which used by respondents' structural designers. The results demonstrate that 80.0% of the respondents are able to use special computer software for structural design, and 20.0% of the respondents are not able to use special computer software for structural design. This results show that most of structural designers are able to use special computer software for structural design because contributes to the completion of design in a shorter period of time with much précis way than those given by those given by the manual design.

Table (5.12) Percentage of analysis and design codes that used special computer software for structural design.

Special computer software for structural designer.	Percent value	
	Yes	No
Respondents Structural designers	80.0%	20.0%

Finally, a major obstacle that faces newly graduated engineers is lack of national building codes that govern the design and construction of structure. Local universities use international design codes (standards) for teaching their students, similar to American (ACI, ASCI), and European standard (EURO code) are dominant.

Engineers who graduated from other international universities use different design codes (standards) throughout their undergraduate studies.

5.2.3 Evaluation of structural design auditing process

Results indicated that the expression "Setting a criteria to determine the scientific and practical qualifications for structural design reviewer" have been ranked in first by respondents' structural designer as shown in Table (5.13). This indicates that Design Reviewers must first meet special qualifications according to the countries they are working in and, becoming a member of review committee for the local authorities is not an easy thing. Also, results show the high importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer and most of respondent's structural designers agree that. Because it shows there design criteria, applied loads and the used structural system by structural designer. In addition, the early discovery of mistakes that might occur during the design process before starting the construction phase. This results indicates that most of respondents structural designers agree that one structural design reviewer is in the auditing committee of Engineers Association in Gaza unable to understand all the known design codes and insufficient to review all the structural plans.

Table (5.13) The six most important expression of evaluation of structural design auditing process.

Evaluation of structural design auditing process	Mean	rank
Setting a criteria to determine the scientific and practical qualifications for structural design reviewer	4.5	1
The importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer.	4.4	2
Structural designer is held responsible, in all cases, for the structural design which he has designed.	4.4	3
The existence of a clear calculation sheet , facilitates and accelerates the process of auditing the structural plans by the audit committee	4.2	4
One structural design reviewer is unable to understand all the known design codes, and structural design systems.	4.1	5
One structural design reviewer in the auditing committee to review the structural plans is insufficient.	4.0	6

The application of One-way ANOVA test on the results obtained from population characteristics in regards to qualification of structural concrete designer, and evaluation of structural design auditing process indicate that:

1. There is no significant relationship between scientific qualification with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.
2. There is significant relationship between year of graduation with qualification of structural concrete designer categories due to the difference in the views of respondents' structural designers toward the impact of university study on the structural concrete designer , also respondents' structural designers have a difference in the views toward educational and practical qualifications to practice the profession of structural designer due to their graduation year.
3. But there is significant relationship between year of graduation and evaluation of structural design auditing process category.

4. There is no significant relationship between experience with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.
5. There is no significant relationship between organization type with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.
6. There is no significant relationship between scientific qualification with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.
7. There is significant relationship between year of graduation with qualification of structural concrete designer categories due to the difference in the views of respondents' structural designers toward the impact of university study on the structural concrete designer , also respondents' structural designers have a difference in the views toward educational and practical qualifications to practice the profession of structural designer due to their graduation year.
8. But there is significant relationship between year of graduation and evaluation of structural design auditing process category.
9. There is no significant relationship between experience with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.
10. There is no significant relationship between organization type with qualification of structural concrete designer categories, and evaluation of structural design auditing process category.

5.3 Recommendations

Recommendation to the concerned authorities and organizations that work in the structural design field which may lead to the development of the structural concrete design profession in Gaza strip, are listed below.

5.3.1 Responsible authority on structural design profession

The Engineering Association in Gaza Strip is recommended to perform the following activities:

1. Conduct statistical information on the structural designer engineers which is available in the structural field (Their number, ages, experience, skills, etc…..).
2. Setting qualification requirements for structural designers' engineers based on the prevailing condition in Gaza strip.
3. Setting a specific produces for registration and regulation of professional structural engineers in Gaza strip.
4. Examining the adequacy of ACI code for local situation, because it was evident through the study it is the most frequently used by the structural designers engineers in Gaza strip.
5. Conduct training and education programs to the structural designer engineers to improve their skills in the field of structural design.
6. Formulating regulations by Engineering Association to set the responsibilities placed upon the structural designer engineers.
7. Passing an exam to practice the profession under the supervision of the Engineers Association to promote to practice the profession of structural designer.
8. Setting a criteria to determine the scientific and practical qualifications for structural design reviewer.
9. The Engineering Association auditing Committee should consist of more than one licensed structural engineer to review the structural plans.
10. Asserting on the importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer.

5.3.2 Organization

Organizations which work in the field of structural design are key players in developing the structural design filed. Organizations responsibilities are:

1. Encourage the structural designer to enter the training programs to improve their skills in the structural concrete design field.
2. Establish Methods for measure of performance after the completion of training.
3. Prohibit new graduating engineers and those who have not completed the training provided by the Engineers Association from practicing the profession of structural designer in their organization.
4. Provide incentives programs to the structural designer to improve their performance in structural design filed.

