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ENTRY TO EMPLOYMENT:

CHOICES MADE BY QUALIFIED

WOMEN CIVIL ENGINEERS LEAVING HIGHER EDUCATION

SUZANNE WILKINSON

A thesis submitted in partial fulfilment of the
requirements of Oxford Brookes University
for the degree of Doctor of Philosophy

October 1993

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ABSTRACT

SUZANNE WILKINSON

ENTRY TO EMPLOYMENT: CHOICES MADE BY QUALIFIED WOMEN CIVIL ENGINEERS LEAVING HIGHER EDUCATION

DOCTOR OF PHILOSOPHY

The subject of this thesis is the career choice of final year women civil engineering students. Though a considerable body of general literature exists on women in the labour market, including women in engineering and women in construction, there is a lack of knowledge about women in civil engineering specifically. Present attitudes are largely based on unproven assumptions unsupported by empirical data. By examining the career choice of the group, the aims of the thesis were to examine the factors affecting career choice of women civil engineers; to extend the knowledge base and to test some of the current thinking about women in engineering and construction.

Four objectives were formulated. These concerned the initial reasons for the career choice, differences in male and female choices, whether there is a relationship between college experiences and career choice and whether there is a relationship between career expectations and career choice. These objectives were explored in a comprehensive literature review, and in an extensive series of interviews followed by a national survey of all final year women civil engineering students and an equivalent number of final year male civil engineering students. The data was analyzed by testing a number of hypotheses for each of the four objectives using advanced statistical techniques.

The results of the study showed that there were a very large number of complex factors involved in women's career choice. Of particular interest were the differences in the career choices of male and female civil engineering students, that some college experiences of women were related to career choice and that generally the beliefs women had of a career in civil engineering did not appear to be related to their choice of sector of civil engineering.

The thesis, in its original research, has clearly made an important contribution to the study of women in civil engineering and there is ample scope for future research projects to build on this original research. These findings have important implications for career advisors, teachers, lecturers in higher education as well as employers in the construction industry.

CHAPTER ONE

INTRODUCTION

1.0 INTRODUCTION

The title of this thesis is "Entry to Employment: Choices made by qualified women civil engineers leaving higher education". This research, as the title suggests, discusses the original career choice and the career choices that women make when they are about to complete their civil engineering degree. But it does more than this; in addition to examining what these choices are, it tries also to understand the reasons for these choices. The aim of this introductory chapter is to give an overview of the thesis. It contains an overall statement of the topic being investigated and explains the importance of this topic. It then states the main aims of the research followed by a statement of the objectives to be investigated. Following this, the main hypotheses as identified and developed in the thesis are stated. Finally, an outline of the methodology used at each stage of the thesis and a summary of the chapters is then given.

1.1 THE TOPIC BEING INVESTIGATED AND ITS IMPORTANCE

The central topic of this research is the career choice of women civil engineers. Four aspects of this topic were identified in the initial stages of the research as warranting investigation. The first aspect of this topic identified as warranting research was the investigation of the factors affecting the decision of women to choose civil engineering. The research problem here stems largely from the lack of data available on the background reasons for women choosing civil engineering specifically. Much of the literature identified reasons why women choose engineering, without specifying which type of engineering (see, for example, research

by Johnson, 1992; Carter and Kirkup, 1990; Newton, 1987 as discussed in chapter two of this thesis). Interviews conducted for this research revealed reasons for women choosing civil engineering not previously identified in the literature (these are discussed in chapter two). However, no research had investigated, in detail and from a large sample, reasons for women choosing civil engineering specifically. In this research, clarification of these reasons is pursued.

The second of the aspects of career choice to be investigated was the identification of the differences in the career choices of men and women civil engineering students about to leave higher education. Analysis of the literature appeared to suggest that there were differences in the careers undertaken by male and female civil engineers, following the completion of their degrees (see for example the discussion of the literature of the First Destination Survey Results analyzed and discussed in chapter three). This was tentatively confirmed by a number of interviews conducted for this research (as analyzed and discussed in chapter three). Other studies in the literature examined reasons for these differences but were applied to all engineering (see for example the discussion of the literature of the work of the IVL, 1989; Weinreich Haste and Newton, 1983; and others, discussed in chapter three). It appeared, from the literature, that women leave civil engineering for alternative occupations in a much higher proportion than do men. A more detailed examination of accounts of this phenomenon in the literature also revealed that women enter some sectors of civil engineering in greater proportions than do men. However, no research had examined these differences in detail with regard to civil engineering students or investigated the potential reasons for the differences in career choice between male and female civil engineers.

The third aspect of career choice examined in this thesis is the investigation of the experiences that women civil engineers have at college, and to determine whether these

experiences are related to their decisions to enter civil engineering or enter another profession. Although some studies have examined the experiences of some women on engineering courses (for example Thomas, 1988; Tizard and Chiosso, 1990 and other researchers whose work is discussed in chapter three), these tended to conclude that women do face problems on such courses, but did not relate these problems to their ultimate choice of career. Some of these experiences were confirmed by interviews carried out in the earlier stages of the research (the results of the analysis of these interviews regarding college experiences and career choice can be found in chapter three). These interviews suggested that there might be a relationship between college experiences and career choice for women leaving higher education. More detailed research was clearly warranted to ascertain whether this was the case.

The fourth aspect of career choice under investigation is to explore the relationship between the impression women have of a civil engineering career and their intended career choice. It was suggested in the literature reviewed (for example the ICE, 1984; and the discussion in chapter four), and also in some of the interviews conducted for this research (see chapter four for an analysis of these interviews with regard to career expectations), that the impressions of women who enter civil engineering have of sectors of civil engineering varies, and could be related to choice of sector of the industry. So, for instance, those women who enter contracting may have a different view of consultancies than those who enter consultancies. Further investigation of these expectations and their relationship to career choice was warranted.

One of the main reasons for the investigation of career choice of women civil engineers was that there was little empirical research prior to this thesis which examined the career choice of women civil engineers. Where research did exist it tended to concentrate on small

samples, of either women engineers or women on construction courses, or was anecdotal (the problem of drawing conclusions from these sources is discussed throughout the thesis). Therefore a need for controlled and original research on a larger scale on this topic was identified as important. Since the subject area was previously little researched, all of the relevant literature had to be drawn from two main sources related to the problems of the research. These sources were literature on women in engineering and literature on the less well developed area of women in construction where from both sources the representation of women in civil engineering could often be inferred. The topic of women in civil engineering appears to be a new area for research, and as a consequence there appeared to be little previous examination of any of the four research aspects outlined in this section and pursued in this thesis.

1.2 A STATEMENT OF THE RESEARCH AIMS

Aim one:

To identify the factors affecting the career choice of women civil engineering students leaving higher education

Aim two:

To broaden the knowledge base of available information about women in civil engineering

Aim three:

To test some of the statements made by some of those who research into the role of women in engineering and construction to see if they are applicable to women in civil

engineering

1.3 A STATEMENT OF THE RESEARCH OBJECTIVES

Objective one:

To investigate the initial reasons for women choosing a career in civil engineering

Objective two:

To investigate whether there are differences in the employment choices of male and female civil engineering students leaving higher education

Objective three:

To investigate whether there is a relationship between the college experiences of women civil engineers and their career choice

Objective four:

To investigate whether there is a relationship between the career expectations women hold of civil engineering and the sector of the civil engineering industry they chose

1.4 THE MAIN HYPOTHESES OF THIS RESEARCH

There were four main hypotheses developed in this thesis designed to test the four main objectives of the research

Hypothesis one:

There are general patterns in the initial career choice of women on civil engineering

degree courses

Hypothesis two:

Female and male civil engineering students leaving higher education choose employment differently

Hypothesis three:

There is a relationship between the college experiences of women civil engineering students and their career choice

Hypothesis four:

There is a relationship between the career expectations that women hold of civil engineering and the sector of the civil engineering they choose

For each of these main hypotheses, sub-hypotheses were formulated to test particular aspects of these main hypotheses. These are discussed in chapter five of this thesis.

1.5 RESEARCH METHODOLOGY

Stage one of the study performs two roles. It reviews and analyses previous literature on women in engineering and women in construction. Also, during this stage interviews were undertaken with women on civil engineering courses and women civil engineers to examine their background reasons for choosing civil engineering, their experiences at college and their career expectations. Other interviews took place with male civil engineering students. Discussions of the research topic took place at research conferences, seminars and courses

throughout this stage. Details of the analysis of the literature, interviews and discussions can be found in chapters two, three and four. The research from this stage enabled the formulation of the research hypotheses as discussed in chapter five of this thesis.

In stage two of the research a national questionnaire for female and male civil engineering students was designed and piloted. Details of this can be found in chapter six.

In stage three of the research a national questionnaire to all final year women civil engineers on degree courses and an equivalent number of male civil engineering students was administered and follow up procedures to ensure maximum responses were adopted. Discussion of this stage can be found in chapter six.

Stage four of the research involved the quantitative analysis of the results of the questionnaires using a statistical computer package (Statistical Package for Social Sciences). These results are presented and discussed in chapters seven, eight, nine and ten.

1.6 SUMMARY OF THE CHAPTERS

Chapter two reviews and analyses the literature on the background reasons why women enter civil engineering. It examines probable influences on women's decisions to choose civil engineering, and the reasons why there are few women entering civil or other types of engineering, and construction, at degree level. It also discusses the results from interviews conducted for this research which aim to identify the reasons for women choosing civil engineering.

Chapter three assesses the results of statistics examining the first career destinations of male and female civil engineers. It then examines possible reasons for the differences in the careers of male and female civil engineers. The discussion then focuses on what are the experiences of women on engineering and construction courses. Results of interviews are

discussed which aim to determine possible differences in the career choices of male and female civil engineering students. Further results of interviews are also discussed which attempt to identify the experiences of women on civil engineering courses and how these experiences might influence their career choices.

Chapter four examines the role of women in the labour market and the problems affecting a career for women in civil engineering. Results of the analysis of the interviews regarding career expectations of women civil engineers are discussed in this chapter

Chapter five discusses in detail the four research problems as they emerged from the literature and were supplemented from interviews conducted in the early stages of the research. It then formulates the hypotheses to be tested as a method of investigating the four research objectives of this research.

Chapter six discusses the research methodology, outlining the methods involved in gathering data for the interviews and discusses the nature and number of interviews undertaken. The reasons why the methods of gathering the data from the national questionnaire were used are also discussed together with the means of analyzing the data and the types of statistical tests undertaken.

Chapter seven describes the profile data of male and female civil engineering students as analyzed from the results of the questionnaire. It then discusses the results of the questionnaire, analyzing the background reasons why women choose to study civil engineering.

Chapter eight discusses the results of the questionnaire, analyzing the differences in employment choices made by male and female civil engineering degree students leaving higher education.

Chapter nine discusses the results of the questionnaire, analyzing the relationship between

college experiences and choice of career.

Chapter ten discusses the results of the questionnaire, analyzing the relationship between career expectations of women civil engineers and career choice.

Chapter eleven discusses the research findings in relation to the four main hypotheses outlined in this chapter. Throughout this chapter the limitations of the findings and a discussion of their significance is given.

Chapter twelve contains the final conclusions of the thesis which relate to the objectives and aims of this research as outlined in this chapter. Finally, it assesses the wider implications of the research and suggests possible further research projects.

CHAPTER TWO

BACKGROUND REASONS FOR WOMEN CHOOSING CIVIL ENGINEERING

2.1 INTRODUCTION

The aim of this chapter is to discuss the factors that affect the entry of women on to civil engineering degree courses. The background reasons why women enter civil engineering as a degree course is one of the central themes of this research. These reasons will be discussed in this chapter, together with reasons why women enter other types of engineering courses and why women do not enter construction courses, since, as will be shown in this chapter, many of the reasons why women enter other engineering or some construction courses are similar to the reasons why women enter civil engineering. This chapter first provides some general definitions of civil engineering and then discusses the routes to a civil engineering degree. It then examines the many reasons researchers have put forward in the literature for the lack of women on civil engineering, engineering or some construction courses such as building, together with the reasons why some women do enter such courses. Finally, some of the background reasons for women choosing civil engineering as expressed in interviews with women on civil engineering courses are discussed. (The methodological details of these interviews can be found in chapter six.) Where there exists scholarly disagreement or where the existing literature appears deficient, this is noted. The disagreements and deficiencies provide ground for research later on in this thesis.

2.2 DEFINING CIVIL ENGINEERING

The Civil Engineering Careers Service (CECS) states that civil engineers "plan, design,

construct and maintain: transport systems, public health services, structures and, [amongst other things], flood and coastal protection" (CECS, 1988a, p7). Scott in *The Penguin Dictionary of Civil Engineering* provides a general definition that civil engineering includes, amongst other things "land drainage, water supply, rivers, canals, harbours, docks, marine construction, water power, sewage disposal, sewage, bridges, tunnels,railways, roads, traffic engineering, foundations, airports, municipal engineering, soil mechanics, structural design, town planning and transportation engineering...The work of a civil engineer consists of preparing plans after surveying a site, letting sites, supervising construction and so on" (Scott, 1985, p54). These definitions give some idea of the type of work a civil engineer does. Civil engineering relates to both engineering and construction. The CECS, in their literature, provide information about engineering, stating that civil engineering, together with other types of engineering (in the United Kingdom) comes under the co-ordination of The Engineering Council who "...accredit the professional institutions and societies to supervise the education and training of engineers" (CECS, 1988a, p3). For regulating the standard of education and training of civil engineers, there is the Institution of Civil Engineers. The literature from the CECS also defines the industry that civil engineers work in as the construction industry and they state that "There are two traditional ways of organising design and construction within the construction industry: the civil engineering industry and the building industry." (CECS, 1988a, p9) The CECS go on to say that "The Channel Tunnel, the Humber Bridge, the motorways and the Thames Barrier are principally civil engineering projects while your home and structures such as office blocks, hospitals, sports stadia and concert halls are principally building projects. However, in nearly all projects building and civil engineering overlap" (CECS, 1988a, p9). The literature goes on to say that "...a building project is designed by a team which usually includes an architect, a structural

engineer, a building services engineer and a quantity surveyor and is built by a firm of building contractors" (CECS, 1988a, p9). Whereas, they state, a civil engineering project is designed by a Chartered Engineer, or team of engineers working in a consulting engineering company and built by a contractor. However, since structural engineering is acknowledged as a branch of civil engineering (CECS, 1988a, p7), it appears that civil engineers are employed in both building projects and civil engineering projects. The Department of Education and Science estimated in 1990 that "...building accounts for 80 per cent of the industry's construction activity and civil engineering for 20 per cent" (DES, 1990, p1). The research in this study is concerned with qualified civil engineers and the areas of the construction industry in which they choose to work. Other CECS careers literature suggests that the principal components of a civil engineering project - plan, design, construct and maintain - are carried out by various sectors within the construction industry (for instance; CECS, 1988b; CECS, 1992). In their literature, they suggest that civil engineers, who are employed on the planning of projects, tend to work in central and local governments, for utilities such as water and electricity companies and private developers, all of whom are often the clients of the projects (CECS, 1988b, p1; CECS, 1992, p8). They also state that civil engineers involved in planning of projects also work for consulting engineers (CECS, 1988b, p1). They stress that a project is designed (and often supervised) by a team of people, including civil engineers, who work primarily for consulting engineers or, in the case of government or utilities, an organization's own engineers' department, pointing out that some consultancies specialise in particular fields such as environmental engineering or transportation (CECS, 1988a, p10, CECS, 1988b, p1, CECS, 1992, p10-11). Other parts of their literature make reference to the construction of projects which, they suggest, are mainly carried out by contractors who employ civil engineers, and the maintenance is usually done

by local authorities or a large private or public concern (CECS, 1988b, p1; CECS, 1992, p10, 14-15). Another sector in which, they suggest, civil engineers work, is research - either in specialist research organisations such as the Building Research Establishment, or research in higher education institutions (CECS, 1988b, p1, CECS, 1992, p8, p26). This information gives a general idea of the main sectors of the construction industry in which civil engineers are employed and will be used throughout this research.

2.3 ENTRY ONTO A CIVIL ENGINEERING DEGREE COURSE

In their report on construction in higher education the Department of Education and Science reported that "Women are well represented on architecture, environmental health, planning and estate management courses where they make up between 20 and 50 per cent of the enrolment. However, their overall representation on construction courses is less than 10 per cent since few enrol on technician courses leading to HNC/D qualifications or on degree courses in subjects such as building, civil engineering and building services engineering" (DES, 1990, p16). As will be discussed, one of the main reasons why there are not many women on civil engineering courses in this country is that they do not secure the required qualifications. The most usual route to a civil engineering degree course is through Advanced level (A level) qualifications (or Scottish Certificate of Education Higher Grade) in mathematics and physics or engineering science (CECS, 1988a, p11). Further confirmation that these are the required entry qualifications is found in university entrance information where it is stated that the A level qualifications required are usually in mathematics and physics. Where A level physics is not specified, then it is usually required at GCSE level (University Entrance, 1991, p224). The Civil Engineering Careers Service, and the university entrance information, also suggest other routes to civil engineering degrees. These include

qualifications such as BTEC Higher National Diploma (HND) or Higher National Certificate (HNC) courses, studied either full-time or part-time, at further or higher education colleges and universities; some HITECC (Higher Introductory Technology Conversion Courses) studied at various universities (CECS, 1988a, p11; University Entrance, 1991, p224). Other routes to civil engineering degree courses are available. For instance, foundation courses can be studied for one year by students without the relevant A level qualifications, or entry can be gained either by the International and European Baccalaureates; for mature students (21 or over) access courses and interviews can also be an alternative route onto these courses (University entrance, 1991, p224). Much of this chapter is concerned with the A level route, and in particular the question of why so few women have the necessary A level qualifications to enter a civil engineering degree course.