5.4 Proposed Flowchart for registration and regulation of structural design engineers in Gaza Strip based on questionnaire results.

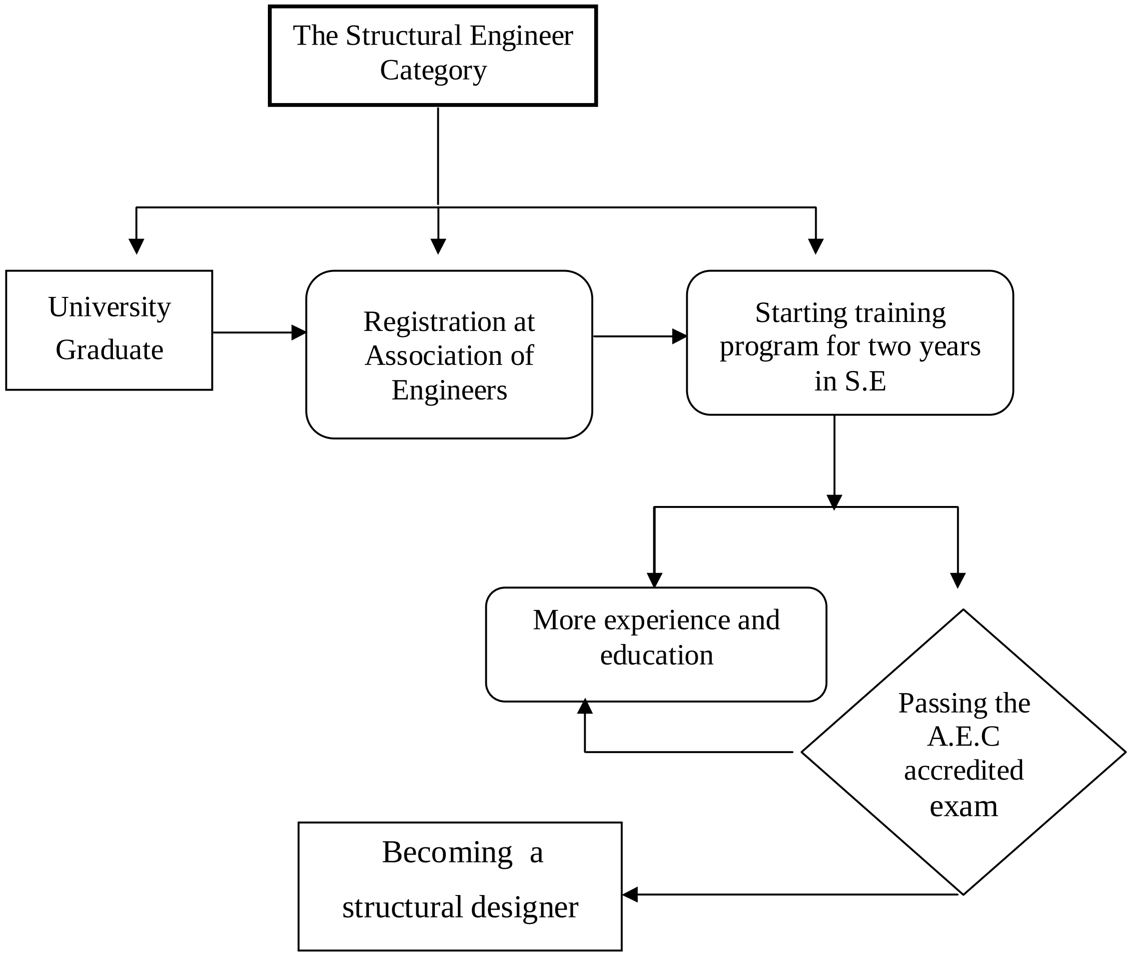

Figure (5.1) Structural Engineer qualification process flowchart in Gaza Strip .

5.5 Comparison between the current situation in Gaza Strip with other countries.

One of the objectives of research is to compare the qualification requirements for structural concrete designers, and the review process required for approving structural design documents in Gaza Strip with those adopted in other countries. The comparison that will be presented in Table (5.14), and Table (5.15) will show the main differences in follow up systems for qualification structural concrete designers, and reviewing process for structural design documents in Gaza Strip and other countries. Also it will show the variables that effect the development of structural design field in Gaza Strip.

5.5.1 Comparison between the qualification requirements in Gaza Strip with those adopted in other countries.

Table (5.14) Comparison between the qualification requirements in Gaza Strip with those adopted in other countries

No	Comparison Items	Country Name				
		U.S	U.K	Canada	Egypt	Gaza Strip
1	Recently graduated engineers start practicing the work as structural designer after completing (EIT) under the direction of licensed engineer.	applicable	applicable	applicable	applicable	Not applicable
2	Passing an exam to practice the profession under the supervision of the concerned authorities.	applicable	applicable	applicable	applicable	Not applicable
3	The structural design profession is only permitted for licensed structural engineers (P.E).	applicable	applicable	applicable	applicable	Not applicable
4	Supervises a specialized committee from the concerned authorities to prepare the exam questions to practice the profession structural design.	applicable	applicable	applicable	applicable	Not applicable
5	Prohibits recently graduated engineers of practicing the profession of structural designer.	applicable	applicable	applicable	applicable	Not applicable
6	Restrict the experience years for engineers whom want to practice the profession of structural designer.	applicable	applicable	applicable	applicable	Not applicable
7	The title "Structural Design Engineer" is legally protected by local authorities.	applicable	applicable	applicable	applicable	Not applicable

5.5.2 Comparison between the process of approving structural design documents in Gaza Strip with those adopted in other countries.