2.4 REASONS FOR THE LACK OF WOMEN STUDYING PHYSICS

One of the main reasons for the lack of women on civil engineering courses is that they do not secure the necessary qualifications at A level, in particular a qualification in Advanced level physics which, as previously put forward, is usually required for entry onto civil engineering courses. The following table, 2.1, is presented to give an indication of how few young women take A level physics compared with boys, and compared with other subjects. The subjects chosen indicate the differences in qualifications between the various subjects, including physics. The years shown are to give an indication of how the percentages have changed, or not changed, over a ten year period. Table 2.1 shows that a small percentage of girls achieve A level passes in physics compared with boys (1989-90, boys 26.1%, girls 7.9%). In other subjects there is also a marked difference; for example in chemistry and mathematics boys achieve in much higher percentages. In other subjects such as English,

French and creative arts, girls appear to achieve these qualifications in much higher percentages than do boys. However, the main point from this table is that most girls do not appear to achieve A levels in physics. Of course, to be able to study A level physics, it is usually the case that students should have studied GCSE physics. Here the disparity between girls and boys, achieving this qualification, is still marked.

TABLE 2.1 PERCENTAGE OF SCHOOL LEAVERS WITH A LEVEL QUALIFICATIONS IN SELECTED SUBJECTS FOR SELECTED YEARS

subject	boys %			girls %		
	1979 80	1988-89	1989-90	1979-80	1988-89	1989-90
leavers achieving passes in						
physics	31.1	27.8	26.1	7.6	7.9	7.9
mathematics	33.8	34.6	32.1	14.4	19.1	17.9
chemistry	21.6	21.0	20.5	11.4	12.9	13.4
biology	12.6	11.7	11.9	17.7	18.3	18.4
technology	5.5	5.3	5.7	1.4	0.8	0.8
english	13.8	16.6	17.8	34.5	34.3	35.6
history	15.0	15.6	16.0	17.7	17.5	17.4
french	5.7	5.5	6.9	19.5	15.0	16.5
Creative arts	6.7	8.1	9.3	11.0	15.8	15.8

Source: School Examination Survey 1989/90, Government Statistical Service, Department of Education and Science.

Table 2.2 shows the percentages of boys and girls who have attained qualifications in a number of subjects over a period of ten years. It again shows the differences between boys and girls in the attainment of qualifications, in this case A-C/CSE1 grades at GCSE/Olevel. From these tables, 2.1 and 2.2, we can establish that the pattern of these differences does not vary in most subjects from O level to A level. In both cases the attainment of girls

compared to boys in subjects such as physics and technology is much lower. There are changes in other subjects; many girls appear to drop mathematics at A level, despite having this qualification at O level/GCSE, whereas for boys, the drop appears to be in the study of English. However, the main point of these statistics for this research is the low numbers of girls attaining physics qualifications at O/GCSE and A level.

TABLE 2.2 PERCENTAGE OF SCHOOL LEAVERS WITH GRADES A-C/CSE 1 LEVEL QUALIFICATIONS IN SELECTED SUBJECTS FOR SELECTED YEARS

subject	boys %			girls %		
	1979 80	1988 89	1989-90	1979-80	1988-89	1989-90
leavers achieving passes in						
physics	19	23	22	6	10	10
mathematics	29	38	40	23	33	37
chemistry	13	17	18	8	13	14
biological science	12	14	13	18	20	20
technology	18	20	19	3	6	5
english	32	39	42	42	52	56
history	14	15	16	15	17	18
french	10	14	16	17	23	25
Creative arts	10	13	15	15	23	26

Source: School Examination Survey 1989/90, Government Statistical Service, Department of Education and Science.

It is possible that the problem of few girls attaining physics at GCSE/O level will change with the National Curriculum introduced under the 1988 Education Reform Act, which requires all students to have studied science and technology until the age of sixteen. However, it is too early to assess its impact on the science and technology education of girls. But if the numbers of girls attaining O/GCSE level physics does increase it could be possible

that more girls may attain A level physics. However this is speculation, and as the tables above show, in mathematics attainment, even though many girls attain GCSE/O level mathematics, their numbers have fallen by A level.

Having argued that few girls appear to achieve A level physics and as a consequence few are qualified to enter civil engineering courses, the next section examines some of the reasons researchers have given in the literature for the lack of girls studying physics together with some other reasons why there are low proportions of young women choosing to study engineering. In addition to this, some of the main reasons why some women do choose engineering and other technical courses as put forward by researchers are discussed.

2.4.1 REVIEW OF REASONS GIVEN BY RESEARCHERS WHY YOUNG WOMEN DO NOT STUDY PHYSICS OR CHOOSE AN ENGINEERING CAREER

Many attempts have been made to try to understand why most young women do not choose engineering as a career (for example, Peacock, 1986; Newton, 1987; Pickup, 1991). Some of the research carried out has attempted to link socialisation, schooling, the job market structure and family expectations as a basis for such an understanding of the reasons why young women do not study physics, engineering or other non-traditional subjects (for example Whyld, 1983; Wilson, 1991; Eccles, 1992). In one recent article, Wilson summarised the reasons some researchers have given to explain the "massive avoidance of the sciences" by girls. Although she failed to define the term science, it can be inferred from her discussions that she included physics (Wilson, 1991, p47). The reasons she put forward for this "massive avoidance of the sciences" by girls were: socialisation patterns, experience and play activities, subject images, teacher attitudes mediated in interaction in the classroom and the organizational features of the school (Wilson, 1991, p47). Samuel also suggested that

"...women's underachievement [in science] is a consequence of the interaction of individuals with their immediate social environment - peers, parents, teachers, books and the media" (Samuel, 1983, p116). It is reasonable to assume that, if these barriers exist, then young women wishing to study physics and then enter civil engineering as a degree, must overcome some, or all, of the barriers to which Wilson and Samuel refer. Since part this research is concerned with the reasons why women choose to study civil engineering as a degree, then the factors which may have helped, or hindered this decision need to be identified.

The following section examines each of the factors that were referred to by Wilson and others and identifies what, if anything, could have contributed to the decision of some women to choose to enter civil engineering. Other researchers suggested the same, and additional reasons, why women might be discouraged from studying physics or undertaking careers in engineering and other technological disciplines. Some of the other frequently mentioned ones are class, self-image, and careers guidance (for example, Eccles 1992; Carter and Kirkup, 1990; Newton, 1987). It appears from all these lists that both the school environment and the home environment are important in the choice of careers. Many of the factors which affect young women's decisions, as presented by Wilson and other researchers, are discussed in this chapter only in so far as they affect girls' decisions to choose to study for a civil engineering degree. For clarity, most of these factors will be discussed either under the heading of the "home environment" or the heading of the "school environment". First, the next section examines the first item on Wilson's list, that of socialisation patterns, since it appears that socialisation is used as a general reason for explaining the different choices made by girls and boys, and may be useful in helping to understand why there are few women choosing civil engineering as a career.

2.4.2 SOCIALISATION PATTERNS

Socialisation patterns were cited as one of the reasons for the "massive avoidance of the sciences" by girls (Wilson, 1991, p47). In this section the possible effects of socialisation on the career choice of women are discussed. First a basic definition of socialisation is needed. Socialisation is such a huge topic in itself, that this section is designed merely to give an indication of how socialisation theories, as presented by researchers working in that field, can possibly help to explain the low numbers of young women choosing physics, or an engineering career.

Holland noted that "Socialization is the basic concept used to explain the transmission of culture from the society to the individual agent, the process whereby the individual becomes a member of his/her society, accepting the norms, values and behaviourial procedures of the group of which s/he is a part. It takes place through various agencies and institutions of the society, primarily in the family, secondarily through the influence of school and peer group, and continuously through the media, work and the life experience of the individual" (Holland, 1981, p20).

Much research has been undertaken on how this process encourages the development of different patterns of behaviour and characteristics for boys and girls. The research in this thesis is not concerned with the many theories of socialisation but with the effects of the various socialising agencies and institutions to which Holland refers on the study of physics at school, and ultimately on civil engineering in higher education, by young women. The following discussion covers some of the main features, as suggested by researchers, of these socialisation arguments and how they may affect the decision of women to choose civil engineering as a degree.

There have been some claims, by socialisation theorists (for example MacDonald, 1980;

Weiner, 1980; Kelly, 1981), that children are actively shaped by the environment created by parents, teachers and peers, and that this is the primary explanation for sex-differentiation in behaviour. Holland suggests that this shaping is conducted through a mechanism of social learning where "Skills, habits and some behaviour are learned through reward and punishment and ... parents and significant others provide role models for imitative behaviour." (Holland, 1981, p20). Later in this chapter, the ways in which, for example, teachers or parents can affect the decisions of young women to choose civil engineering either by providing or not providing "role models for imitative behaviour" are discussed.

Carter and Kirkup concluded that from their research on women engineers that "Family culture, upbringing and expectations all played a part in the critical step, sometimes complementing what took place at school, sometimes opposing it, sometimes offering the young woman encouragement in the face of school hostility towards a non-traditional decision." (Carter and Kirkup, 1990, p36). Carter and Kirkup appear to suggest that there are various and occasional conflicting factors which some women who enter engineering have to contend with.

Other theories, as reported by Kelly, suggest that children observe and imitate behaviour, that they are essentially self-socialising, and that they first develop categories of male and female and then fit themselves into these categories (Kelly, 1981, p74). In other words they react to the world as they see it, and train themselves to fit into it. So it seems possible, according to Weiner and Kelly, that if girls see some subjects as mainly the domain of men, then, as a female child, they are unlikely to relate to this and the consequence may be a lack of interest in these subjects (Weiner, 1980, p78, Kelly, 1981, pp74-76). The image of physics, engineering and other subjects, as presented in the media and through learning material, are discussed later in this chapter.

Apart from socialisation theories, biological theories have been developed which suggest that biological differences between boys and girls can explain the psychological and behavioural differences between the sexes, and that this can be used to explain the differences in science achievement between boys and girls (for example Gray, 1981, pp42-58). This chapter is not concerned with the debate between biological theories and socialisation theories, or even the debate between various socialisation theories. Both biological and socialisation theories appear to be tools attempting to explain the ways in which boys and girls develop differently. Kelly suggests that biology is not solely responsible for these differences, arguing that "even if a biological contribution to girls' underachievement in science were to be established...Society has the option, through schooling and socialisation, of providing additional training in the areas where each individual is weakest." (Kelly, 1981, p82)

The main point is that, according to most of the theories mentioned, male and female children develop different behaviour and preferences, and that there is some indication that society helps shape these differences. Kelly linked the development of girls' behaviour to their low achievement in science, suggesting that, "...the characteristically low achievement of girls in science is an aspect of the feminine sex role - that is, learned behaviour which is appropriate for females in our society." (Kelly, 1981, p73). This idea is examined in later sections in this chapter. The next sections examine in more detail the effect of some of the influences mentioned above on the career choice of women, in particular their choice of engineering, including civil engineering, as a career. It examines these in the context of the home environment, including parental encouragement, hobbies and leisure activities, amongst others, and the school environment including the behaviour of teachers, subject images and others factors. Those factors warranting further investigation and those factors where there is a consensus in the literature are identified.

2.5 THE HOME ENVIRONMENT

This section examines the effect of the home environment on subject choice and career choice with particular emphasis on young women's choice of engineering. It first examines the influence of parents on these decisions, then it examines the type of hobbies and activities that could be important in this decision, and also the effects of the media and subject images on shaping career decisions.

2.5.1 PARENTAL INFLUENCES

Some researchers have tried to assess the impact of parental influences on the school subject and career choices of students, including young women who choose engineering. Ebbutt suggested, in his research on science options in a girls' grammar school, that when girls chose science there was an element of parental guidance in the choice process (Ebbutt, 1981a, p119). However, this appeared to conflict with the work on a much a larger sample of school children in Scotland by Ryrie et al, who suggested that few parents were actively involved in the process of subject choice (Ryrie et al, 1979, p60), although they later reported that "...parents who made definite recommendations to their children frequently suggested secretarial studies or home economics to girls and technical subjects to boys" (Ryrie et al, 1979, p83). Ryrie et al's work was on general subject choice, and did not examine in detail the career choices of girls in relation to science. Other evidence suggests that when students, including young women, choose an engineering career, parents are an important influence on this decision (IVL, 1989, p14). This was supported by a study by the Construction Industry Training Board on the career choice of 12 to 14 year old males which found that parents (mothers and fathers) were seen as the greatest influence on career choice (CITB, 1988a, p14). However, they did not suggest how this might differ with 12 to 14 year

old females although their work did contend that for 18 to 24 year old males and females, the influence of family on helping them choose their career was stronger for women than men (CITB, 1988a, p15).

The work of some researchers indicated that the level of involvement in subject choice was related to the occupational level of the father (for example Ryrie et al, 1979, Carter and Kirkup, 1990). Ryrie et al suggested that "the higher the occupational level of the father, the more the parents were involved" (Ryrie et al, 1979, p63). Redpath and Harvey in their study of young people's intentions to enter higher education suggested that, when examining the A level subjects students had chosen, their results showed that "Proportionally more boys and girls from Social Class I than from other groups took each of the main science subjects (including physics) with the difference particularly marked for girls" (Redpath and Harvey, 1987, p26). They also suggested that "girls who came from families where one or both parents had a degree tended more to take A level physics than girls from families where neither parent had a degree" (Redpath and Harvey, 1987, p39). Carter and Kirkup, whose research relied on interviews with forty women in engineering, argued that "professional families are more likely to support a daughter's non-traditional career choice" (Carter and Kirkup, 1990, p37). Newton reported that, from her study which interviewed women engineers, "female engineers were more likely than their friends or the male engineers to have fathers who were in a professional job" (Newton, 1987, p195) thus tending to support the results of the research by Carter and Kirkup above. From this evidence presented in this section, it does appear that there is some relationship between parental influence, parental occupation and subject choice, but this relationship is unclear and has not been determined for women civil engineers. Clearly then more detailed investigation is warranted to determine this relationship for women civil engineers.

The results of some of these surveys, and others (eg Weinreich-Haste and Newton, 1983, p42; Fitzpatric and Silverman, 1989, p269), do suggest that the involvement of fathers in the choice of an engineering career for women may be particularly important. Newton suggested that "fathers may serve as important exemplars of engineers and that they are often described as being positive about their daughters' interest in engineering" (Newton, 1987, p196). Usher and Ward suggested that women civil engineering students tend to have a male relative (probably a father or uncle) in the engineering profession (Usher and Ward, 1991, p4). Carter and Kirkup suggested that another male relative, an older brother, could provide support in the choice of engineering (Carter and Kirkup, 1990, p41). It thus appears that family influence can, according to the literature, be important in women's choice of engineering, including civil engineering. Another survey which interviewed some women working in civil engineering in the United Kingdom suggested that "the initial introduction into the industry was most frequently via families" (Wilkinson, 1990, p16). This was supported by the work of Bakos who, from his survey of women civil engineering students in the USA suggested that "...it was surprising to find that the father overwhelmingly was cited as the strong role model or the major encouraging influence. Most of the respondents had fathers who were engineers or contractors and their behaviour, attitude, job satisfaction, etc., had a profound effect on their daughters." (Bakos, 1992, p18).

Most of the studies cited in this section, appeared to suggest that women engineers could be influenced by their parents, in particular their fathers, in their choice of engineering as a career. There is therefore something of a consensus in the literature although there is some disagreement about, for instance, the role that parents play in subject choice. However, much of the literature is not directly concerned with the choices of women to enter civil engineering. There appears to be scope for research into the influence of families on

specifically these women's choices. The next section examines what part hobbies and play activities may have on young women's career decisions.

2.5.2 HOBBIES AND INTERESTS

Some researchers have suggested that the hobbies and play activities of children might be important factors in their future choice of an engineering career, particularly an engineering career for women (for example, Kelly, E. 1981; Ebbutt, 1981a; Newton, 1987). The results of a survey on the different toys that boys and girls are likely to play with indicated that boys are far more likely to have toys which develop spatial awareness and that provide opportunities for problem solving (Burn, 1989, p67). Wilson, citing the work of Kaminski, suggested that boys under the age of eleven have better spatial awareness than girls, and that this can be used to explain later divergent patterns in study and employment (Wilson, 1991, p44). The development of spatial awareness and the ability to solve problems are all skills used in engineering. The IVL survey of attitudes and intentions of graduating engineers found that of the 1854 male and female engineering students surveyed, 52% reported that childhood hobbies and interests were an important influence on their decision to choose an engineering career (IVL, 1989, p14). Although they do not mention the types of hobbies and interests to which they refer, there could, it is argued, be a connection between boys being given toys that develop their spatial awareness and problem solving abilities, and the influence of these on the choice of an engineering career. Another study suggested that, for some women engineers, their hobbies and leisure experiences equipped them less well with the basic skills of practical and mechanical aspects of engineering than their male peers on an engineering course (Weinreich-Haste and Newton, 1983, p52). Newton's work on women engineers in the UK and Johnson's work on women civil engineers in the USA tend to link toys and

career intentions. Newton suggests that women choosing engineering are likely to have had the types of toys which are normally given to boys. She found in her work on women in engineering, that female engineers were "significantly more likely to have played with unconventional ["boys'"] toys in their childhood than all other groups" (Newton, 1987, p195). By other groups she is referring to male engineering trainees and young women entering traditional "feminine" occupations. Similar evidence of the differences in scientific interest between boys and girls at school and its effect on girls is suggested by Samuel where she argues that "boys were more likely to have experience of using saws or screwdrivers, of helping to maintain a cycle or a car, and of playing with electrical or constructional toys. And because girls have less experience of using or maintaining machines, they are less confident about their ability to control or maintain the "machines" they encounter in science and craft lessons" (Samuel, 1983, p118). However, Kelly found from one of her surveys that girls who had some experience of playing with mechanical toys and handling tools were only slightly more likely than other girls to choose to study technical craft and she concluded that "If you don't give your daughter a train set by her fifth birthday, you haven't ruined her chances of becoming a scientist..." (Kelly, 1987c, p43). This was in contrast to Johnson, who suggested that one factor influencing future career decision was the toys children were given. She emphasised the different nature of toys marketed for boys compared and girls. She suggested that "Most toys for boys require problem solving and "doing"; girls' toys emphasise social skills. As a result children and parents are more likely to purchase the construction sets and tool sets for boys than girls" (Johnson, 1992, p32). She continued by saying that if girls were not being given the opportunity to explore and learn how things work through their toys then "They may feel this learning loss acutely when they sit in physics, statics or similar courses". Kelly also mentions the differing marketing strategies

and their effects on career decisions. She contended that "Toys such as Meccano which taught engineering principles were marketed exclusively for boys" (Kelly, E., 1981, p62). She also suggested that this also extended to children books where "they portray boys as active characters who go camping, build tree houses, have adventures" whereas "...girls stay at home, play with dolls and kittens, and help mother" (Kelly, E., 1981, p62). The evidence presented in most of the surveys in this section suggest that toys, hobbies and interests may be important in ultimate career decisions, and they may be particularly important for women in the development of an interest in physics and a career in engineering. However, there is some disagreement about the significance of toys and hobbies, and different researchers offer different explanations of how they might affect women's choices. (For example, some researchers said that mechanical hobbies had causal significance through influences on spatial awareness, others said that their significance lay in the association of mechanical hobbies with boys.) Further work needs to be done to resolve these differences, and some of this is done later in the thesis by examining the relationship between hobbies and choice of civil engineering as a career for women. The next section examines how the image of science, in most cases physics, affects girls' decisions to choose to study it and the role of the media in presenting these images.