Table (5.15) Comparison between the process of approving structural design documents in Gaza Strip with those adopted in other countries.

No	Comparison Items	Country Name				
		U.S	U.K	Canada	Egypt	Gaza Strip
1	Different procedures, admission standards and approval of structural plans in municipalities and Engineering Association (local authority).	Not applicable	Not applicable	Not applicable	Not applicable	applicable
2	Some municipalities (local authority) auditing committee employee have other jobs in some engineering office after office hours.	Not applicable	Not applicable	Not applicable	Not applicable	applicable
3	The lacks of building regulations which make it vague and varied in different municipalities.	Not applicable	Not applicable	Not applicable	Not applicable	applicable
4	Deficiencies in knowledge of regulations and procedures of municipalities by structural designers in engineering offices and consulting due to large revisions.	Not applicable	Not applicable	Not applicable	Not applicable	applicable
5	Lack of experience of design reviewers in a large number of observed cases.	Not applicable	Not applicable	Not applicable	Not applicable	applicable
6	Assign one structural engineer to carry out the whole reviewing process of structural documents, in spite of different design used codes by designer engineers. This due to unavailability of national design code.	Not applicable	Not applicable	Not applicable	Not applicable	applicable

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List of Annexes

Viewpoints of structural designers questionnaire:

- **Annex 1: questionnaire in Arabic language**
- **Annex 2: questionnaire in English language**

Annex 1

The Islamic University - Gaza
Higher Education Deanship
Faculty of Engineering
Civil Engineering Department
Design and Rehabilitation of Structures

الجامعـــــة الإســــــلامية ـ غـــــزة
عمـــــــادة الدراســــــات العليـــــا
كليـــــــــــــة الهندســـــــــــــة
قـــــسم الهندســـــــة المدنيــــــة
تــــصميم و تأهيـــــل المنـــــشآت

استبيان
حول دراسة مهنة التصميم الإنشائي الخرساني في قطاع غزة

وجهة نظر المصممين الإنشائيين

استكمالا لمتطلبات الحصول على درجة الماجستير في تصميم وتأهيل المنشآت

الباحث
المهندس/ محمد عبد الكريم أبو عقلين

المشرف
الدكتور/ سمير شحادة

March, 2008

<u>استبيان حول دراسة مهنة التصميم الإنشائي الخرساني في قطاع غزة</u>

يعبأ من قبل (المصممين الإنشائيين)

السادة المحترمين:

السلام عليكم ورحمة الله و بركاته و بعد:

بداية أتقدم لكم بجزيل الشكر و الامتنان لمساهمتكم بجزء من وقتكم الثمين للإجابة على هذه الاستبانة، وألفت عناية حضراتكم إلي الملاحظات الآتية:

1. يعتبر هذا الاستبيان جزء من دراسة حول مهنة التصميم الإنشائي الخرساني في قطاع غزة.
2. الدراسة هي البحث التكميلي لنيل شهادة الماجستير في تصميم و تأهيل المنشآت.
3. يأمل الباحث أن تسهم الدراسة في تحسين أداء المصمم الإنشائي في مجال التصميم الإنشائي.
4. تقديرا لجهودكم و مشاركتكم في تعبئة هذه الاستبانة فإن الباحث سيطلعكم على نتائج الدراسة للاستفادة منها قدر الإمكان ولخدمة مجال التصميم الإنشائي في قطاع غزة.
5. المعلومات التي ستساهمون بها هي لغرض البحث العلمي، وسيتم الالتزام التـام بالمحافظـة علـى سـرية المعلومات الخاصة بكم.
6. يرجو الباحث أن تكون المعلومات صحيحة و دقيقة للوصول إلى النتائج المرجوة من هذا البحث.

مكونات الاستبيان:

- معلومات عامة
- تأهيل المصمم الإنشائي الخرساني
- تقييم عملية مراجعة وتدقيق المخططات الإنشائية
- التطبيقات المتعلقة بالعوامل المؤثرة على أداء المصمم الإنشائي

مع خالص الشكر والتمنيات بالتوفيق

الجزء الأول: معلومات عامة

أولاً / بيانات شخصية : يرجي اختيار الإجابة التي ترونها مناسبة بوضع علامة (X)

1. الجنس

ذكر	أنثي

2. مكان التخرج (حسب أخر مؤهل علمي حصلت عليه):

جامعة وطنية (قطاع غزة)	جامعة وطنية (الضفة الغربية)	جامعة عربية	جامعة غربية (أوربا – أمريكيا)	جامعة من الاتحاد السوفيتي	أخري

3. سنة التخرج:

قبل1975	1980-1975	1985-1981	1990-1986	1995-1991	2000-1996	2005-2001	2006 حتى الآن

4.المؤهل العلمي

بكالوريوس	ماجستير	دكتوراه

5. سنوات الخبرة العملية:

أقل من5 سنوات	5-10 سنوات	11-15 سنوات	16-20 سنوات	أكثر من عشرين سنة

6. عملت كمصمم إنشائي في السوق (يمكن اختيار أكثر من إجابة):

محلي	إقليمي	دولي	لم أعمل

7. عدد المشاريع الإنشائية التي قمت بتصميمها خلال عملك مجال التصميم الإنشائي:

1-5 مشاريع	6 -10 مشاريع	11 فأكثر

8. إجمالي قيمة المشاريع الإنشائية التي قمت بتصميمها خلال خمس سنوات الماضية: (حيث م=مليون دولار أمريكي)

أقل من 0.25 م	0.25م إلي أقل من 0.50م	0.50م إلي أقل من 1م	1م إلي أقل من 5م	5م فأكثر

<u>ثانيا/ معلومات عن المؤسسة التي تعمل فيها كمصمم إنشائي</u>: يرجي اختيار الإجابة التي ترونها مناسبة بوضع علامة (X)

1. تصنيف المؤسسة التي تعمل بها حاليا:

قطاع عام	مكتب هندسي استشاري	مؤسسة أجنبية (UNDP, UNRW, Etc..)	مؤسسة غير حكومية

2. نوعية المشاريع التي يتم تصميمها من خلال المؤسسة التي تعمل لديها (يمكن اختيار أكثر من إجابة):

مباني مكونة (1-5) طوابق	مباني مكونة (خمس طوابق فأكثر)	أخري

3. المتوسط السنوي بالدولار لقيمة المشاريع الإنشائية التي تم تصميمها من خلال المؤسسة التي تعمل لديها: (حيث م=مليون دولار أمريكي)

أقل من 0.5م	0.5م إلي أقل من 1م	1.0م إلي أقل من 3م	3.0م إلي أقل من 5م	5م فأكثر

4. سنوات خبرة مؤسستك في مجال التصميم الإنشائي:

أقل من5 سنوات	5-10 سنوات	11-15 سنوات	16-20 سنوات	أكثر من عشرين سنة

الجزء الثاني: تأهيل المصمم الإنشائي الخرساني

أولاً/عام : يرجي اختيار الإجابة التي ترونها مناسبة بوضع علامة (X)

1. عدد مساقات التصميم الإنشائي الخرساني التي قمت بدراستها خلال المرحلة الجامعية______مساق
2. كود التصميم الإنشائي الخرساني الذي قمت بدراستها خلال المرحلة الجامعية (يمكن اختيار أكثر من إجابة).

EURO	CSA	BS	ACI
ARAB Code	other	Syrian	Egyptian

3. كود البناء (Building Code) الذي قمت بدراسته خلال المرحلة الجامعية (يمكن اختيار أكثر من إجابة).

UBC	IBC	ASCE	Arab code	Other (specify)

اعتمادا على خبرتك في مجال التصميم الإنشائي الرجاء حدد درجة الموافقة على العناصر الآتية في تأهيل المصمم الإنشائي الخرساني.

م	العبارة	أوافق بشدة	أوافق	محايد	أرفض	أرفض بشدة
أولاً: تأثير الدراسة الجامعية على المصمم الإنشائي الخرساني						
1	زيادة عدد مساقات التصميم الإنشائي خلال فترة الدراسة الجامعية ترفع من مستوي المصمم الإنشائي.					
2	زيادة عدد المساقات خلال الفترة الجامعية يوضح عملية التصميم الإنشائي.					
3	زيادة عدد المساقات خلال الفترة الجامعية يساهم في فهم عملية التصميم الإنشائي.					
4	تؤيد تدريس أكثر من كود تصميمي واحد في مجال التصميم الإنشائي خلال فترة الدراسة الجامعية.					
5	تؤيد تخصيص الجامعة لقسم خاص ب" التصميم الإنشائي"					
6	شعرت بنقص ناتج من الطريقة التدريسية خلال فترتك الدراسية المتعلقة بمجال التصميم الإنشائي.					
7	التطبيق العملي للتصميم الإنشائي خلال فترة الدراسة الجامعية ترفع من مستوي المصمم الإنشائي.					
8	طرح مساقات خاصة بتطبيقات التصميم الإنشائي					