2.5.3 IMAGE

This section examines the image of science, engineering and some parts of the construction industry and their effect on the career decisions of young women. There are two parts to this section; the first examines what the image of science is and the possible effect of the image of science, in particular physics, as it is depicted in the media and literature and elsewhere, on the numbers of women choosing to study it. The second part examines what the image

of engineering and of construction is, and how this might affect the numbers of women choosing to work in these fields, particularly as civil engineers.

2.5.3.1 THE IMAGE OF SCIENCE

Easlea, in his article "The Masculine Image of Science", suggested a number of reasons why science had a masculine image. He defined "masculine" as "those psychological and behaviourial characteristics that are widely supposed to be possessed or displayed predominantly by men...In British and American culture it would appear that, *very crudely speaking*, such qualities as aggressiveness, hardness, 'disconnectedness', self-control and emotional reticence." (Easlea, 1986, p134). He drew on concerns expressed by a 1982 report of the Physics Education Committee, set up jointly by the Royal Society and the Institute of Physics, and argued that if science is regarded as having a masculine image, then not only parents and teachers may think of science as inappropriate for girls, girls may also see achievement in science as incompatible with their developing femininity (Easlea, 1986, p134). Easlea also suggested that the strongly masculine image of physics can be explained by a variety of factors such as the male domination of physics, the linking of physics with "masculine" spheres of activity such as military and space, and the remoteness from concern with living beings (Easlea, 1986, p135).

Kelly, in her article "The Construction of Masculine Science", also commented on this masculine image and argues that "the masculinity of science is often considered the prime reason that girls tend to avoid the subject at school." (Kelly, 1987b, p127). She argued that it is this image which helps to perpetuate particular choices of subjects and leads to the low number of girls who opt for these subjects, including physics, at school (Kelly, 1987b, p127). In another article, Kelly argues that there are at least four distinct senses in which

science is viewed as masculine. These are; the numbers who study and teach science; the packaging and presentation of science; the way it is reflected in classroom behaviours and interactions, and "the suggestion that the type of thinking commonly labelled scientific embodies an intrinsically masculine world view" (Kelly, 1987a, p66). Kelly further argues that it is these four which help to establish science as a male preserve (Kelly, 1987a, p66). Weinreich Haste supports part of this view stating that "Statistically, scientists are predominantly men, but in addition to this, the image of science and the activities of the scientist are perceived as stereotypically masculine" (Weinreich-Haste, 1981, p218).

A survey by Weinreich Haste suggested that pupils of both sexes view physics as masculine. She contended, from her research, that physics, together with maths and chemistry, were rated by pupils as the most masculine academic subjects (Weinreich-Haste, 1981, p220). Ryrie et al suggested that "The fact that certain subjects have up to now been done by more members of one sex than of the other no doubt made it natural for pupils to adopt this assumption" (Ryrie et al, 1979, p83). The assumption here being that there are certain subjects that are appropriate for girls and others for boys. The effects of this image were highlighted by Kelly who suggested that "if science achievement has a masculine image in any society, then boys will be motivated to achieve competence in science as part of their developing masculinity; conversely girls will see success in science as incompatible with their developing femininity and so avoid it" (Kelly, 1981, p79).

This argument was put forward in another way by Easlea who suggests that "culture associates men ...with competence in the design and control of apparatus and machines and associates women...with competence in professions demanding the capacity to care and nurture" and concludes that "the practice of physics is associated with a masculine ability to manipulate and control inanimate matter rather than with a feminine ability to empathize,

communicate and care. As a consequence, the discipline of physics may come to be embraced by many schoolboys and rejected by many schoolgirls as one of the sciences further removed from a stereotypical feminine realm of relating empathically and caringly to other human beings" (Easlea, 1986, pp 135-136). As Sarage and Griffiths remarked, "different sciences ... have different images, with the physical sciences being seen as more masculine than the biological sciences." They suggest that this is one of the reasons for few women in physics since, as they argue "choosing the biological as opposed to the physical sciences [thus] involves girls in fewer contradictions and they receive more encouragement and support in their choice" (Sarage and Griffiths, 1981, p92). Smithers and Collings argued that "proportionally more girls in single-sex schools than mixed sex schools opt to study the sciences" (Smithers and Collings, 1981, p176). They suggested that one of the reasons for this could be the masculinity of science where they argued that "in a co-educational setting girls become more aware of behaviour thought to be appropriate to their sex ...One way girls can demonstrate their femininity is by rejecting masculine preoccupations like studying sciences" (Smithers and Collings, 1981, p176). They also contended that, from their study of girls in science in the sixth form, these girls tended to be more intelligent and less person-orientated than other girls who were not involved in science in the sixth form (Smithers and Collings, 1981, p165). They argued that from their surveys, girls studying science tended to see themselves as "less feminine" (Smithers and Collings, 1981, p170). However, they suggested that, again from their survey, the more able girls were less affected by the masculinity of the subject (Smithers and Collings, 1981, p177).

Kelly commented on another aspect of image, that of packaging and presentation of science and she concluded that "girls and women are seldom included in science textbooks and when they do appear they do so in sex-stereotyped roles which serve to emphasize their marginal

position in science." (Kelly, 1987b, p128). Other researchers have examined how the sexes are portrayed in text books and concluded that females in text books are unlikely to be involved in scientific activities (eg Taylor, 1979; Walford, 1980). Northam supported this, suggesting that in mathematics texts books use of stereotype families was widespread, differences between the sexes, by using dress and hair, were emphasized and that girls were unlikely to be involved in, amongst other things, setting and solving problems (Northam, 1987, pp155-159). She also supported the view that girls were unlikely to be involved in activities associated with self-assertiveness such as performing in a play, boasting or playing jokes (Northam, 1987, p158).

There appears to be a consensus in the results of the surveys presented in this section where most of the surveys tend to suggest that one of the reasons girls are not pursuing science, especially physics, is because the image is masculine and does not appeal to them. The next section examines the extent to which engineering and other related industries have an image that deters girls.

2.5.3.2 IMAGE OF ENGINEERING AND CONSTRUCTION

Chivers reported on the problem of the image of engineering and suggested that this was partly responsible for girls who had achieved qualifications in physics, choosing to enter medicine, science or teaching. He also argued that part of the outcome of this image was the low status of engineering compared with other professions in the UK and that this further deterred women entering engineering (Chivers, 1991, p33cd). Newton, quoting the work of Rossi, also suggested that the image was one of the reasons for few women choosing engineering. She argued that "Engineering presents both a highly masculine image and it also suggests less prestigious blue-collar work ...many women see engineering as a job requiring

skills and characteristics that women do not possess " She went on to argue that the "powerful and negative image of engineering as a career for women serves to prevent most girls from ever considering it" (Newton, 1987, p186). In her research, Newton also argued that "a woman choosing engineering is likely to perceive herself as having masculine qualities" and went on to suggest that "female engineers differed from other female groups in that they tended to see themselves as having more masculine characteristics" (Newton, 1987, p194). These results tend to support the results of the survey by Smithers and Collings on women in science as mentioned in section 2.5.3.1

It is often claimed that the image of the construction industry is a poor one. Ball writes, "Of all industries in Britain, construction has one of the worst public images. High cost, poor quality and chaotic working practices are believed by many to be synonymous with building work...the general view of construction [is as] not quite proper, full of sharp practices, dangerous, inefficient and definitely not like any other modern industry " (Ball, 1988, p1). The suggestion here is that there is something unsavoury about the industry. This may well deter women from entering it. This corresponds to some research in which women working in construction were interviewed about their work as civil engineers. This suggested that the women thought that the construction industry's poor image deterred women from entering it (Wilkinson, 1990, p17). Ball also mentions the undesirable nature of some of the work in construction (although in another context). He states that some of it is of a hard, physical nature, undertaken in a poor working environment (Ball, 1988, p3). But for those who think that this might deter women from applying to work there (and this includes some employers) Ball points out that most physically demanding tasks are now carried out by machines (Ball, 1988, p3). In any case, the unpleasant nature of site work (insofar as it is unpleasant), or the difficulties of manual labour, could not explain the under-representation of women civil

engineers, who are not manual workers and may not even work on site.

Florman claims that the explanation for the relative absence of women engineers, including civil engineers, is that "talented young women were avoiding engineering because they perceived other professions as a more direct route to political power and social prestige...The perception is widespread...if you're smart enough to be an engineer, you're too smart to be an engineer" (Florman, 1987, p215). One problem with the explanations of Ball and Florman is that they do not show why women are disproportionately deterred from entering the industry.

There is another version of the image explanation which concentrates on the disproportionate effect on women. This is an explanation which claims that the industry has a 'masculine' image, and that this deters women. The image of science as masculine was discussed in section 2.5.3.1, but the argument has also been applied to the image of engineering and construction industries. The explanation can take a variety of forms. Newton claims that the perception of the engineering industry as 'male' discourages women from applying for jobs there. The image of the industry can have this effect in different ways, for example by leading women to believe that they would be isolated, or that they would be discriminated against, or that somehow the work was not suitable for them (Newton, 1987, pp 185-6). Gale argues that another way in which the image deters women is by giving women the perception that the organization and methods of the industry do not fit their feminine characteristics. He claims that the (well-documented) conflictual nature of the industry is discouraging to those (typically women) adhering to feminine norms of cooperation (Gale, 1992, p419).

From the results presented in the last two sections, it appears that from the literature, the image of science, engineering and construction is seen as masculine and that this can deter women from choosing them. There is a good deal of consensus about the causal influence

of the masculine image of science on males and females. There may therefore be little need for further research in this area. Furthermore, it should be noted that the effect of 'masculine' images is very hard to test using survey research of the sort that occurs in this thesis. People probably do not choose subjects because they consciously think of them as masculine or feminine and so their answers are unlikely to reveal directly the effects of those subject images, if there were any effects.

The next section examines the effect of the school environment on the choice of subjects and careers for women, with particular reference to women choosing civil engineering.

2.6 THE SCHOOL ENVIRONMENT

It has already been suggested in previous sections that school can influence career choice of both male and female pupils. The next sections in this chapter examine the part played by the school, in particular the role played by teachers and careers advisers in the career decisions of pupils, together with other factors associated with the school environment.

2.6.1 THE INFLUENCE OF TEACHERS AND CAREERS ADVISORS

This section examines the influence of teachers and careers advisors on the choice of subjects by young women, particularly on physics, and also on career choice, particularly engineering.

Many researchers have investigated the influence of careers advisors and teachers on career choice (for example; Blackstone, 1987; Spear, 1987; Kelly, 1987). Spear, summarising the work of other researchers, suggested that "The advice and encouragement received from teachers is one of the factors that can influence a pupil's decision to study a particular subject" (Spear, 1987b, p56). Ryrie et al's work on the choice of subjects by school children

in Scotland found that in some of the schools studied, the numbers of pupils receiving guidance from teachers was small, and that in other schools pupils were required to meet with individual teachers to discuss their choice (Ryrie et al, 1979, pp 70-73). However, they concluded that in their view the advice or guidance given by teachers had only a limited effect upon the choices of most pupils (Ryrie et al, 1979, p76).

Spear's previous research, focusing only on the subject choices of girls, had suggested that generally teachers believed that qualifications in technical subjects were unimportant for girls and that many teachers also thought that girls were weak at technical subjects. As a consequence, she argued that "some teachers do not actively encourage girls to opt for technology and that some even positively discourage them" (Spear, 1985, p42).

A large survey of male and female graduate engineers in the UK suggested that over a third of respondents thought that teachers had played an important part in encouraging their career decision towards engineering (IVL, 1989, p15). However, this survey was of male and female engineering graduates. When examining the advice for women engineers only, Carter and Kirkup, in their work on women in engineering in the UK and the USA, stated that "...in most cases schools concentrated on getting girls into traditional female careers and the subjects appropriate for these" (Carter and Kirkup, 1990, p54). However, other work on the influence of teachers on careers for women in engineering has concluded differently. Newton's survey of women engineers concluded that "female engineers saw teachers and the media as being most important in their choice of engineering" (Newton, 1987, p196). The positive influence of teachers was confirmed by Fitzpatric and Silverman in their work on women in science and engineering in the US, where they indicated that women found a strong positive influence from high school teachers on their decisions to choose science (Fitzpatric and Silverman, 1989, p273).

Another way in which teachers might affect career choice was suggested by Whyte who stated that "teachers who continue to hold sex stereotyped attitudes and beliefs are likely to convey these sentiments to their pupils" (Whyte, 1985, p43). Spear also commented on this when she asserted that "Teachers who consciously or unconsciously believe that the physical sciences are masculine subjects are likely to perceive girls as unsuited for science studies" (Spear, 1987a, p46). Reporting the work of Rowell, she states that "teachers' expectations can either reinforce or counteract girls' under-achievement in sciences" (Spear, 1987a, p46).

Carter and Kirkup stated that "The educational advice that young women receive in school still leaves much to be desired." (Carter and Kirkup, 1990, p74). The careers advice that their sample of women engineers had received was very varied. They contended that some women had been offered informal advice or encouragement by teachers while others faced opposition at school and were forced to seek advice elsewhere. Concluding they stated that "for the sample as a whole, careers advice and counselling on engineering at school ranged from excellent, through unreliable and individualistic, to non-existent" (Carter and Kirkup, 1990, p45). Newton also remarked on careers advice that women received suggesting that the biases and shortcomings in many schools careers programmes and the careers service had deterred some women from applying for engineering courses (Newton, 1981, p.140) Over a number of years efforts have been made to encourage more women to enter engineering or science courses by providing additional, often residential, careers services (eg Chives, 1986, p247; Kelly, 1987a, p100, EITB, 987a, p4). These courses aim to encourage more girls of all ages to choose sciences at school, or engineering as a career. Some research has suggested that these are successful in encouraging young women to consider engineering as a career (Kelly, 1987a, p112). The Engineering Industry Training Board in their report 'New Graduate Recruitment to Engineering' stated that "...initiatives such as Insight have had a

considerable impact on the number of women choosing to study these [engineering] degree disciplines". A recent survey carried out on sixty sixth form girls on a residential "Taste of Technology" course suggested that the students' knowledge of professions such as civil engineering, mechanical engineering and others was enhanced by the course (Wilkinson, 1992c, p338). The survey further argued that such courses were a successful method of attracting girls to technological careers and providing them with information to help them enter these careers (Wilkinson, 1992c, p392).

The results in the literature surveys discussed above show a good deal of contradictory views, and there seems to be no clear indication, either way, on the influence of teachers or careers advisors in the choice of engineering for women. There seems to be ample scope here for further research. Later, the thesis tests for the significance of careers advisers and teachers in influencing subject and career choices of women civil engineers. The results of the surveys of the literature examined in this section have shown that there are differing opinions about the encouragement and influence of teachers and careers advisors on the career choice of young women. The next section examines whether the type of school attended is an important factor in encouraging the study of physics, and the choice of engineering as a career for girls.

2.6.2 TYPE OF SCHOOL

Some researchers have argued that more girls study science in single-sex schools than mixed sex schools (eg, Dale, 1974; Smithers and Collings, 1981; Arnot, 1986). Arnot reporting on a study of curriculum differences for boys and girls by the DES suggested that "Although girls were more likely to be offered a science subject in a mixed-sex schools, they were less likely to actually choose and take the subject in such schools" (Arnot, 1986, p161). Dale

commented on this in his work, indicating that girls in single-sex schools are more likely to choose physics or physical science and mathematics than girls in mixed-sex schools (Dale, 1974, p68). This was confirmed by another report, which showed that over twice as many girls in single sex schools as in mixed schools took physics as an examination option and 41 per cent of girls in such schools took chemistry compared with 26 per cent in mixed schools (Pratt et al, 1984, p87). Redpath and Harvey summarised that from their study on young people's intentions to enter higher education that "There was hardly any difference in the uptake rates for A level physics between the three types of institutions previously attended by boys; however, there was a higher take-up of A level physics among girls at independent schools, compared with girls attending other institutions." The three types of institutions referred to here are Independent, Maintained and Further Education College (Redpath and Harvey, 1987, p38). Marland summarised the work of some researchers by suggesting that "Subject choice is less stereotyped in single-sexed girls' schools than in mixed" (Marland, 1983, p181). He argued that in girls-only schools the physical sciences are less likely to become part of the masculine image and also suggested that the chances of there being women teachers in mathematics and physical sciences is higher in girls-only schools than in mixed schools. He continued by saying "It is therefore likely that the leadership of strong and successful role models will encourage the pupils towards what would otherwise be non-typical sex efforts and choices" (Marland, 1983, p182).

It would appear from the discussion above that for women who are likely to study physics, the type of school attended is an important factor in influencing subject choice. How far it has an effect on choice of civil engineering specifically is something that is tested later in the thesis.

2.6.3 PEER PRESSURE AND SELF IMAGE

This section examines another factor which could affect the numbers of young women choosing engineering courses; that of peer pressure. Kelly suggested, from her research on women in science, that girls could find science classrooms intimidating (Kelly, 1987b, p128). This was supported by Johnson in her work on women in civil engineering in the United States. She contended that "sitting in a classroom with one or two other women and 20-40 men, learning about a subject that has traditionally been male territory, is intimidating to many young women" (Johnson, 1992, p34). Johnson suggests that for many women the rewards of engineering are not enough to subject themselves to such pressure. Kelly further commented on peer pressure in her work which observed classroom interactions between students in science classes. She observed that the boys acted as if they had priority over resources, which took the form of pushing for apparatus, monopolising the teachers' time, and assuming that they knew more about science than girls. She suggested that, as a consequence, many girls lose confidence in their ability in science classrooms (Kelly, 1987b, p128).

Some researchers have also suggested that career decisions are influenced by their peers in that women may wish to do the same subjects as their female friends (eg Ebbutt, 1981a, p116; Johnson, 1992, p34) and that because of this, studying physics and engineering may not be a high priority (Johnson, 1992, p34).

There appears to be some consensus in the literature discussed in this section that peers can influence career choice away from science and engineering. The following section examines some other reasons given by researchers for women choosing, or not choosing, to study physics, and engineering.

2.7 OTHER FACTORS WHICH HAVE BEEN IDENTIFIED AS IMPORTANT

A number of additional factors have been identified by some researchers as important in influencing career or subject choice. Ryrie et al suggested that, from their analysis of subject choices, "The biggest single number of choices (31 percent of all individual choices) were explained in terms simply of interest in or liking for the subject; 26 percent were explained in terms of usefulness of the subject for job or career; and 24 percent were said to have been chosen on someone else's recommendation, or because there seemed to be no other possibility." (Ryrie et al, 1979, p54). Redpath and Harvey confirmed some of these reasons, by suggesting that "students mainly picked their A level subjects because of interest and enjoyment, because the subjects were required for their preferred higher education course, because they had a good O level or CSE pass in the subject, or because they believed they could pass at A level" (Redpath and Harvey, 1987, p24). They went on to suggest, from their analysis of why pupils do not take physics, that "...the predominant reasons ...for not taking A level physics were lack of interest (reason(i)) and anticipated difficulty (reason (ii))." (Redpath and Harvey, 1987, p43). Bakos also reported on other factors that had influenced career choice. From his work on women on civil engineering courses in the USA, he listed some factors which he had found to be important in their decisions to choose civil engineering such as "...college oriented families, variety of work choices available in engineering, attractive salaries, opportunity to apply mathematics and science (since they liked or were good at science and math), and high school teachers." (Bakos, 1992, p18). It will be useful to see whether Bakos's results can be duplicated for women civil engineers in the UK. Although there is, unsurprisingly, little disagreement that enjoyment and ability influence choices, there still seems to be value in testing this for UK women civil engineers to get a better understanding of the importance of these factors.

From this section, it appears that there are many additional factors which could influence career decisions. The next section focuses on reasons give by women, interviewed for this study, for choosing civil engineering.

2.8 RESULTS OF INTERVIEWS ABOUT THE INITIAL REASONS FOR WOMEN CHOOSING CIVIL ENGINEERING

The discussions in this chapter have focused on the reasons why women do, or do not, choose to study physics, engineering or construction courses. Wherever possible, the reasons put forward by researchers in the literature for women choosing civil engineering have been discussed. This section reports on the findings of forty three interviews with women civil engineering students and women civil engineers (see section 6.4.3.1 for details of the number and nature of these interviews) about their initial reasons for choosing civil engineering, and relates their reasons to the reasons given in the literature analysis presented in this chapter. The results of these interviews tended to confirm the importance of family in providing encouragement for a decision to choose civil engineering. Eighteen women had fathers who were in engineering or in professions related to construction, and of these women, sixteen were encouraged by their fathers in their choice of career. Older brothers were mentioned by seven women as providing encouragement, and there seemed to be an indication that it was brothers who were in engineering careers who provided the most support since five of these women had brothers in these professions. Although mothers were not always mentioned in providing encouragement, two women said that their mothers had discouraged or been sceptical about their career choice.

Provision of advice and support from teachers was identified as an influence on career choice. Five women mentioned that they had particular support and encouragement from

physics teachers, three women mentioned support from mathematics teachers. These results tended to correspond with some of the results of the discussion in section 2.6.1 confirming that teachers might be important in the career decisions of women entering civil engineering. The results of these interviews tended to confirm the erratic nature of careers advice, which varied from person to person. Of those women who commented on career advice at school, six women were encouraged and given help in finding information, whereas eight were given no help in career planning. One of the women who had been on an 'insight into engineering' course said that this had given her enough information to feel confident in her choice of civil engineering. There did appear to be some indication that women received different careers advice depending on the type of school they had attended. For instance, it appeared that seven of the fourteen women commenting on career advice at school had attended a single-sex school and they appeared to get more encouragement, and more individual advice from both careers services and teachers. Eleven women interviewed stated that they had sought careers advice outside school, and in most cases it was suggested by them that this was because the advice at school was inadequate. In most cases women found information from their families, but in two cases they went to different sources such as the library. The impression gained from the interviews was that the erratic nature of careers advice meant that seven women felt that they had not known very much about civil engineering even when they had decided to choose it.

The analysis of the literature indicated that hobbies could be important but this was not found to be the case in any of the interviews conducted for this research, although one woman said she "played with her brother's toys".

In thirty two of the interviews, women were asked what were their strongest and weakest subjects at school. Twenty five of these women felt that mathematics and physics were their

strongest subjects at school and it was usually inferred from this that this had been one of the main factors in their decision to choose a technical career, such as civil engineering. A general impression was gained from the analysis of the interviews confirmed some research in the previous section, that women wanted to use their science and mathematics qualification and that this led them to consider civil engineering, amongst other technical careers. From nine of the women an impression was gained that they were not as good at arts subjects such as history or English as they were at physics and mathematics, and that this meant that they sought careers with science qualifications. The decision to choose civil engineering for ten of the women interviewed was after A level subjects had been chosen, when they were considering what they could do with the subjects they had elected to do. In most cases these subjects were mathematics and physics.

What also appeared from these interviews to be important in women's career decision was the nature of the work involved. In interviews, one of the reasons that women gave for choosing a career in civil engineering was because they were attracted by certain features of the work. Further prompting revealed that the reasons given were often similar for many women - features such as interesting work (eighteen women mentioned this), working outside (twenty one women mentioned this), potential high salary (nine women mentioned this), transferable skill (seven women mentioned this, and since two of the students were interested in working in the third world, this was particularly important for them), working in a male dominated field (two women mentioned this), not working with the general public (one women mentioned this). The general impressions gained from these interviews was that some common reasons for women choosing civil engineering might exist.

The results of some of the literature suggested that there was an image problem. However, most of the women interviewed for this research reflected on the image of engineering as one

which would offer them a challenging and exciting career. Despite this, the results of the interviews did suggest that many women felt they had insufficient knowledge of civil engineering before they began the course and would have liked to have known more about civil engineering as a career prior to entering the profession.

The results of these interviews have helped to clarify some of the reasons given in the literature for women choosing engineering as a career. They have also suggested other reasons for women choosing civil engineering not covered in the literature. Further investigation of the reasons identified in the literature and in these interviews is carried out in this research, where the initial reasons for women choosing civil engineering as tested on a national sample is carried out to see if any general patterns exist.

2.9 CONCLUSION

This chapter has discussed the factors which affect the entry of women to civil engineering degree courses. It examined some of the many reasons offered to explain why few women study physics. The point was made that a physics qualification appeared to be a precondition for studying civil engineering at degree level. The chapter argued that this is a qualification that girls do not acquire and examined reasons for this. The chapter identified what factors might encourage and discourage women to choose civil engineering and discussed from which of these factors there was a consensus and which required further investigation. Finally, the chapter concluded with a section examining the results of personal interviews, conducted for this research, which helped clarify some of the data in the literature, and also suggested additional reasons, given by women civil engineers, for choosing civil engineering.

CHAPTER THREE

WOMEN IN HIGHER EDUCATION

3.1 INTRODUCTION

The last chapter examined some of the reasons put forward in the literature for the lack of uptake by women of engineering, including civil engineering, courses in the United Kingdom. It concluded that there are many influences on young women from within education and in society which may affect their career choice. The aim of this chapter is to identify the possible differences in the career choices made by male and female civil engineering students, and to identify how the experiences of women on civil engineering courses might influence these choices. In order to do this, the situation of women in higher education in the U.K is first discussed. Following this figures, published by the Central Services Unit, are presented which indicate that there is a difference in the career choice of male and female civil engineering graduates. Research, mainly from the U.K but also from the U.S.A, identifies the problems some women may face when they study for a broad range of science, technology and engineering subjects at colleges in which, as women, they are in a small minority. These problems might explain the difference in career choice between males and females and are discussed. Finally, the results of interviews with male and female civil engineering students examining their career intentions are discussed. Following this the results of interviews with women civil engineers, conducted for this research which aimed to examine whether there was a relationship between college experiences and career choice, are discussed.

3.2 WOMEN IN HIGHER EDUCATION

In 1987-88, women accounted for 45 percent of full time students in higher education and 39 percent of part-time students in the U.K (Wilson, 1990, p45). However, despite women taking almost half of the places in higher education, the pattern of sex-differentiated subject choices in higher education is quite clear. Table 2.1 illustrates the different percentages of women enroled on a variety of university degree subjects. The subjects were chosen to illustrate the marked differences between some of the more traditional "male" subjects, e.g engineering, and what are considered by some researchers (for example; Kelly, 1981; Wilson, 1991) as the more "female" subjects e.g sociology. Many other subjects could have been chosen also to illustrate the differences, but the basic point here is that there are marked differences in the percentages of male and females enroled for some subjects, including civil engineering.

TABLE 3.1 PERCENTAGE OF MEN AND WOMEN FULL-TIME UNDERGRADUATES OF UK DOMICILE ANALYZED BY SUBJECT OF STUDY AND SEX AT UNIVERSITIES IN GREAT BRITAIN.

	men %				women %			
	1980-81	1983-84	1986-87	1989-90	1980-81	1983-84	1986-87	1989-90
civil engineering	95 6	92 5	88.1	85.7	4.4	7.5	11.9	14.3
electrical engineering	96 3	94 4	92 5	91.7	3.7	5.6	7.5	8.3
physics	86 6	85 4	84.1	83.9	13.4	14.6	15.9	16.1
chemistry	76 1	72 2	69 4	66.9	23.9	27.8	30.6	33.1
mathematics	72 1	72 1	67.7	67 6	27.9	27.9	32.3	32.4
sociology	35 8	32 5	33 4	30.8	64.2	67.5	66.6	69.2
biology	53 6	47 0	45.9	44.6	46.4	53.0	54.1	55.4

Source: University Statistical Records, Volume One, annually, 1980-1990.
Notes: 1. mathematics 1986/87 and 1989/90 includes statistics
2. The figures contained those enroled in universities only, before the polytechnics became universities.

Table 3.1 shows that in 1989-1990, at universities (not including the former polytechnics) in Great Britain, women make up less than fifteen percent of students on civil engineering, electrical engineering and physics. They occupy around a third of places on chemistry and mathematics, half the places on biology and two thirds of the places on sociology. This differentiation is partly explained by the differences in subject uptake at A level, as discussed in the previous chapter.

It is important to note here that, according to Wilson, in 1987 32% of all sixteen to eighteen year olds were to be found in further education (Wilson, 1990, p43). Here, female students were heavily concentrated in home economics, catering, secretarial, and health courses (Wilson, 1990, p46). She estimated that four times as many men as women pursue courses in technical and vocational qualifications and that ninety-nine per cent of those on engineering courses at this level are male (Wilson, 1990, p46). It appears from these figures that men tend to be in an even greater majority on engineering courses in the technical colleges and further education than in universities and polytechnics. Since the courses at further education and technical colleges act, to some extent, as feeder courses for engineering degree and diplomas, including civil engineering, the proportionate representation of men on engineering courses is further increased by this intake whilst that of women is not.

Research has been carried out to attempt to identify reasons why women do not enter engineering or construction courses. Many of these possible reasons were discussed in the previous chapter. A possible explanation of why women do not study what Fuller loosely termed science and technology subjects, despite having the necessary A levels, was put forward by Fuller in her analysis of gender and the arts/science divide in higher education (Fuller, 1991, P.338). Briefly, she suggested that many women, even those with the necessary qualifications to enter science and technology, were already considering the

implications of a science or technology career on having a family, and that their perceptions were that employers in these areas were not providing the necessary career breaks and child-care support. A more detailed discussion of this argument is covered in the next chapter. For construction, The Construction Industry Training Board has focused on the image of construction as a potential problem (CITB, 1988a, p27-41). Other researchers (eg Gale 1989, 1991a, 1991b; Srivastava, 1991, 1992a, 1992b) have looked at the image and culture of built environment courses as a possible barrier. Various disciplines involved in the construction process, such as architecture and town planning, are more successful at attracting women than other courses such as building and civil engineering and some research (for example; Srivastava, 1991, 1992a) have examined reasons for this.

One of the main problems in this research is the lack of information on women in civil engineering specifically. Where information on women in civil engineering has been located, it has usually been in one of two main areas. Research on women in engineering usually includes women in civil engineering (eg Carter and Kirkup, 1990; McRae et al, 1991; amongst others); similarly research into women in construction usually includes women in civil engineering (e.g. Srivastava, 1991, 1992a, 1992b). Statistics on education tend to list civil engineering within "engineering and technology" (University Statistical Records, most years) but they tend to term courses like building as "architecture and related studies". This differs from a report by the Department of Education and Science titled "Higher Education 'n the Polytechnics and Colleges; Construction" which quite clearly allies civil engineering with courses such as surveying, building, estate management, architecture and others (DES, 1990, p7). Thus, it appears that although civil engineering forms a distinct branch of construction, it is also often categorised within "engineering and technology".

Entry qualifications to civil engineering courses reflect the technical nature of the course. A

background in physics and mathematics, usually at A level, is required, whereas for building courses the entry qualifications are more flexible (University Entrance, 1991). Since civil engineers predominantly work in the construction industry but are employed as engineers, relevant literature has been found both in the area of women in engineering and women in construction. But, as mentioned, it is often insufficiently specific about civil engineering. In this chapter the career choices during, and after, higher education of women in construction, those of women in engineering, and occasionally those of women in physics are discussed in so far as they appear to affect women in civil engineering. Differences between the disciplines do not appear to affect the arguments presented below, since it appears from the literature that the experiences of women on courses where their percentages are less that about 30% seem to be in many ways similar (Carter and Kirkup, 1990, pp50-75; Tizard and Chiosso, 1990 pp14-16; Thomas, 1988, pp123-137). Having established that there are differences in the uptake of degree subjects according to sex, and that women are in a minority in some of the science, technology and most engineering courses, this next section examines what choices men and women make when they leave higher education with civil engineering degrees.

3.3 LEAVING HIGHER EDUCATION

The percentage of women on university civil engineering courses is currently about fourteen per cent (University Statistical Records, 1991). Table 3.2 shows the total full-time undergraduates enroled on civil engineering course in Great Britain at universities for the years 1985 until 1990. The table shows that, despite the rising numbers of women enroled on civil engineering courses, in 1990 they still formed less than 15 per cent of the total numbers enroled.

TABLE 3.2 TOTAL FULL TIME UK DOMICILE UNDERGRADUATES ENROLED ON CIVIL ENGINEERING COURSES IN GREAT BRITAIN (UNIVERSITIES) FOR ALL YEARS OF COURSE.

year	no of men	no of women	total number of UK domicile students	women as a percentage of total
1985 1986	3326	421	3747	11.24
1986 1987	3295	446	3741	11.92
1987-1988	3119	452	3571	12.66
1988 1989	3010	490	3500	14.00
1989-1990	3121	520	3641	14.28

Source University Statistical Records (annually, 1985-1990)

The following table, 3.3, shows the numbers of men and women graduating with civil engineering degrees from universities and polytechnics from 1986 until 1990. Table 3.3 also shows that the number of women on university and polytechnic courses has increased over the years 1986-1989 with a slight decrease in 1990. However, it does also show that the number of men graduating with civil engineering degrees has decreased since 1986.

TABLE 3.3. NUMBERS OF STUDENTS GRADUATING WITH CIVIL ENGINEERING DEGREES BETWEEN THE YEARS 1986-1990

year	Number of men (univ)	Number of women (univ)	Number of men (poly)	Number of women (poly)	Total number of male students (poly and univ)	Total number of female students (poly and univ)	Total number of students	Women as a percentage of total (polytechnic and university)
1986	1345	130	681	28	2026	158	2184	7.23
1987	1340	157	657	32	1997	189	2186	8.65
1988	1273	165	638	42	1911	207	2118	9.77
1989	1161	175	639	50	1800	225	2025	11.11
1990	1088	155	649	53	1737	208	1945	10.69

Source: Central Services Unit, 1991, First Destination Survey Results

Much research has concentrated on why so few women enter most engineering and many built environment courses, but little research has been done on what experiences women encounter on these courses and whether these experiences lead them to enter employment in the construction industry. Such research would be valuable in the light of the First Destination Surveys, which indicate an apparent difference in the careers that male and female civil engineers choose after they graduate. The First Destination Surveys are carried out by polytechnics, colleges and universities throughout the UK. These surveys give information on the first employment that graduates have after leaving higher education with degree and diploma qualifications. The survey relies on the higher education establishment collecting the data about all their graduates on different courses. This information is then collected centrally by the Department of Education and Science (statistics branch) from colleges and polytechnics and by the Universities Statistical Records for universities. The information is then tabulated and published by the Central Services Unit and gives an indication of the type of work graduates from universities, polytechnics and colleges of all disciplines enter. The following results of the First Destination Surveys of civil engineering graduates were received from The Central Services Unit (CSU).

Table 3.4 shows the percentage of civil engineering graduates answering the First Destination Survey each year from 1986 to 1990. This shows that the response rate to the survey ranges from 47.7% (response rate of male students in 1986) to 63.1% (response rate of female students in 1989).