م	العبارة	أوافق بشدة	أوافق	محايد	أرفض	أرفض بشدة
	باستخدام الحاسوب خلال فترة الدراسة الجامعية ترفع من مستوي المصمم الإنشائي.					
9	عقد دورات تدريبية لبرامج التصميم الإنشائي باستخدام الحاسوب خلال فترة الدراسة الجامعية ترفع من مستوي المصمم الإنشائي.					
ثانيا: التدريب و سياسات التطوير للمصمم الإنشائي الخرساني في مجال التصميم الإنشائي						
1	تحديد مستوي المهارات لدي المصمم الإنشائي في مجال التصميم الإنشائي الخرساني.					
2	عقد دورات تدريبية خاصة لصقل وزيادة المهارات للمصمم الإنشائي في مجال التصميم الإنشائي الخرساني.					
3	وجود برامج تدريبية مناسبة و قابلة للتطبيق في مجال التصميم الإنشائي.					
4	تشجيع المصمم الإنشائي للدخول في البرامج التدريبية.					
5	سياسة تكليف التدريب للمصمم الإنشائي في مجال التصميم الإنشائي الخرساني.					
6	سياسة تكليف التدريب للمؤسسات التي تعمل في مجال التصميم الإنشائي الخرساني.					
7	طرق قياس تحسين المهارات و الأداء بعد الانتهاء من التدريب.					
8	التعلم من الخبرة الذاتية و الخبرة السابقة.					
9	التعلم من الأداء الأفضل لدي الآخرين.					
10	مراجعة الأخطاء و المشاكل التي تواجهها خلال ممارسة مهنة التصميم الإنشائي الخرساني ووضع الحلول المناسبة لها.					
11	التدريب على التحليل الهندسي الإنشائي حيث تشمل ترتيب عناصر المشروع الإنشائية بما يؤمن الناحية الفنية و الاقتصادية.					
12	التدريب على التصميم الهندسي و استعمال النظم الإنشائية المعتمدة.					

م	العبارة	أوافق بشدة	أوافق	محايد	أرفض	أرفض بشدة
	ثالثا: الاحتياجات التدريبية للمصمم الإنشائي الخرساني في مجال التصميم الإنشائي (لأي درجة تعتقد أن البرامج التدريبية الآتية ضرورية)					
1	المهارات الفنية و التقنية لدي المصمم الإنشائي في مجال التصميم الإنشائي الخرساني مثل تعليمه أكواد جديدة لزيادة وتحسين الأداء في مجـال التـصميم الإنشائي.					
2	تحليل و تصميم الأنظمة المقاومة للزلازل.					
3	تحليل و تصميم الأنظمة المقاومة للرياح.					
4	تحليل و تصميم الكباري و الجسور.					
5	تحليل و تصميم المنشآت المائية مثـل الخزانـات بكافة أنواعها .					
6	تقييم المنشآت القائمة ومدي تحملها للقوي المـؤثرة عليها					
7	تقوية المنشآت القائمة لجعلها تتحمل أحمال أضافية					
8	تطبيقات الكمبيوتر و البرامج المساعدة في مجـال التصميم					
	رابعا: المؤهلات العلمية و العملية المطلوبة لممارسة مهنة المصمم الإنشائي (لأي درجة تعتقد أن الأحكام الآتية و اللوائح ضرورية)					
1	يحظر تماما مزاولة مهنة المـصمم الإنـشائي إلا للمهندسين المقيدين لدي نقابة المهندسين.					
2	إن يمارس المصمم الإنشائي عمله الهندسـي فـي تخصصه الذي تنص عليه شهادته و طبقـا لقيـده بنقابة المهندسين.					
3	إن يبدأ المهندس المتخرج حـديثا عملـه كمـصمم إنشائي بعد خضوع إلي فترة تدريب تحت أشـراف مهندس مرخص له في مجال التصميم الإنشائي.					
4	اجتياز امتحان لمزاولة المهنة تحت إشراف نقابـة المهندسين يؤهله لمزاولة مهنة المصمم الإنشائي.					
5	تشرف لجنة متخصصة من النقابة على وضع أسئلة الامتحان لمزاولة المهنة.					
6	تشرف لجنة متخصصة من النقابة على وضع أسئلة الامتحان.					

أرفض بشدة	أرفض	محايد	أوافق	أوافق بشدة	العبارة	م
					تكون الأسئلة شاملة و متنوعة للعناصر الإنــشائية التي قد يواجهها المصمم الإنشائي.	7
					يحظر المهندسون حديثي التخرج و الذين لم ينهــوا فترة التدريب المنصوص عليها من نقابة المهندسين مزاولة مهنة المصمم الإنشائي	8
					تصنيف المهندسين المقيدين في نقابـــة المهندســين حسب خبراتهم التصميمية وحسب المشاريع التــي قاموا بتصميمها	9

الجزء الثالث: التطبيقات المتعلقة بالعوامل المؤثرة على أداء المصمم الإنشائي

1. أي نوع من طرق التصميم الإنشائي تستخدم في عملية حساب الأحمال علي المنشآت الخرسانية.

c طريقة الإجهادات القصوى (Ultimate strength design)	c طريقة الأحمال التشغيلية (Working stress method)	c طرق أخري وضح--------

2. أي من الأكواد الآتية تستخدم في تحليل و تصميم المنشآت المقاومة للزلال (يمكن اختيار أكثر من إجابة).

UBC 1994 c UBC 1997 c	IBC 2000 c IBC 2003 c IBC 2006 c	ASCE 98 c ASCE 2002 c ASCE 2005 c	c طرق أخري وضح-----

3. أي من الأكواد الآتية تستخدم في تحليل و تصميم المنشآت المقاومة للرياح (يمكن اختيار أكثر من إجابة).