TABLE 3.4 NUMBERS OF STUDENTS GRADUATING WITH CIVIL ENGINEERING DEGREES BETWEEN THE YEARS 1986-1990, NUMBERS WHO ANSWERED THE FIRST DESTINATION SURVEY, AND RESPONSE RATE.

year	Number of men (university and polytechnic)	Number of women (university and polytechnic)	Total number of male students (polytechnic and university) answering the FDS Survey	Total number of female students (polytechnic and university) answering the FDS Survey	Percentage of male students answering the FD survey	Percentage of women students answering the FD survey
1986	2026	158	967	78	47.7	49.4
1987	1997	189	1112	104	55.7	55.0
1988	1911	207	1128	123	59.0	59.4
1989	1800	225	1132	142	62.9	63.1
1990	1737	208	1051	127	60.5	61.1

1 Figures based on the analysis by the CSU of First Destination Survey results

The following table, 3.5 shows the percentage of civil engineering graduates entering employment category building, civil engineering and architecture from 1986-1990. As can be seen from this table, the percentage of women (out of the total number of women answering the First Destination Survey) entering this employment category each year is consistently lower than the percentage of men. It also shows that, according to the First Destination Survey Results, there has been a consistent increase in the numbers of men and women entering these types of employment. However, between approximately 30% (in 1989) and 50% (in 1986) of women, do not enter this employment category on graduation, and between approximately 22% (in 1989) and 40% (in 1986) of men, do not enter this employment category on graduation. The graduates unaccounted for in these figures tend to enter other sectors of the construction industry or other professions altogether.

TABLE 3.5 NUMBERS OF STUDENTS GRADUATING WITH CIVIL ENGINEERING DEGREES BETWEEN THE YEARS 1986-1990 WHO ENTERED BUILDING AND CIVIL ENGINEERING WORK

year	Number of men (univ and poly) answering FDS entered civil/ build/archit	Number of women (univ and poly) answering FDS entered civil/build archit	Total number of male students (poly and univ) answering the FDS Survey	Total number of female students (poly and univ) answering the FDS Survey	Percentage of male students entered civil/build/archit work (who answered FDS survey)	Percentage of women students entered civil/ build/archit work (who answered the FDS)
1986	575	38	967	78	59.5	48.7
1987	708	59	1112	104	63.7	56.7
1988	830	84	1128	123	73.6	68.3
1989	876	101	1132	142	77.4	71.8
1990	808	82	1051	127	76.8	64.6

Source Figures based on the analysis by the CSU of First Destination Survey results

The following tables shows the numbers of graduates who enter other sectors of civil engineering, with civil engineering degrees. They show those graduates with civil engineering degrees who entered local authority and public utility employment (table 3.6), and the numbers of graduates with civil engineering degrees who entered financial employment (table 3.7).

TABLE 3.6 NUMBERS OF STUDENTS GRADUATING WITH CIVIL ENGINEERING DEGREES EACH YEAR FROM 1986-1990 WHO ENTERED LOCAL AUTHORITY AND PUBLIC UTILITY WORK

year	Number of men (univ and poly) answering FDS entered L/A or P U	Number of women (univ and poly) answering FDS entered L/A or P U	Total number of male students (poly and univ) answering the FDS Survey	Total number of female students (poly and univ) answering the FDS Survey	Percentage of male students entered L/A or P/U (who answered FDS survey)	Percentage of women students who entered L/A or P/U who answered the FDS
1986	178	17	967	78	18.4	21.8
1987	135	22	1112	104	12.1	21.2
1988	108	18	1128	123	9.6	14.6
1989	110	17	1132	142	9.7	12.0
1990	117	24	1051	127	11.1	18.9

source Figures based on the analysis by the Central Services Unit of First Destination Survey results

It can be seen from table 3.6 that the proportion of women entering local and other public authority areas of work is consistently higher than the number of men. Local authorities employ many civil engineers to work in road, drainage and structures departments amongst others. Reasons why women may be attracted to local authority work in these higher percentages than their male colleagues will be discussed later in this thesis.

A high percentage of the remainder of the graduates leaving universities with civil engineering degrees tend to concentrate in financial work. The main alternative employment categories that both male and female civil engineering graduates migrate to in significant numbers are accountancy, banking, insurance and finance and other commerce and commercial services. Table 3.7 shows the percentage of university graduates leaving with civil engineering degrees entering these disciplines.

TABLE 3.7 NUMBERS OF STUDENTS GRADUATING WITH CIVIL ENGINEERING DEGREES EACH YEAR FROM 1986-1990 WHO ENTERED ACCOUNTANCY, BANKING AND INSURANCE AND OTHER COMMERCIAL EMPLOYMENT.

year	Number of men (univ and poly) answering the FDS who entered banking etc	Number of women (univ and poly) answering the FDS who are entered banking etc	Total number of male students (poly and univ) answering the FDS Survey	Total number of female students (poly and univ) answering the FDS Survey	Percentage of male students entered banking etc (who answered FDS survey)	Percentage of women students entered banking etc who answered the FDS
1986	91	9	967	78	9.4	11.5
1987	113	14	1112	104	10.2	13.5
1988	64	11	1128	123	5.7	8.9
1989	53	9	1132	142	4.7	6.3
1990	31	10	1051	127	3.0	7.9

Source Figures based on an analysis by the CSU of First Destination Survey results

The above table shows that women civil engineering graduates appear to enter accountancy, banking, insurance and other commercial employment in consistently higher percentages than men. However, on examining tables 3.6 and table 3.7, it appears that women enter financial and commercial disciplines in quite high percentages, approximately half as high as for those who enter local and public authorities. From the tables it can also be seen that the numbers of women entering financial sectors has been declining since 1985. However, it does appear that there are still a relatively large number of both men and women seeking employment outside construction.

The remaining graduates unaccounted for in the above statistics in any of the three categories entered a variety of occupations, including, the civil service, HM Forces, teaching, higher education, agriculture, oil, mining and manufacturing. However, entry individually into these professions was in very small percentages (see First Destination Statistics, 1986-1990).

Gale and Fellows suggested that the jobs done by women with construction management and

building degrees were different to those done by men, arguing that "...women are not involved for the great part in the production management of construction. They are more likely to be found in office based roles associated with design, management services, education and research" (Gale and Fellows, 1991, p680). This was supported by the opinion of a women working in civil engineering reporting for the Graduate Scientist and Engineer where she suggested that a women on site is more rare than a women in the design office (Graduate Scientist and Engineer, 1990, pp88-89). Despite the apparent differences in the choice of occupations of male and female civil engineering graduates, no attempt has been made in the literature to establish reasons for these differences, although some research has explored these differences in wider fields, such as the whole of engineering. The different career choices that women engineering students make could be explained by something to do with their experiences on the course. Or (or as well) they could be explained by the recruitment policies of the industry. Perhaps fewer women intend, on graduating, to become engineers. That could be explained by their experiences at college. On the other hand, perhaps their intentions are no different from men's, and the facts about their different distributions among occupations have to be explained by looking at what employers are doing. The First Destination Surveys alone cannot provide solutions as to which of these explanations is valid (or if both or neither are) because it only records women's and men's first destinations and not what they would have liked to have done on graduating. Hence there is a need for a survey of women's intended career choices compared with men's, and that is partly what this thesis does.

There is some research relevant to this topic. The following search of the literature is designed to elicit some of the reasons why the choices of women engineering students differ from those of men. The validity of these reasons can then be tested in the later research of

this thesis. As things stand, the existing literature does not offer the sort of consensus on explaining the differences which makes further research unnecessary. Furthermore, the explanations offered in the literature are sometimes slightly sketchy or do not concern civil engineering specifically. Hence they need to be supplemented with further research.

A large piece of research was undertaken in 1989 which made an attempt at determining the career intentions of final year engineering students (IVL, 1989). It examined the responses of nearly 2,000 graduates from varying types of engineering courses. Its results indicated that course experience was seen to be very important in the decision process, and stated that "The students judged their courses to be too theoretical, with too few practical and managerial components" (IVL, 1989, p13). Usher and Ward, in their study of the civil engineering degree course at Southampton University argued that "Classroom practices are very influential in shaping behaviour and patterns of participation and achievement. Teaching methods, the nature of the interaction between teacher and student, and between students are all important in conveying what is approved practice in engineering" (Usher and Ward, 1991, p1). This appears to imply that there is a relationship between the experiences during the course and the engineering career where, as Usher and Ward suggest, the learning process is impressing on the students what is acceptable in practice. It is possible that this learning process is having an adverse effect on some students' desires to enter the profession. It has been recently suggested that up to 25 per cent of students studying engineering at Imperial College, London, will not take up jobs in engineering (Cope, 1993, p1). One of the explanations put forward for this was that because the degree subject is difficult, the expectation that this difficulty will continue leads to many graduates choosing to look for managerial jobs outside the profession (Cope, 1993, p1).

Some further evidence of the move away from engineering can be found in a small survey

of students graduating with civil engineering degrees where it was found that there was a fall in the numbers entering the engineering profession from 93.9% (in 1983) to 53.9% (in 1986) and a rise in the percentages of graduates moving into finance from 0% to 34.7% over the same period (Eyers et al, 1988, p82).

The IVL survey found that career intentions differed between the sexes, and suggested that the proportion of female students intending to go into non-industrial jobs (although it is not quite clear what the term "non-industrial" means in this case) was greater than the proportion of male students; 16% compared with 11% (IVL, 1989, p13). The argument put forward to explain this difference was that 64% of females thought that there was 'unofficial discrimination against them' in industry, and that 59% thought that the 'engineering career structure mitigates against women succeeding' (IVL, 1989, p13). Although these two factors might deter women entering engineering, it seems that other factors, discussed later, could also affect this decision. What the IVL survey did suggest, though, was that when selecting employers, females place slightly more emphasis on training and the quality of the company while males place more emphasis on salary and promotion (IVL, 1989, p13). The IVL survey suggested that employer attributes can be divided into four sections in terms of their importance to students but did not distinguish any difference in this importance between male and female students. They suggested that "First the job must be challenging, stimulating and varied; the training and salary prospects are ranked a close second; thirdly, students look for success and stability in an employing company and finally, of lesser importance, come factors such as organisation and philosophy of the company" (IVL, 1989, p31). A large survey from the USA supported some of these factors. Concerned only with women engineers, the research suggested that from their list of factors important to women engineers in choosing employment, that "... respondents list the most important considerations as the

opportunity to do interesting work and for professional advancement, compatibility with their work place colleagues, first impressions of the company and location of the organisation." (Coopers Union, 1989, p6). Both these surveys were concerned with the whole of the engineering profession. Differences in the factors influencing career choice between male and female civil engineers has not been investigated and is carried out in the research in this thesis.

More evidence of a difference in job destinations between male and females students can be found in a study conducted by Weinreich-Haste and Newton, who found that of pupils just entering engineering, young women intending to enter engineering appeared to be relatively less concerned with pay and status than young men with similar career plans (Weinreich-Haste and Newton, 1983, p50). It is possible that this difference continues throughout an engineering education, as part of the IVL survey suggested. Another survey in the UK, of engineering graduates, appeared to confirm some of the findings of the IVL survey. This attitude survey of engineering undergraduates argued that "female students were consistently less enthusiastic about working in the engineering sector than male students and instead are keener to start in business and finance (5% compared with 2%)" (Davis et al, 1990, p16).

Further research has tried to establish some of the difficulties women face when they are on minority courses, although possible links between these difficulties and future career decisions were not made. However, according to the IVL survey, college experiences can affect career decisions and therefore it is possible that there exists some relationship between the college experiences of women civil engineers and their career decisions. Since there has been no research which has determined whether this is the case, part of the research in this thesis is concerned with this potential relationship, specifically examining the relationship between the college experiences of women civil engineers and their career choice. The

remainder of this chapter is concerned with the college experiences of women on courses where they are in a small minority, such as engineering, physics and building, and asks whether these experiences can affect career decisions. As mentioned earlier, the lack of large scale information dealing explicitly with the experiences of women in civil engineering meant that the experiences of women on other courses where they were in a minority had to be considered. The following section reviews some of the literature about the experiences of women on courses like engineering, building and some sciences.

3.4 THE EXPERIENCES OF WOMEN ON SCIENCE AND TECHNOLOGY COURSES AND THEIR POSSIBLE EFFECT ON FUTURE CAREER CHOICE

This section reviews the experiences of women on engineering and other non-traditional courses (mainly courses in the U.K but where indicated, courses in the U.S have been used as well) with the aim of discovering what these experiences are as a preliminary to seeing whether these experiences could affect women's career choices. Much of the literature does not deal explicitly with this latter question. If, for instance, it is true that women feel at an initial disadvantage on their courses, does this affect their career choice upon graduating, or would that *initial* disadvantage be irrelevant by that stage? No discussion of women's experiences would be complete without mentioning any sense of initial disadvantage, but its role in explaining career choice may be obscure. (Its role is something tested in the thesis.) Similar remarks apply to many other items in the literature. While they contain valuable discussions of women's experiences, it is often not clear how these relate to their career choices. In addition, most of the research discssed in this section relies on the methodological technique of interviewing which, by its nature, is usually concerned with small samples.

Carter and Kirkup discussed in their research on women in engineering in the U.K and the

U.S some of the experiences that the women had during their engineering courses (Carter and Kirkup, 1990, pp50-75). Although all the sample interviewed in their research were working as engineers and the research did not examine these experiences in relation to choice of career after the course, the experiences of these women are similar to experiences of women discussed by other researchers (Tizard and Chiosso, 1990 pp14-16; Thomas, 1988, pp123-137). Some common themes are present in these and other researchers' work discussed in this chapter.

Carter and Kirkup suggested that women tended to be at an initial disadvantage compared to their male colleagues, both in performance and confidence (Carter and Kirkup, 1990, p59). They also suggested that some women began the course with only a vague idea about the nature of engineering work (Carter and Kirkup, 1990, p62). Thomas, in her work with women in physics degree classes, also suggested that women expressed a lack of confidence, and were aware that being in a minority, they did not quite fit in (Thomas, 1988, p128). Usher and Ward concluded from their study of women civil engineers that when asked what improvements the university could make for female students in particular, "...women students' replies reflected a lack of confidence in applying the theoretical knowledge to practical situations" . They went on to say that "Respondents suggest that the experience could be improved by more varied teaching methods, more practical training, more group work, contact with other women engineers and better information about career opportunities" (Usher and Ward, 1991, p2). Further evidence of the lack of experience of female students compared with male students came from Weinreich-Haste and Newton, who suggested in their study that some women on engineering courses felt that their hobby and leisure activities equipped them less well than their male peers with basic skills of practical and mechanical aspects of engineering (Weinreich-Haste and Newton, 1983, p54). Bakos

reported, from his study of women civil engineering students in the USA, that "Many lacked mechanical drawing and thus, had to take a deficiency course upon entering college" (Bakos, 1992, p24). He went on to say that "A few felt at a disadvantage during early college examinations (in status and strength of material) since many problems were written with the assumption that all the students knew what a torque wrench was or what a cam shaft did" (Bakos, 1992, p24).

Both the surveys, conducted by Thomas and by Carter and Kirkup, indicated that within the course the one main cause of anxiety amongst women appeared to be laboratory work. Again, lack of experience in dealing with technical instruments was mentioned as a cause of anxiety in female students by both Thomas (1988, p131) and Carter and Kirkup (1990, p66) and because of this, in group work women appeared to end up writing the report rather than performing the experiment. A large questionnaire survey confirmed this by stating that "many women [in engineering classes] assumed the role of "recording data" in laboratory work" (Cooper Union, 1989, p.6).

Both Thomas and Carter and Kirkup discussed the experiences of women in these minority classes and their relationship with their male peers as well as their relationship with their (usually male) lecturers. Whereas Carter and Kirkup found little evidence to suggest that lecturing staff were unhelpful, indeed, indicating that some women found encouragement from staff (Carter and Kirkup, 1990, p65), Thomas suggested that the women in her sample did not find the lecturing staff very "approachable" (Thomas, 1988, p132) and that some women felt that they were "picked on" or "harassed" (Thomas, 1988. p133). However, a large scale survey of women engineering students in the USA found that less than a quarter of women surveyed felt uncomfortable approaching male lecturers (Cooper Union, 1989, p.5).

Fitzpatric and Silverman suggested, from their research which interviewed a sample of women on science and engineering courses in the US, that professors' influence could be important in encouraging women to remain in a field of study and could be critical to the level of career aspiration (Fitzpatric and Silverman, 1988, p275). However, Greed, in her work on women surveyors, found that some women surveying students felt that they were not always seen as serious students by staff and that they had to work twice as hard to be seen as any good (Greed,1991, p103). She also mentioned that, during her research, she received many reports that construction and technology lecturers use all sorts of sexist comments (Greed, 1991, p120). This was confirmed by Usher and Ward who stated that "Anecdotal evidence suggests that sexist language, gender-biassed comments and examples are commonplace in the classroom and that sexual harassment is not unknown" (Usher and Ward, 1989, p4). Tizard and Chiosso, in their survey of women on construction and engineering vocational courses, reported that most women they interviewed said that they received more attention than men and that generally lecturing staff were helpful, but they did point out that some hostile attitudes from lecturing staff did exist (Tizard and Chiosso, 1990, p15). While many working in this area believe that lecturers have an important role to play in career choice, there is no real consensus on what that role is. As shown, some found that women students thought lecturers unhelpful, others that they thought them helpful. There is scope, then, for further research.

When examining the literature which discussed female students' attitudes towards their male peers, the literature tended to reflect on the unfavourable aspects of these attitudes. Thomas suggested that men on a physics course found women students an anomaly because they were both women and physicists, with the possible result that they were not taken seriously (Thomas, 1988, p133). A similar example of this was reported by Carter and Kirkup who

suggested that women in their engineering classes were not taken seriously by their male peers and that a certain antipathy existed between women and men on the course (Carter and Kirkup, 1990, p65). This antipathy could possibly help explain the results of the survey by Newton who said that when she asked the female engineers to describe their male classmates, they characterised them as "dull and immature, as well as unfriendly" (Newton, 1987, p188). Another source of this antipathy, suggested by one survey could be caused by the feeling that some women had that they intimidated male students (Cooper Union, 1989, p.5).