UBC 1994 c UBC 1997 c	IBC 2000 c IBC 2003 c IBC 2006 c	ASCE 98 c ASCE 2002 c ASCE 2005 c	c طرق أخري وضح-----

4. أي من الأنظمة الإنشائية الآتية تستخدم في تحليل و تصميم المنشآت المقاومة للزلال (يمكن اختيار أكثر من إجابة).

c نظام حوائط القص الخرسانية (shear walls)	c نظام إطاري مقاوم للعزوم (Moment Resisting Frame)	c النظام الإنشائي المشترك بين النظامين السابقين (Combined System)	c أنظمة أخري وضح-----

5. أي من الأنظمة الإنشائية الآتية تستخدم في تحليل و تصميم المنشآت المقاومة للرياح (يمكن اختيار أكثر مـــن إجابة).

c نظام حوائط القص الخرسانية (shear walls)	c نظام إطاري مقاوم للعزوم (Moment Resisting Frame)	c النظام الإنشائي المشترك بين النظامين السابقين (Combined System)	c أنظمة أخري وضح-----

6. هل تجيد استخدام برامج الكمبيوتر الخاصة بالتصميم الإنشائي.

c نعم	c لا

7. أي من برامج الكمبيوتر الآتية تستخدم في تحليل المنشآت الخرسانية (يمكن اختيار أكثر من إجابة).

SAP 2000 c	ETABS9 c	SAFE 8 c	STAAD-Pro c	Prokon c	c برامج أخري وضح------

8. أي من برامج الكمبيوتر الآتية تستخدم في تصميم المنشآت الخرسانية (يمكن اختيار أكثر من إجابة).

SAP 2000 c	ETABS9 c	SAFE 8 c	STAAD-Pro c	Prokon c	c تصميم يدوي

9.هل استخدام برامج الكمبيوتر في عملية التصميم الإنشائي يسهم في أنجاز التصميم في مدة زمنية أقصر.

c نعم	c لا	c أحيانا

10. هل استخدام برامج الكمبيوتر في عملية التصميم الإنشائي يسهم في أعطاء نتائج تصميم أدق من تلك التـــي يعطيها التصميم اليدوي.

c نعم	c لا	c أحيانا

الجزء الرابع: تقييم عملية مراجعة وتدقيق المخططات الإنشائية

اعتمادا على خبرتك في مجال التصميم الإنشائي الرجاء حدد درجة الموافقة على العناصر الآتية في تقييم عملية مراجعة وتدقيق المخططات الإنشائية

م	العبارة	أوافق بشدة	أوافق	محايد	أرفض	أرفض بشدة
1	وضع معايير تحدد مؤهلات المدقق الإنشائي العلمية والعملية					
2	اعتماد المخططات الإنشائية من خلال نقابة المهندسين يعتبر كافيا لسلامة المنشأ.					
3	وجود مدقق واحد في لجنة التدقيق لمراجعة المخططات الإنشائية غير كافي.					
4	مدقق واحد غير قادر على الإلمام بجميع أكواد التصميم المعروفة وأنظمة التصميم الإنشائي					
5	تستغرق عملية تدقيق المخططات الإنشائية وقت طويل لوجود مدقق واحد.					
6	تستغرق عملية تدقيق المخططات الإنشائية وقت طويل لوجود مدقق واحد غير ملم بجميع أكواد التصميم المعروفة.					
7	تكون نتائج التدقيق الإنشائي مرضية للمصمم الإنشائي بشكل عام.					
8	يركز المدقق الإنشائي في نقابة المهندسين على العناصر الإنشائية الأساسية.					
9	أهمية تقديم مذكره حسابية للتدقيق توضح الكود التصميمي المستخدم و نظرية التصميم من قبل المصمم الإنشائي.					
10	تجد شكل ومحتويات المذكرة الحسابية المطلوبة من قبل لجنة التدقيق مبالغا فيه أحيانا.					
11	وجود مذكره حسابية واضحة يسهل ويسرع عملية التدقيق الإنشائي للمخططات الإنشائية من قبل لجنة التدقيق					
12	مراجعة المخططات الإنشائية من قبل لجان التدقيق المختصة يخلي مسؤولية المصمم الإنشائي.					
13	يتحمل المصمم الإنشائي في كل الأحوال مسؤولية التصميم الإنشائي الذي قام به.					
14	تدقيق المخططات الإنشائية من قبل مهندس أخر يعمل في مكتب أخر قبل اعتمادها.					

Annex 2

The Islamic University - Gaza
Higher Education Deanship
Faculty of Engineering
Civil Engineering Department
Design and Rehabilitation of Structures

الجامعـــــة الإســـلامية – غـــزة
عمـــــادة الدراســـــات العليـــــا
كليــــــــــة الهندســــــــــة
قـــسم الهندســـــة المدنيـــــة
تـــصميم و تأهيــــل المنـــشآت

Questionnaire

INVESTIGATING THE STRUCTURAL CONCRETE DESIGN PROFESSION IN GAZA STRIP

Viewpoints of structural designers

To fulfill the requirements of the Mater's
degree of in design and rehabilitation of structures

Researcher
Engineer/ Mohammad A.K. Abu Aqleen

Supervised by
Dr. Samir Shihada

April, 2008

Questionnaire Related to Investigating the structural concrete design profession in Gaza strip.

To be filled up by structural designers

Dear Sirs:

Pace Be Upon You:

Firstly, I would like to express my gratitude for you for the valuable time you are using to answer the questions include in this questionnaire moreover, I would like:

1. This questionnaire is part of a study related to profession of structural concrete design in Gaza strip.
2. To fulfill the requirements of the Mater degree of in design and rehabilitation of structure
3. The researcher hopes that this research will enhance the profession of structural engineers in design field.
4. As a reward to your contribution and efforts in filling up this questionnaire the researcher will provide you with the research results.
5. The information you will provide will be used for scientific research. This information you are providing will be kept secret.
6. The researcher is asking for correct and accurate information in order to satisfy the objectives of this research.

The questionnaire composed of the following:

- General information.
- Capacity building of structural concrete designers.
- Evaluation of auditing structural design and drawings.
- Applications related to factors affecting performance of structural designer's

Thank you for your efforts

Part one: General Information

First/Personal information: Please select the answer that you deem appropriate by placing (X)

1. Sex :

Male	Female

2. Graduation place (according to the latest attained scientific degree):

National University (Gaza Strip)	National University (Waste Bank)	ARAB Universities	Western University (Europe - U.S.)	University for the Soviet Union	Other

3. Year of graduation:

Before 1975	1975-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006 Until Now

4. scientific qualifications:

Bachelor	Master	Ph.D.

5. Years of practical experience:

Less than 5 years	5-10 years	11-15 years	16-20 years	More than 20 years

6. Have you worked as, structural designer? (you may choose more than one answer):

Local	Regional	International	I have not work

7. Number of structural projects that you've designed during your work as structural designer:

1-5 projects	6-10 projects	More than 11 projects

8. Total value of structural projects that you have designed during the last five years (where M=Million in $)

Less than 0.25M	0.25- less than 0.5M	0.5M- less than 1M	1M- less than 5M	More than 5M

Second/ Information about the organization you work in as structural designer :

Please choose the answer that you deem appropriate placing (X)

1. Category of the organization you are currently working at.

Public owner	Engineering consulting office	International Agency (UNDP, UNRW, Etc…)	NGOs

2. Types of projects that you have designed though your organization you working at.

Buildings of (1-5) floors	Buildings of (more than 5) floors	Others

3. The average annual value of structural projects which you have designed though your organization (where M=Million in $)

Less than 0.25M	0.25- less than 0.5M	0.5M- less than 1M	1M- less than 5M	More than 5M

4. Which best describe your organization working experience?

Less than 5 years	5-10 years	11-15 years	16-20 years	More than 20 years

Part two: Qualification of the structural concrete designer

First/General: Please choose the answer that you deem appropriate placing (X)

1. Number of structural concrete design courses you've studied during the university study period_____ Courses.
2. The structural design code, which you've studied during the university study period (may choose more than one answer).

ACI	BS	CSA	EURO
Egyptian	Syrian	other	ARAB Code

3. The Building code, which you've studied during the university study period (may choose more than one answer).

UBC	IBC	ASCE	Arab code	Others (specify)

S No.	Expression	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
First: The impact of university study on the structural concrete designer.						
1	Increasing the number of design courses during university study raises the level of the designer.					
2	Increasing the number of university courses clarifies the structural design process.					
3	Increasing the number of university courses contributes to understanding of the structural design process.					
4	Supports to teaching more than one design code in the structural design field during the university study.					
5	Supports the allocation of a special department of "structural design" at the university.					
6	You felt the lack of output from the teaching way during the studying period relies on structural design field.					
7	The practical application of the structural design during the university study raises the level of structural designer					
8	Offering special Courses in structural design using computer applications during the university					

S No.	Expression	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
	study raises the level of structural designer.					
9	Holding training courses for the structural design programs using computer application during the university study raises the level of the structural designer.					
Second: Training and development policies for the structural concrete designer in the field of structural design.						
1	Determining the level of skills of the structural designer in the field of structural concrete design.					
2	Holding special training courses to refine and increase the skills of the structural designer in the field of structural concrete design.					
3	The existence of appropriate training programs and can be applied in the structural concrete design field.					
4	Encourage the structural designer to enter the training programs.					
5	Mandated policy of training for the Structural designer in structural concrete design field.					
6	Mandated policy of training for the organizations which work in the field of structural concrete design					
7	Methods for determination of performance after the completion of training.					
8	Learning from self experience and the past experience of others.					
9	Learning from the best performance among others.					
10	Reviewing the mistakes and problems you are facing during profession practice as structural concrete designer and developing appropriate solutions for them.					
11	Training on structural engineering analysis, where the order includes structural project elements sorted, so as to ensure the economic and technical aspects.					
12	Training in structural engineering design and the use of approved structural systems.					
Third: Training needs for the structural concrete designer in the field of structural design (to what degree you believe that the following training programs are necessary)						
1	Professional and technical skills to					