Having other women on the course was seen as important by women in some surveys (Thomas, 1988, p132,134; Carter and Kirkup, 1990, p60,70). Thomas described a co-operative strategy between three women on a physics course who provided help and support during the course (Thomas, 1988, p132), and noted that other women devised similar strategies for dealing with being in a minority, by sticking together and forming a "collective identity" (Thomas, 1988, p134). Carter and Kirkup also remarked on this, explaining that some women students provided support networks (Carter and Kirkup, 1990, p71). Srivastava, in her work with women construction students, found that the perceptions of their courses by women students were more favourable with the existence of role models such as women lecturers and women students (Srivastava, 1992b, p237). Tizard and Chiosso suggested that loneliness was the biggest problem faced by women studying on male-dominated courses, and that initially women tended to make contact with other women on the course (Tizard and Chiosso, 1990, p14). However, Bakos reporting on the experiences of women civil engineering students in his sample suggested that "...it was surprising to learn that few felt any regular feelings of isolationism, detachment, loneliness, etc." but went on to contend that "A few women wished that they had more female classmates or coworkers in order to establish friendships and share mutual feminine interests." (Bakos, 1992, p18). In the US,

some colleges have recognised that women science and engineering students may need additional support and encouragement and have set up initiatives such as making provision for women engineering and technology students to mentor first year women students and setting up "women only" technology courses in an attempt to alleviate these problems (Wilkinson, 1992d, p256-257).

Only the results from the survey by Fitzpatric and Silverman indicated that the experiences of women on courses where they are in a minority might affect future career decisions (Fitzpatric and Silverman, 1988, p275). It seems reasonable to assume that the experiencing by some women of any the above features discussed could deter women's future participation in such professions, which is not to say that any do. Not all women on courses where they are in a minority are going to be able to cope with such a situation, and as has been discussed earlier, more female that male engineers appear to choose not to work in engineering when they have completed their degrees.

As mentioned earlier, the link between experiences and career choice is often not made or else is left unclear in the literature and therefore further research is warranted to establish whether there is a relationship. In order to uncover any link, it is necessary to have an understanding not only of college experiences but also career intentions and experiences in trying to secure employment. To find out which tests it would be useful to carry out, interviews and discussions were conducted for this research. In section 3.5 some of the results of the interviews of male and female civil engineering students which aim to examine what might influence the differences in career choice are presented, and in section 3.6, the results of the interviews with women students and women civil engineers are examined to try to establish whether there could be a relationship between college experiences and career choice.

3.5 RESULTS OF INTERVIEWS ON THE CAREER CHOICES OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS

Sixteen semi-structured interviews with final year women civil engineering students on degree and diploma courses and ten semi-structured interviews with final year male civil engineering students were conducted to examine details about their career choices at the end of their course (refer to section 6.4.4 for a discussion of the nature and number of all the interviews conducted in this research). These interviews provided further evidence that there were differences in the intended career choice of these students. Apart from differences between male and female civil engineering students already discussed, it became clear that there were a number of important differences not covered by the literature which merited detailed investigation. These differences were found in exploratory interviews and are tested with the national questionnaire in this research. The results of these differences as suggested in the analysis of the interviews are presented in this section.

Of the male and female students interviewed, eight said that they were considering further study, and though this was, in part, a reflection of the situation in the job market, there also seemed to be a difference between male and female students in considering further studies (five female and two male). The impression gained from this was that the desire to undertake further study to get higher qualifications was stronger for women than men. Ten students (six male, four female) were thinking of travelling and holidaying after their degree, in six cases (four female, two male) before entering the labour market or embarking on another course; for four students this appeared to be a prolonged activity, lasting up to a year.

The students were asked about their prospects of finding employment and also where they found out about job opportunities. Many of the students were without a job (thirteen female,

four male), but were actively looking, which meant that some comparisons between the ways in which male and female civil engineering students found out about employment opportunities could be made. The impression gained was that some differences did exist. In particular it appeared that men were more successful at gaining employment than women, and also that there appeared to be a difference in the approximate numbers of job applications that women and men were making. Women seemed to be making more job applications than men (estimates for women average 15-20, estimates for men average 10-15) but were not being as successful at securing employment. The feeling amongst those women without employment who were interviewed appeared to be that they lacked any prospects of employment, whereas four men had secured employment and two others were attending interviews. The opinion gained was that this may be significant in showing that the industry tends to prefer male to female engineers. If that preference existed, it could help to explain the results of the First Destination Surveys examined in 3.3. However, from the interviews investigations suggested that it was worth examining the processes by which male and female engineering students try to secure employment for any differences.

When students were asked where they obtained information about job opportunities, the careers service at college seemed to be one of the main sources for both male and female students. Four women mentioned the use of family contacts and two the use of friends. Three men also mentioned the use of friends to find out about employment prospects but families were only mentioned in a two cases. About half of both male and female civil engineering students (five men and nine women) said that they often used the journal "New Civil Engineer" to discover what employment opportunities were available.

Other ways of securing employment were mentioned, for instance, personal contacts, past work contacts, and lecturers at college. Impressions gained from these interviews were that

overall, women seemed to be making more of an effort to secure employment and were using a greater variety of methods.

Students were also asked what they were looking for when applying for employment. Because there were few employment opportunities at the time, those students without employment said that they were willing to take any job and then look for other possibilities when the situation improved. Despite this, prompting revealed that there were various features that both male and female students were seeking in employment. Some of these features have been commented on by other researchers in the literature and discussed earlier in this chapter, while other features of work specific to women are discussed in chapter four. The evidence from these interviews showed that factors such as salary, benefits, the training policies of companies, promotion, amongst others were often quoted by students as being the reason why they would choose one job above another. Other features, for instance child-care policies and programmes, were mentioned only by women, and others, such as opportunity to travel overseas, were mentioned by both male and female civil engineering students, although the impression gained was that men appeared more likely to consider travel as an important feature of employment.

Three women were looking for employment near their families, and considering going to live back with them. One woman was considering employment near to her boyfriend. This was in contrast to the male students who usually stated that they were willing to work anywhere they could find work.

Another feature which emerged from the interviews was the type of work available. Nearly all men and women (twelve women and eight men) wanted work which required using their degree, and a training programme leading to Chartered Engineer status appeared to be particularly important. Other features such as interesting, varied work and promotional

prospects were also mentioned by men and women as important considerations in choosing employment.

Prestige of the job and of the organisation were mentioned by three men as being important, whereas two women said that a pleasant working environment was important. Three women also suggested that the numbers of women engineers in an organisation was important to them in deciding what type of employment to choose. Throughout the interviews those students without jobs did stress that they would be pleased with any job since they thought that this would be preferable to no employment. However, the general impression gained from the responses in interviews and discussions was that there were a number of differences between male and female civil engineering students when choosing employment and that this merited further investigation.

3.6 RESULTS OF INTERVIEWS WITH WOMEN ON THEIR EXPERIENCES OF CIVIL ENGINEERING COURSES

Having identified in this chapter that the experiences of women on a variety of courses where women are in a minority are quite similar in a number of ways, this section reports on the findings of thirty two interviews with women civil engineering students and recently graduated women civil engineers. The content of this section relates to twenty three civil engineering degree and diploma students and nine recently graduated women civil engineers where the college experiences and possible links with their future career choice were specifically examined. A more detailed explanation of the number and nature of the interviews is presented in the methodology chapter of this thesis.

The findings of these interviews tended to confirm the fact that women had experienced a number of difficulties on courses where they were in a small minority, in this case civil

engineering.

Initial difficulties to do with a lack of engineering knowledge compared with the male students were mentioned by eight women as one of the first bad experiences of the course. This was especially clear when women spoke about the practical aspects of the course, where three women felt that they were less used to dealing with apparatus, and as a consequence initially allowed the male colleagues to do the work whilst they recorded the data. From personal observations of women civil engineering students working in laboratory classes, it appeared that women often assume certain roles during the experiment, often one of note taking. The consequence of this was pointed out by one women, who said she was "fed up" with being the class secretary. It is possible that feelings like this could affect the career choices women make once they have completed their courses. For instance, if women feel that their role in class is assigned because of their sex, then for some women, to avoid this happening this could lead them to choose careers in which there already are a number of women. Four women expressed concern that they had problems in their relationships with their male peers. The overriding impression was that they felt that they were unable to relate to them during team work and found that their abilities were often ignored. In one case the manifestation of these feelings led to her choosing an alternative career.

Thirteen women thought that they had to work much harder than their male colleagues. One common explanation given was that they thought they had to compensate for their lack of initial experience in the subject. The impression given by one of these women was that the men on the course were more used to engineering than they were, and this feeling could lead to a lack of confidence amongst the women, a point which was discussed in section 3.4. It appeared that a continued lack of confidence where women compared their performance with their male colleagues was in part the reason why one women interviewed considered an

alternative career other than civil engineering.

In the interviews sixteen women discussed their relationship with their lecturing staff. Eleven of these suggested that they received helpful advice and encouragement. Prompting revealed that four of these women felt that they received more attention than male students where two thought that they had overall received less attention, the remainder expressed that they received about the same. Evidence from these interviews tended to support the research of Tizard and Choisso (Tizard and Choisso, 1990, p15) who suggested that generally the lecturing staff were helpful. However, there was also concern expressed by three of the female students who commented on the use of sexist language by some of the male lecturing staff. This was noted by Greed, (Greed, 1991, p120) and the interviews tended to confirm that sexist language was used on civil engineering courses.

Feelings about the small number of female staff and other female students was discussed in many of the interviews. The impressions gained from the interviews was that they generally felt that having more women on the course would reduce their occasional feeling of isolation. Five women, when expressing an opinion, felt excluded from the social scene provided by the engineering departments, whereas two women said they were actively involved in organising engineering societies. For those women not involved in the social scene, the impression of exclusion was felt and this tended to contribute to feelings of being an outsider. The majority of women (twenty six) did appear to be pleased that they had chosen civil engineering, but two students felt that a career in civil engineering was not suitable for them, and as a consequence appeared less interested in many parts of the course and more critical of their experiences.

Overall impressions from the analysis of the interviews regarding their experiences at college led to an initial impression that the effects of some of the difficulties faced by women could

affect their decisions to remain in civil engineering. This will be examined in this research.

3.7 CONCLUSION

This chapter has tried to examine what factors specifically to do with college experiences might influence the career choices of women civil engineers in the U.K when they leave higher education. In order to do this, the situation of women in higher education in the U.K was first discussed. Figures produced by the Central Services Unit were then presented which appeared to show that there were differences in the career choice of male and female civil engineering graduates. Following this, some results of research, mainly from the U.K but also from the U.S.A, identified the problems some women may face when they study for a broad range of science, technology and engineering subjects in which, as women, they are in a small minority, which might give rise to this difference in career choice, was discussed. In section 3.5, the results of some interviews, conducted for this study, with male and female civil engineering students, were discussed. These brought out additional points not included in the literature on differences in career choice between the sexes, and provided support for others. Finally, section 3.6 discussed the results of interviews with women civil engineering students and women civil engineers which attempted to identify a possible relationship between college experiences of women civil engineers and career choice.

CHAPTER FOUR

WOMEN IN THE LABOUR MARKET

4.1 INTRODUCTION

This chapter describes the place of women in the labour market generally and in civil engineering in particular. One of the most striking features of women's current position in the labour market is the extent to which women occupy only a very limited range of jobs and also tend to occupy junior positions. One of those occupations in which there are very few women is civil engineering. As previously mentioned, although civil engineering is the primary focus of the research, most of the literature on which this study could draw did not specifically concentrate on civil engineering, and it was necessary to turn to related research. This chapter uses both the literature of research into engineering and into construction.

The first section in this chapter produces statistics to illustrate the extent and nature of segregation in the labour market, and, in particular, in civil engineering. It then describes and comments on some of the more common explanations put forward in an attempt to explain this.

Part of the aim of the research as a whole is to identify the factors affecting the career choice of women civil engineering students leaving higher education. In chapter two, one main explanation was offered which pointed to the effects of socialization on young girls. In this chapter, an alternative (although not necessarily mutually exclusive) explanation is explored. This is one which examines what it is that women want from work, and then examines the extent to which this fits with what it is that civil engineering offers. It is possible that what causes few women to want to enter civil engineering is that it fails to offer what they want to the same degree as do other forms of employment (or not working at all). In 4.3, the

section examines some of the evidence from surveys which have attempted to discover and explain women's aims in work.

In 4.4 and 4.5, there is a description of the barriers that some writers have said exist which hinder women's entry to engineering and their promotion within it. These sections examine how much the lack of child-care or part-time work inhibits women from entering civil engineering or, once there, staying there. It also assesses whether there is hostility to women in the construction industry and what effect this might have on women's choices. Furthermore, it examines the attitudes of employers to women in civil engineering. The final section of this chapter examines the expectations that female civil engineering students have of a career in civil engineering.

4.2 WOMEN IN THE LABOUR MARKET

This section examines the role of women in the labour market in the United Kingdom. The Women and Employment survey conducted by Martin and Roberts in 1980 gave an overview of the position of women in the labour market. The research argued that women have a lifetime attachment to labour market and that their work histories are often interrupted by periods out of the labour market. It also showed that women usually return to paid employment after such breaks but are likely to take on part-time work (Martin and Roberts, 1984a, pp2-10). Another important factor which Martin and Roberts commented on was the concentration of women in certain industries (such as service and health) and the concentration of men in others (such as engineering). In addition, they reported that women are concentrated in certain types of jobs (such as secretarial work) within industries.

The following table from another survey on women in the labour market tends to confirm Martin and Robert's findings in that it clearly reports that women employees are concentrated

in certain industries and correspondingly under-represented in others (Webb, 1989, p146). This phenomenon is technically described in most literature as 'segregation'. Segregation, it is reported, does not occur only between certain types of employment and types of industries - it also occurs within them. Thus women employees tend to have different jobs within the same industry. Typically these are the lower-paid and more junior jobs. Segregation thus comes in two forms: 'horizontal' segregation occurs when women and men are concentrated in different occupations while 'vertical' segregation occurs when men and women work at different grades, ie managerial and non-managerial, within the same occupation (see for example; Dex, 1987, p10; Beechy, 1986, p91; Cockburn, 1988, p33).

TABLE 4.1 OCCUPATIONS LISTED ACCORDING TO THE DEGREE TO WHICH THEY ARE DOMINATED BY ONE SEX.

predominantly female occupations	predominantly male occupations
90% or over	90% or over
hand and machine sewers and embroiderers	miners and quarrymen
nurses	furnace, forge, foundries etc
maids, valets, etc	electrical and electronic (excluding assemblers)
canteen assistants	engineering trades (excluding inspectors)
typists, shorthand writers, secretaries	woodworker
75% and under 90%	butchers and meat cutters
shop salesmen and assistants	construction workers
charwomen, cleaners and sweepers	painters and decorators
kitchen hands	drivers of stationary engines, cranes, etc
office machine operators	building and contracting labourers
Hairdressers, manicurists and beauticians	drivers: road passenger service and goods vehicles
telephone operators	postmen and mail sorters
60% and under 70%	commercial travellers, etc
clerks and cashiers	police, armed forces
waiters and waitresses	administrators and managers
primary and secondary school teachers	engineers
packers, labellers and related works, cooks, bartenders	technical and related work
	groundsmen and gardeners

The titles of occupations used in this table are taken from the official census; those with suffix 'men' may include employees of both sexes.
Source Webb M ,1989, p.146

There are several different methods which researchers have used to measure occupational segregation (see for instance; Dex, 1987; Webb, 1989; Beechy, 1986; Cockburn, 1988). But whether one measures it as the proportion of occupations in which no man or woman is employed, or as the proportion of occupations in which women are over-represented, or any other method, it is fairly clear that occupational segregation is pervasive and widespread (Dex, 1987; Cockburn, 1988; Martin and Roberts, 1984).

Martin and Roberts survey produced figures from the 1980 General Household Survey showing that the percentages in the main categories for full-time women working were; clerical (41%), as professionals and related in education, welfare and health (16%), and in catering, cleaning and hairdressing (10%) (Martin and Roberts, 1984a, p23). The 1989 Labour Force Survey produced by the Department of Employment showed little change for full-time women working. Clerical (36.1%), professionals and related in education, welfare and health (15.6%),catering, cleaning and hairdressing (9.9%) (DoE, 1990, p15). If the three categories (full-time women working) are added together the results show a slight decline in the proportion of women concentrated in these three main occupational bands (Martin and Roberts Survey 67%, Labour Force Survey 61.6%).

For part-time work, the situation is similar, although there are four main categories in which women are concentrated, the fourth being selling. The comparable figures, according to Martin and Roberts, were: clerical (22%), professionals and related in education, welfare and health (10%), and in catering, cleaning and hairdressing (41%), selling (13%) (Martin and Roberts, 1984a, p23). The 1989 Labour Force Survey showed, for part-time women working: clerical (23.7%), professionals and related in education, welfare and health (12.6%), catering, cleaning and hairdressing (34.7%), and selling (15.6%) (DoE, 1990,

p15). If the four categories (part-time women working) are added together, the results show a slight increase in the proportion of women concentrated in these four main occupational bands (Martin and Roberts Survey 86%, Labour Force Survey 86.6%).

Vertical segregation, the form of segregation which researchers suggest occurs when men and women work at different grades within an occupation, can be seen in the next table.

TABLE 4.2 PERCENTAGE OF WOMEN IN OCCUPATIONS IN EACH SOCIO-ECONOMIC GROUP

Non-manual	(%)	Manual	(%)
employers, managers	13	foremen, supervisor	5
professional workers	11	skilled manual	9
intermediate non-manual	44	semi-skilled manual	48
junior non manual	71	unskilled manual	45
personal services	82		

Source: Equal Opportunities Commission, Research Bulletin, 1985, p.14

Table 4.2 shows that a lower proportion of women compared with men are professionals, employers and managers and a higher proportion are in junior non-manual and lower level manual work. Figures for engineering indicate that engineering is characterised by greater segregation than the average. According to one report, women comprised only 3.8% of managers in 1986, despite an increase of 22% between 1978 and 1986 (EITB, 1987, p8). The following table from this report demonstrates this.