S No.	Expression	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
	the structural designer in the field of design, such as learning of new codes to increase and improve performance in the field of structural design.					
2	Analysis and design of earthquake resisting systems.					
3	Analysis and design of wind load resisting systems.					
4	Analysis and design of bridges.					
5	Analysis and design of water structures such as water reservoirs of all kinds.					
6	Evaluation of existing structures and the extent to sustain the applied loads.					
7	Strengthening of existing structures to make them bear the additional loads.					
8	Computer applications and assistance programs in the field of design.					
Fourth: Educational and practical qualifications to practice the profession of structural designer (to what degree you believe that the following provisions and regulations are necessary)						
1	The structural design profession is only permitted for the engineers enrolled in the Engineers Association.					
2	The structural designer practices his engineering work, which provided for his testimony, according to the record in Engineers Association.					
3	Recently graduated engineers start practicing the work as structural designer after completing engineering in training program under the direction of licensed engineer.					
4	Passing a exam to practice the profession under the supervision of the Engineers Association to promote to practice the profession of structural designer.					
5	Supervises a specialized committee from the association to prepare the exam questions to practice the profession.					
6	Supervises a specialized committee from the association is to prepare					

S No.	Expression	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
	the exam questions.					
7	Questions are comprehensive and diverse for the structural elements, which faces the structural designer.					
8	Prohibits recently graduated engineers and who have not completed the training provided by the Engineers Association of practicing the profession of structural designer to practice the profession.					
9	Rating engineers enrolled in the Engineers Association based on their design experience and the projects which they have designed.					

Part Three: applications on the factors affecting the performance of structural designer.

1. Which of structural design method you use in the process of calculating loads on concrete structure.

c Ultimate strength design	c Working stress method	c Other methods explain -----------

2. Which of the following codes do you use in the analysis and design of earthquake-resisting systems? (May choose more than one answer).

c UBC 1994 c UBC 1997	c IBC 2000 c IBC 2003 c IBC 2006	c ASCE 98 c ASCE 2002 c ASCE 2005	c Other methods explain -----------

3. Which of the following codes do you use in the analysis and design of wind-resisting systems? (May choose more than one answer).

c UBC 1994 c UBC 1997	c IBC 2000 c IBC 2003 c IBC 2006	c ASCE 98 c ASCE 2002 c ASCE 2005	c Other methods explain -------------

4. Which of the following structural systems do you use in the analysis and design of earthquake-resisting systems? (May choose more than one answer).

c (Shear Walls System)	c (Moment Resisting Frame Systems)	c (Combined Systems)	c Other systems explain--------

5. Which of the following structural systems do you use in the analysis and design of wind-resisting systems? (Can choose more than one answer).

c (Shear Walls System)	c (Moment Resisting Frames Systems)	c (Combined Systems)	c Other systems explain-------------

6. Are you able to use special computer software for structural design?

c Yes	c No

7. Which of the following computer software do you use in analysis of concrete structure? (May choose more than one answer).

c SAP 2000	c ETABS9	c SAFE 8	c STAAD-Pro	c Prokon	c Other software explain ------------

8. Which of the following computer software do you use in design of concrete structure? (May choose more than one answer).

c SAP 2000	c ETABS9	c SAFE 8	c STAAD-Pro	c Prokon	c Manual design ------------

9. Do you think using software in the structural design process contributes to the completion of design in a shorter period of time?

c Yes	c No	c Sometimes

10. Do you think using software in the structural design process contributes to achieve the results of the design in much précis way than those given by the manual design?

c Yes	c No	c Sometimes

Part 4: Evaluation of structural design auditing process.

Depending on your experience of structural design to what degree you believe that the following are necessary in evaluation of structural design auditing process

S No.	Expression	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Setting a criteria to determine the scientific and practical qualifications for structural design reviewer					
2	Approval of Structural drawings through the Engineers Association is sufficient for the safety of structure.					
3	One structural design reviewer in the auditing committee to review the structural plans is insufficient.					
4	One structural design reviewer is unable to understand all the known design codes, and structural design systems.					
5	Structural plans auditing takes a long time due to the existence of one structural design reviewer.					
6	Structural plans auditing take a long time due to the existence of one structural design reviewer who is unfamiliar with all design codes.					
7	Structural auditing results are satisfactory for the structural designer ,generally.					
8	Structural design reviewer in the Engineers Association focuses on the basic structural elements.					
9	The importance of providing calculation sheet for auditing illustrates the used design code and design theory by the structural designer.					
10	Find the form and contents of the calculation sheet required by the Audit Committee sometimes exaggerated.					
11	The existence of a clear calculation sheet , facilitates and accelerates the process of auditing the structural plans by the audit committee					
12	Structural design review by special auditing committee relieves the responsibility of structural designer.					
13	Structural designer is held responsible, in all cases, for the structural design which he has designed.					
14	Structural design auditing by another engineer working in another office before adoption.					