TABLE 4.3 EMPLOYMENT OF MALE AND FEMALE MANAGERS IN ENGINEERING 1978 - 1986

	1978	1980	1982	1984	1986
female managers	3813	4345	4070	4160	4670
male managers	128927	134686	122949	117947	116910
total managers	132740	139031	127019	122107	121580
females as a proportion of total managers	2.9	3.1	3.2	3.4	3.8

Source: EITB, 1987, p.8.

Some research has also demonstrated that within organisations in the construction industry there is vertical segregation. Gale suggested that "the construction industry is demonstrably male" (Gale, 1992, p421). Apart from showing that in the construction industry, few women (8.4% in 1981) occupy managerial positions and that the majority of women (82.2% in 1981) were employed in secretarial or clerical jobs, he produced recent figures of membership of the Chartered Institute of Building which showed that in 1992 less than 2% of members were women (Gale, 1992, p421).

For the Institution of Civil Engineers, an analysis of the statistics of membership by Stone showed that in 1992 of the members for the following grades of membership, 10.6% of student members were women, 6.3% of graduate and associate members were women and 0.8% of member and fellow grades were women (Stone, 1992, p1).

4.2.1 WHY IS THERE VERTICAL SEGREGATION?

Webb suggests three reasons why vertical segregation might exist in an organization (Webb, 1989, p150). First, he suggests that it is possible that women are unrepresentatively young in a firm. They would therefore be much less likely to be in senior positions. An

organization would be likely to have an unusually high number of young women relative to the total of women employed if it were the case that women had only recently begun to enter it, or the industry of which it is a part. One might therefore expect women in civil engineering to be concentrated in junior positions. Further evidence in support of this idea came from Stone who suggested that, in her study of women in senior management levels in construction, she was not surprised that few women were represented in these levels. She argued that it took about 20 years to accumulate the necessary experience to handle a job in senior management (in construction) and that a career break or part-time working could extend the time taken for women engineers to reach these levels by about five years. Given that 20 years ago few women were in construction, she suggested it is unsurprising that there are few women in senior management positions (Stone, 1992, p1).

The second reason for vertical segregation suggested by Webb was that 'women are promoted in fewer numbers and less rapidly than men' (Webb, 1989, p150). He does not speculate why this should be so, but it may be that women are victims of prejudice, or, as Stone points out, that their promotion prospects suffer if they leave the workforce to have children (Stone, 1992, p1).

Thirdly, Webb claims that many of the occupations in which women work are ones in which it is hard to be promoted, and he cites the example of clerical workers in support of his claim (Webb, 1989, p150).

4.2.2 WHY IS THERE HORIZONTAL SEGREGATION?

One frequently cited explanation of horizontal occupational segregation points to the role of caring for families that women have traditionally had to perform (Cockburn, 1988, p31). The explanation says that the particular skills and abilities developed by women during their

childhood and in domestic life are attractive to certain types of employers. Women have been easily employed in nursing and cleaning, for example. Cockburn's explanation is a variant of the socialisation arguments discussed in Chapter Two. She is claiming that, first, women acquire different skills and abilities during their early period of socialisation and, second, that this leads employers to hire them for certain occupations. However, Cockburn does not give a detailed explanation of the mechanism by which employers attract women workers. Chapter Two discusses the first claim. This chapter provides some of the material for examining the second.

A second common explanation draws attention to the predominance of women in part-time work, the importance of this fact in occupational segregation, and its link with the constraints placed on women by their domestic responsibilities (Holdsworth, 1988, p78; Beechy, 1986, p94). Cockburn suggests that women have been "...differentiated from men in the labour market by their preference for part-time work and their tendency to leave the labour market and return to work as family needs dictate and an inability to work overtime and move location" (Cockburn, 1988, p31). In general, women take care of the day-to-day welfare of their children and are offered little support in terms of child-care provision from either state or private sector. The effect of this is that women often work part-time. In this situation they are offered few chances of training or promotion. As Cockburn argues "Employers are shown to be ready to exploit these differences [between men and women] by paying women less and offering them inferior conditions and prospect" (Cockburn, 1988, p31). Other researchers argue that the ultimate result is that women are caught in a cycle of low-paid, part-time work with little chance of promotion beyond junior level and the combination of the low expectations of both the employers and the women, together with poor child-care arrangements, causes occupational segregation (see for example; Dex, 1987; Beechy, 1986;

Webb, 1989; Cockburn, 1988). It is not hard to see how a tendency to take part-time work and career breaks could affect promotion prospects, and so the relationship of that tendency to vertical segregation is clear. But it is not so clear how there could be a link between a preference for part-time work and horizontal segregation, unless part-time work is easier to provide in some occupations than in others. Some of the literature on civil engineering suggests that civil engineering is an occupation where employers do not like offering part-time work (see section 4.4).

Another explanation put forward by researchers points to the exclusion of women from certain occupational groups (eg Cockburn, 1988; Simons, 1981). Cockburn, reporting the work of Liff and Glucksman, suggested that the role of employers in structuring sex segregation can be shown by examining new post-war industries and suggests that from the advent of these new industries, women have been employed in routine production jobs (Cockburn 1988, p31).

Having identified some of the reasons researchers have given for both vertical and horizontal segregation, the next sections examine what women's aims are in work, and whether engineering, including civil engineering, fulfils these aims.

4.3 WOMEN'S AIMS IN WORK

Different firms will offer facilities and experiences which are both good and bad from the point of view of any potential employee. From a female employee, researchers have suggested that some of the following factors are likely to be relevant: the pay offered for the work, the friendliness of the working environment, the provision of child-care (or its absence), the availability of part-time work (Webb, 1989; Martin and Roberts, 1984a). Also relevant is the package of benefits offered by other forms and types of employer since, if

those are better, employees will, other things being equal, want to work for them instead. There have been a number of surveys which have attempted to assess the importance of various factors in women's employment decisions. Table 4.4 shows the results of one survey reported by Webb which examined reasons men and women gave for working (Webb, 1989, p169).

TABLE 4.4 REASONS FOR WORKING, PERCENTAGES OF PEOPLE IN EMPLOYMENT, BY SEX, 1984

	Reasons for working		main reason for working	
	women	men	women	men
need money for basic essentials	58	81	50	71
to earn money to buy extras	43	32	8	4
to earn money of my own	59	45	13	7
working is the normal thing to do	21	46	2	9
to follow my career	26	30	8	5
for the company of other people	36	16	2	-
for a change from children/ housework	1	1	1	-

Source: Webb M, 1989, p169 (table derived from a survey by Jowell and Witherspoon)

The survey data listed above shows that one of the major reasons for women working was a need for the money it brought them. 50% of women said that this was the main reason why they worked. Similarly, in the Martin and Roberts survey, 70% said that they could not manage unless they were earning. Only 11% said they did not really need to work for the money (Martin and Roberts, 1984a, p61). The following table from this survey demonstrates some of the Martin and Roberts survey results.

TABLE 4.5 ALL REASONS FOR WORKING OF FULL AND PART-TIME WORKING WOMEN

reasons for working	main reasons		
	full time (%)	part time (%)	all working women (%)
working is the normal thing to do	20	7	14
need money for basic essentials such as food, rent or mortgage	55	35	47
to earn money to buy extras	35	51	47
to earn money of my own	38	36	37
for the company of other people	40	49	44
enjoy working	55	48	52
to follow my career	24	7	17
to help with husbands job or business	1	2	1
other reasons	2	2	2
base	1877	1477	3354

Source: Martin and Roberts, 1984, women and employment a lifetime perspective

Both tables, 4.4 and 4.5, suggest that non-financial motivations are also important. When women in their surveys were asked to select all those statements which best described their reasons for working, both financial and non-financial reasons were given. Both their surveys showed that similar proportions attached weight to the non-financial advantages of work. (Martin and Roberts' results are presented first with the corresponding figures from Webb in brackets afterwards.) 40% (36%) of full-time women workers said that seeking the company of other workers was a reason for working. 55% (59%) gave as a reason for working that they enjoyed it. 24% (26%) stated that 'following my career' was a reason to work.

In order to find out the priorities that women attached to the different factors affecting their

work choices, Martin and Roberts carried out a further survey. The results presented in the table below are derived from the Martin and Roberts survey (Martin and Roberts, 1984a, p.72)

TABLE 4.6 PROPORTIONS OF WORKING WOMEN RATING AS ESSENTIAL OR VERY IMPORTANT EIGHT DIFFERENT ASPECTS OF JOBS, AND THEIR AVERAGE IMPORTANCE RATING FOR EACH ASPECT

aspects of jobs	all working women	
	% rating as essential or very important	Average importance rating
work you like doing	91	1.7
the opportunities to use your abilities	71	2.1
good prospects	49	2.6
a good rate of pay	74	2.0
a secure job	76	2.0
friendly people to work with	86	1.9
convenient hours of work	75	2.1
an easy journey to work	59	2.3
base	3354	3354

1=essential, 2=very important, 3=fairly important, 4=not very important

Martin and Robert's survey data showed that the women in their surveys attach much weight to non-financial reasons for working. Commenting on their results, Martin and Roberts reported that "Overall, 'work you like doing' was considered most important, followed by 'friendly people to work with'. 'Good prospects' was considered the least important aspect of a job. Full and part time workers differed in their priorities for some aspects, although 'work you like doing' was considered most important by both full and part time workers. However, for part timers 'convenient hours of work' was rated of equal importance. For full

-time workers 'a good rate of pay', and 'a secure job' were considered to be of equal importance to 'friendly people to work with', whereas for part-time workers the first two of these aspects were of lesser importance". (Martin and Roberts, 1984a, pp71-2)

So far, women's attitudes to the financial and non-financial motivations to work have been described in this survey of the literature. But it has not yet been fully established in the literature how important the provision of child-care and part-time work are. It is likely that their importance to women will depend on the age of the respondents. For example, Weinreich-Haste and Newton report that, in their survey of young men and women, 'work which fits in with family commitments' was ranked low on a list of factors important in work. Perhaps more surprisingly, neither sex thought this factor more important than the other (Weinreich-Haste and Newton, 1983, p54). This result is worth testing on a large scale for civil engineering, and that is done later in this thesis. It is unlikely that the attitude persists in later life, since according to Martin and Robert's survey, economic activity is at its highest among women in their teens, but women aged 25-29 are the least represented in the workforce, because these are the peak child-bearing years. They went on to suggest that although activity rates increase after this age, much of it occurs in part-time work (Martin and Roberts, 1984a, p11). One would therefore expect the demand for part-time work and\or child-care to rise as women age. This is consistent with the report from Weinreich-Haste and Newton that the provision of child-care or part-time work was not a factor of major importance to young women deciding which industries to enter for the first time. The next section uses the literature research data presented above and examines which, if any, of these factors engineering offers women.

4.4 WHAT DOES ENGINEERING OFFER WOMEN?

In the last section, surveys of women's aspirations in work described in the literature gave some indication of the importance of certain factors for women in employment. Some of the factors directly relevant to the employment of women mentioned in the literature are described in relation to engineering. These include the provision of child-care and the availability of part time work, career breaks, flexible working and maternity leave. One other factor often cited in the literature as a cause of low female participation rates in engineering is prejudice against the employment and promotion of women. The following results from a number of surveys discuss the employment of women in engineering in relation to the provision of child-care, prejudice and promotion.

McRae et al carried out a survey of large multinationals with engineering interests, including Ove Arup, a large civil engineering company. They reported that in the mid-1980s, company managers had realized that female retention rates were poor in comparison with those of men. For example, up to one-third of women in ICI failed to return from maternity leave (McRae et al, 1991, p80). All of these companies have subsequently tried to improve their female retention rates.

McRae et al state that there was little evidence of any trend toward flexible employment, such as job sharing and homeworking. Managers did not consider these to be operationally possible and, in their survey, this was also found to be the means of combining work and family commitments which was least favoured by employees (McRae et al, 1991, p81). This was supported by research by the Engineering Industry Training Board undertaken for the Engineering Council which said in their survey of 124 employers, only 26% would consider job sharing, or working entirely in the home. 36% were prepared to allow part working in the home, but only 24% would consider other non-standard hours (EITB, 1985, p7).

One of the most widely canvassed solutions to the problem of attracting more women into any industry is the provision of child-care. A survey of one hundred civil engineering employers in the UK showed that 43% of employers thought that child-care facilities should be made available to women (Wilkinson, 1990, p11). However, McRae et al found that there was a division of opinion on child-care. They argued that managers generally were hostile to the provision of on-site child-care, citing fluctuating demand and expense as disadvantages (McRae et al, 1991, p82). The EITB survey found that on-site child-care was the least popular solution among the managers that they surveyed, for similar reasons (EITB, 1985, p7). But on the other hand, both McRae et al and the EITB surveys suggested that the idea of state-led child-care was considerably more popular (McRae et al, 1991, p82; EITB, 1985, p7).

One form of benefit designed to encourage women to work is already guaranteed - under certain circumstances - by law. This is maternity leave. Some of the companies in the McRae et al survey believed that enhanced maternity benefits would encourage more women to return to work. The enhanced benefits included, amongst other things, greater maternity pay for those returning within a certain period (McRae et al, 1991, p84). The EITB survey found that 80% of employers were willing to extend maternity leave (EITB, 1985, p6). But both McRae et al and the EITB surveys found that women were concerned about having lengthy periods off work, which raises questions about the value of one popular means of retaining women - career breaks.

Some research suggests that career breaks have been popular with managers in industry because they have proved cheap to run (McRae et al, 1991, p87). In their survey, McRae et al suggested that both managers and employees were aware of the potential difficulties with the scheme - chiefly losing touch with changes in work, so both were eager to retain

links with each other during the breaks. Nonetheless, many employees were doubtful about taking the breaks offered them (McRae et al, 1991, pp85-88). According to McRae et al, many had doubts about career breaks because they were largely untried and untested (McRae et al, 1991, p87). This result was supported by an Institute of Civil Engineers (ICE) survey of women members, which suggested that some women thought that a career break of longer than six months would be 'disastrous' (ICE, 1984, p13).

According to McRae et al, part-time work was more popular than career breaks with women employees (McRae et al, 1991, p91). The majority of women employees interviewed by McRae et al. felt that there should be opportunities for women to work part-time but many felt that part-time work was not really available within their company (McRae et al, 1991, p91). However, managers stressed that the introduction of part-time work would necessitate considerable changes in the organization of the working practices of the company. At the moment, they said, part-time work could not be offered to most employees (McRae et al, 1991, pp89-91). Against this, 57% of those employees surveyed for the EITB said that they were prepared to consider part-time work (EITB, 1985, p7). And McRae et al note that, for all their formal opposition to part-time work, employers were prepared to consider it, frequently on an ad hoc basis (McRae et al, 1991, pp90-91).

Lastly, the possibility that there is prejudice against women in engineering should be considered. Of the companies surveyed by McRae et al, many had equal opportunities policies, designed to ensure that women were not discriminated against in either the selection for jobs or for promotion (McRae et al, 1991, pp70-73). There exists the possibility that these are not meant sincerely - as some women interviewed by McRae et al believed, or that these well-intentioned policies are not put into practice at more junior levels. McRae et al write "Reports of bias and prejudice among personnel with recruitment responsibilities were

made by employees in nearly all of the companies we studied. Our evidence suggests that well-formulated equal opportunities policies were being sabotaged, effectively if not deliberately, by individuals in positions of power" (McRae et al, 1991, p38-39).

On the subject of prejudice, a survey in the USA of the perceptions of women engineering students found that "...one third [of students] expressed concern about sexual harassment on the job. Just over a fifth of the students felt it wold be harder to get jobs as women." (Coopers Union, 1989, p5). Neither of these pieces of research discussed the implications of prejudice on the career intentions, and neither dealt specifically with women civil engineers. Reports of prejudice and bias appear to be common in the literature and it is worth examining how far these influence women's career decisions in civil engineering.

As argued in 4.3, one of the important reasons for women to work put forward in the literature has been the opportunity to meet people within a friendly environment. If, in some companies, this environment was not available due to prejudice against them, women might be discouraged from working there. It seems that some women believe that this is the case for engineering and construction. This is further explored in the next section.

4.5 FURTHER DIFFICULTIES FOR CONSTRUCTION

Some problems specific to the employment of women in construction have been examined by researchers. This section reviews some of that literature. Two particular problems for women working in the construction industry appear to be the attitudes employers hold towards women and the work-based requirement of some sections of construction for mobility.

Sandle in her article on women in construction suggested that there were beliefs in construction about the employment of women. She argued that "...myths associated with the

construction industry still exist: women can't do heavy work, women don't like getting dirty, it's not a place for women" (Sandle, 1990, p38). A report on a survey of the attitudes of one hundred civil engineering employers suggested that there is a certain reluctance to accept women working in construction. This survey estimated that about 20% of employers surveyed may be reluctant to employ women on site (Wilkinson, 1992b, p6). Other results suggested that employers believed that women would have to work harder than their male colleagues to be successful and argued that fewer women, by proportion, would be promoted (Wilkinson, 1992b, p5). The results of the survey also suggested that some employers believed that women had difficulty managing and, in particular, they had difficulty motivating manual labour (Wilkinson, 1992b, p7). Another report suggested that there was much prejudice and resistance to women working in construction, suggesting that some employers believed that, amongst other things, women would cause friction on site, women would leave to have children and women would expect favourable treatment (Anon, 1987, pp12-13). Fryer also commented on the attitudes that exist within the construction industry. He argued that "It is very important for the construction industry to encourage a significant change in attitudes and practices" and suggested that some of the unhelpful attitudes regarding women within the construction industry were "...the industry is too rough for women; the work is physically too hard; women wouldn't like the sort of jobs the industry offers; women wouldn't like the language used on site; we would appoint women but they don't apply; training/promoting women is pointless because they'll leave to have a family" (Fryer, 1992, p2). These attitudes appear to be fairly widespread and could discourage women from entering the industry. For instance, some research has suggested that women feel that there is discrimination in the construction industry. The Construction Industry Training Board found, from their research on factors affecting recruitment to the construction industry, that

of the 18 to 24 year old women they surveyed, few women (17%) thought that working in the construction industry was suitable for them (CITB, 1988a, p33). The CITB results also suggested that women believed that there was discrimination in the construction industry; only 18% of those women surveyed thought that they would receive equal treatment by their colleagues in the construction industry; most agreed that as women working in the construction industry they would suffer a lot of sexual harassment; two thirds of the women thought that the interesting jobs in the construction industry would go to men (CITB, 1988a, p40-41). The impact of some of these attitudes on women's decisions to enter civil engineering is tested in this thesis.

The Institution of Civil Engineers (ICE), in its survey of women members in 1984, also produced results on the question of training and promotion. Respondents were divided into three groups - students, graduate and associate members, and chartered members (ICE, 1984, pp 9,15,23). The results of the survey of student members suggested that some women believed that they were unlikely to be promoted, suggesting, amongst other things, that "...employers would probably promote a man rather than a woman; many employers consider women too "weak" or incapable of doing site work properly and sometimes prevent them; [women were] expected to prove themselves more than a man; and [employers thought that] women were not an investment for a firm because they do not stay for their entire career" (ICE, 1984, p9). At graduate and associate level membership, the comments of women appeared to indicate that they believed that there was less likely to be bias against women, although some women commented that they believed women had to be better than men to get promotion; that employers were less likely to give them training or senior responsibility because they might leave to have children, and some women believed that employers were against the employment of women (ICE, 1984, p15). These results suggest reasons why

women engineering students do not enter the industry in the same proportion as their male counterparts. However, the ICE survey is now nine years old; it is therefore worth testing how far women engineers now consider that the industry will be biased against them.

At chartered engineer membership level again there were a variety of comments about promotion, but still many women felt that they had to work harder than men to prove themselves and that many women had experienced discrimination or were expecting difficulties at senior level (ICE, 1984, p23). At this level women also made distinctions between the various sectors in civil engineering where some women believed that in their treatment of women "...local authorities and government departments did not have any bias, consultants were less hostile and contractors came bottom of the league" (ICE, 1984, p23). Stone suggested that there was a certain amount of wastage of women civil engineers registered with the Institution of Civil Engineers, and suggested that discrimination through ignorance by the older male workforce is a factor (Stone, 1992, p2). The evidence from the literature suggests that there are problems of attitudes towards women and that these not only affect the numbers entering construction, but also might account for some women leaving the industry. Clearly, more detailed research which clarify this position is warranted and is investigated in this thesis.

There is a second problem with working in construction that may, according to the literature, deter women from applying to work there. This is the problem of mobility. Some work in construction - typically site-based work - requires mobility. For some women, especially those who are the primary caretakers of children, this requirement of mobility may pose something of a problem. However, one should remember that not all civil engineering and construction work has the requirement of mobility. The Institution of Civil Engineers (ICE) survey of its women members in 1984 asked for their comments on the problem of mobility.

The requirement of mobility appeared to become more demanding the more senior the engineer responding (ICE, 1984, p10,17,25). Of 41 student members responding, 23 had no views on the problem of mobility. Only 8 thought that there might be problems for women specifically. Of 122 graduate and associate members responding, 19 reported that they had moved in order to follow their husbands, 16 thought that lack of mobility would hinder job prospects and 13 thought that they would have to change to office or academic work. Of 89 chartered members responding, 29 thought that being married restricted mobility (which is not to say that male mobility is not also restricted). But five thought that there was no problem, which was only one fewer than the six who thought site work a problem for those with domestic commitments. On the evidence of the survey, as members have greater experience of the industry, they become more aware of the problems caused by the demand of mobility.

Gale and Fellows suggested that mobility was seen as a constraint on some but not all women arguing that the same could be said for men and that it is a factor affecting recruitment to construction in general. They did stress, however that "...mobility means that there is difficulty in establishing equitable sharing in the responsibilities of a relationship; particularly child-care and domestic work. Typically the man works and women stays at home if his job has mobility. The reverse situation is not common due to role stereotyping. Therefore the need for mobility in a job may reinforce traditional roles" (Gale and Fellows, 1991, pp 676-677). The reinforcing of these roles is supported by some civil engineering employers who appear to believe that women's mobility is restricted by having children. Results of a survey of one hundred employers reported that 48% of employers believed that women were more difficult to employ (in construction) because their mobility is restricted due to having a family (Wilkinson, 1992b, p8). There is some consensus in the literature that mobility is an

issue for women working in civil engineering, but that the research suggests that this is more an issue for women already established in a civil engineering career.

Having examined the literature assessing the role of women in engineering and construction, the next section uses this, and additional information collected from interviews conducted for this study to examine the career expectations of women civil engineering students.

4.6 RESULTS OF INTERVIEWS WITH WOMEN CIVIL ENGINEERS ON THEIR CAREER EXPECTATIONS

The results of the ICE survey suggested that women student members believed that a certain amount of discrimination existed and that, as women, they believed that they were likely to encounter some degree of opposition to their career in civil engineering (ICE, 1984, p9,11). When carrying out personal interviews for this research with twenty three women civil engineering students about what they expected from a career in civil engineering, their career expectations, some of the fears about a career in civil engineering were clarified and other thoughts were identified. These are discussed in this section. In addition, this section discusses the content of twenty interviews with women employed in civil engineering.

The belief that various sectors had better employment prospects than other sectors was common. Fifteen women students interviewed appeared to believe, as the ICE survey suggested, that contractors were the worst sector of civil engineering for their treatment of women civil engineers. Despite this, it was generally seen by them as the most exciting part of civil engineering in which to work. Of the women interviewed who were employed in civil engineering professions, seven worked for contractors and of these three had experienced some form of harassment when working on site. These were either sexist jokes or comments about their ability. Site work appeared to be important in determining whether women would

choose to work for contractors or not, despite the knowledge that not all work with contractors is on site. The impression gained from twelve of these interviews with women students was that the beliefs women had of aspects of a career in civil engineering partly determined their choice of sector of the civil engineering industry to enter. For example, the belief that as women they would receive more opposition to their role of engineer in contracting appeared to make them more likely to choose another sector to work in. Another case where this arose was in the belief that in choosing to work for local authorities, women would find more support for combining a career in civil engineering with having children. The knowledge that there were facilities available in local authorities and consultancies, in the form of flexible working hours and child-care assistance for women who wanted to combine a career with having children was common (eight women civil engineers and five women students mentioned this). However, the general belief, of women students, about contractors was that they did not have the flexibility to cope with women civil engineers with children. This was confirmed by women working in industry who did feel that it was easier to combine having a family and a career in areas other than contracting. Some of the reasons given for this were the existence of long hours and the expectation that one had to often work away from home. This lends support for the results of the ICE survey, which suggested, that for some women, having children and being a civil engineer would be difficult (ICE, 984, p7). However, the results from interviews with students also indicated that for nine women students child-care was not really a problem at this stage since they were not contemplating children just after qualifying. They appeared more concerned with becoming chartered civil engineers and enjoying their profession for a few years before making these decisions. Despite this, there was an anticipation that combining children with working as a civil engineer could be more difficult in some areas of construction than others. There was a

recognition, as in the ICE survey, that it might be necessary to change jobs in order to have children (ICE, 1984, p7).

One common theme that emerged from the interviews with both women students and those working in industry was that they felt that women, and men, had to prove that they were competent engineers, but that there were added pressures for women because they were female; that they felt they had to work harder than their male colleagues. Five of the women students expressed concern about being accepted as an engineer and there was a repeated concern, as mentioned by six women students, that manual workers, particularly on site, were likely to be those showing the least acceptance of their position as engineer. Women, on the whole, expected to experience some prejudice in their role as civil engineers. One optimistic note was that eight women students interviewed and twelve women civil engineers felt that employers were beginning to employ women more readily. This was linked to the belief that once they, as women engineers, had proved themselves there would be fewer problems regarding promotion or opposition. This was borne out in the interviews with women working in engineering where the general impression gained was that they had not been disadvantaged when it came to promotion merely because they were women. However, in saying this, there was again a feeling that some sectors were better at employing and promoting women than others. One women student suggested that promotion might be easier in local authorities than in other sectors because, she believed, they had more enlightened policies for employing women. There was a general feeling in the interviews that women were optimistic that there would be changes in civil engineering in the future as more women chose to work there.

4.7 CONCLUSION

In this chapter the place of women in the labour market and civil engineering has been described. Attention was drawn in the literature to the extent to which women occupy only a highly limited range of jobs and also tend to occupy junior positions. This is the phenomenon known as occupational segregation, which could be either horizontal, or vertical, or both. One of those occupations in which there are very few women is civil engineering. In trying to explain why few women are in the industry now, some of the research data in the literature on women's aspirations in work was reviewed, and this was then checked against the benefits and disadvantages of work in the construction industry. The chapter tended to indicate that there were believed to be distinct disadvantages for women who work in the construction industry. The problem of mobility, or the relative lack of child-care posed a problem in the retention of female employees, but did not seem to enter the calculations of many students deciding whether or not to join the industry. Finally, the beliefs of women civil engineers as reported in the literature and in interviews about a career in civil engineering were examined to find out what their career intentions were and how these problems affected their career choice.

CHAPTER FIVE

RESEARCH PROBLEM AND HYPOTHESES FORMULATION

5.1 INTRODUCTION

In chapters two, three and four, the literature on the background reasons for women choosing civil engineering, the differences between male and female civil engineering students' career choices, the experiences of women on civil engineering courses and the career expectations of women civil engineering students were analyzed. In these chapters, part of the discussion focused on interviews conducted for this research which clarified many of the points in the literature and added additional points for each of the four aspects of career choice under investigation. The aims of this chapter are to discuss the research problems for the four research objectives of career choice raised in chapter one; to formulate the relevant hypotheses necessary for investigating these research objectives and operationalise them in order to make the hypotheses suitable for testing.

5.2 BACKGROUND DECISIONS TO CHOOSE CIVIL ENGINEERING

This section draws on two main sources. First, it draws on the literature in chapter two, and secondly, it uses information, also discussed in chapter two, gained from the semi-structured interviews with women civil engineering students and with women civil engineers on their reasons for choosing civil engineering as discussed in chapter two. In chapter two the main factors which were thought to have contributed to the lack of women choosing science, technology or engineering careers were identified. Within this, parts of the literature identified a number of the reasons why women choose to study civil engineering. Interviews with women civil engineering students, conducted for this research, supplemented the

information analyzed in the literature and provided more reasons why women choose civil engineering. Having identified the reasons for women choosing civil engineering, the purpose of this section is to formulate a number of hypotheses relating to the background of women's decisions to choose civil engineering so that they can be tested with empirical data from a national questionnaire. These hypotheses are then operationalised and tested in the main body of the thesis. The testing of these hypotheses using empirical data will mean that the initial reasons for women choosing civil engineering as determined from the analysis of the results from this national questionnaire, interviews and the literature will have been thoroughly investigated. Therefore the first objective of this thesis will have been achieved.

5.2.1 THE RESEARCH PROBLEM

The problem is that the evidence derived from the literature and interviews indicates that few women choose to study civil engineering as a degree. The literature analyzed in chapter two suggested many reasons why women did not choose a career in engineering, including civil engineering, and most technical careers. However, little research has been carried out to discover why those women who chose civil engineering did so and there exists little empirical data which identifies the reason for this choice of career. Since this was the case, the research objective to investigate the initial reasons for women choosing a career in civil engineering warranted detailed investigation. By testing those reasons so far identified against national sample of women civil engineering students, this could be achieved. In order to investigate the objective, a main and sub-hypotheses were formulated. The main hypothesis formulated to assist in the investigation of objective one is:

> **There are general patterns in the initial career choices of women on civil engineering degree courses.**

In order to test these main hypothesis, sub-hypotheses were formulated which dealt with specific aspects of the main hypothesis. These are discussed in the following sections. Before the sub-hypotheses for these specific aspects are discussed, the next section examines some general problems in identifying the main factors which might be significant for women choosing to study civil engineering, and also discusses the basis for choosing the factors used in the main survey.

5.2.2 PROBLEMS IN IDENTIFYING FACTORS TO USE

Identifying the main factors which might contribute to a woman's decision to choose civil engineering produced many problems. There were three main reasons for this which are examined below:

(i) Much of the literature concentrated on engineering as a whole, and, for instance, considered aeronautical engineering, chemical engineering etc. together with civil engineering. Assumptions were made that women who choose different types of engineering as a career, choose usually for the same reasons. This may not be the case, mainly because civil engineering is very different from, say chemical engineering. Reasons for choosing one may not be the same for choosing the other. By concentrating on engineering as a whole, some of the most important factors for reasons why women decide to choose civil engineering may have been overlooked.

(ii) The literature often relied on small samples of women in building and civil engineering and from this generalisations were made.

(iii) The literature on women in the building industry tended to concentrate on other careers in the building industry such as building and surveying.

Due to the above problems, a system of selecting the most relevant information relating to

women in civil engineering was devised. This is explained below:

(i) Research which had concentrated on women's decisions in choosing careers in all the various types of engineering, including civil engineering, and including the construction industry was analyzed and most of the main factors in this decision identified. This was discussed in chapter two.

(ii) Once all the main factors were identified, those reasons which recurred most frequently for choosing careers in engineering and construction were identified.

(iii) Semi-structured interviews and discussions were carried out with women civil engineering students and women working in civil engineering. These interviews and discussions were conducted to support the analysis of the literature, to act as a check against the reasons so far identified, and to supplement these reasons with any additional ones which may have been missed in the literature.

The discussion of all the factors identified in women's decisions to choose civil engineering gained from the literature and interviews were discussed in chapter two. It was clearly necessary to decide which of the factors so far identified were relevant and important to the decision of women to choose civil engineering. Since investigating the initial reasons for choosing civil engineering was only part of the thesis, it was clearly impractical to examine all the factors mentioned in the literature and in the interviews, given the limited time and resources available for the study. The following sections examine the main factors which appeared in the literature and interviews examined in chapter two to be important in women's decisions to choose civil engineering. For each factor chosen, a justification is given for the choice. In addition to this, for each of these factors, sub-hypotheses are formulated. The testing of these sub-hypotheses will be undertaken in the main survey of this research and

will enable conclusions about the main hypothesis to be presented and hence detailed conclusions relating to research objective one to made.

5.2.3 FORMULATING HYPOTHESES

In chapter two many factors were identified as playing an important part in a woman's decision to choose civil engineering, specific sub-hypotheses relating to these factors were formulated and are presented in this section.

5.2.3.1 FAMILY SUPPORT

In chapter two the discussion focused on parental support as important in women's decisions to choose engineering. It seemed from the literature and interviews discussed in chapter two that fathers, brothers and mothers were important in women's decisions to choose civil engineering. Given the time and resources available it was impractical to examine the influence of all family members and therefore the investigation of family members who appeared to provide the most encouragement was confined to fathers, brothers and mothers. From the literature and interviews discussed in chapter two the following hypothesis relating to family influence on career choice of women civil engineers was derived;

Families are important in encouraging women to choose civil engineering

The analysis of the literature and interviews led to the formulation of more specific hypotheses testing particular aspects of this family hypothesis. The justification for the inclusion of these minor sub-hypotheses is given.

It was suggested, in chapter two, that fathers who were in professional employment were more likely to provide encouragement than those in other employment. This led to the formulation of the following hypothesis about the fathers' occupations and support for their

daughters' decisions to choose civil engineering which is;

Fathers who are in professional occupations provide more encouragement to their daughters' decisions to choose civil engineering than fathers in other occupations.

The literature presented in chapter two also suggested that if a women had a father who was an engineer, or in a building-related profession, then she was more likely to consider engineering as a career. The investigation of this idea led to the formulation of the following hypothesis;

Fathers who are engineers or in building-related professions provide more encouragement to their daughters' choosing civil engineering than fathers in other professions.

Other relatives were mentioned in chapter two as being important influences in women's decisions to choose civil engineering, namely mothers, brothers and uncles. A judgement was made to include in the survey brothers and mothers as family members who provide support but not uncles because the interviews conducted to supplement the literature supported the influence of mothers and brothers more than of uncles, and in particular there appeared to be a suggestion that brothers in building or engineering provided more encouragement which seemed important to test. The investigation of brothers' support is included in the following hypothesis;

Brothers who are engineers or in building-related professions provide more encouragement to women choosing civil engineering than brothers in other professions.

There was no suggestion in the literature that mothers discouraged their daughters' choice of career although, in interviews some women said they were discouraged in their decision by their mothers which led to the formulation of the following hypothesis;

Mothers of women civil engineering students discourage their daughters' choice of civil engineering.

The testing of the hypotheses outlined above will enable conclusions relating to the sub-hypothesis about the influence of some family members on the career choice of women who choose civil engineering to be made. These results will contribute to the main hypothesis where any general patterns in the influence of family members on career choice can be identified. The hypotheses were operationalised in a series of questions in a questionnaire, the methodology of which is discussed in chapter six. This testing of these hypotheses is carried out in chapter seven.

5.2.3.2 SUPPORT FROM CAREERS ADVISORS

The literature presented in chapter two, and subsequent discussions of the results of interviews, suggested that careers advice for women who choose engineering, including civil engineering, is varied, with some receiving much help and others receiving no help. The investigation of the extent to which careers advisors influence choice of civil engineering as a career for women appeared to be important to clarify, especially since lack of careers advice has been one of the factors blamed for the lack of women in engineering. From the literature and interviews, the following sub-hypothesis testing the aspect of the main hypothesis relating to careers advice was formulated. In order to test particular aspects of this ub-hypothesis, minor sub-hypotheses were formulated. The testing of these minor sub-hypotheses will mean that conclusions about the sub-hypothesis can be made and hence this will mean that conclusions about the overall main hypothesis examining general patterns in women's career choice can be made. The sub-hypothesis for this section is;

Careers advice is inadequate for women choosing civil engineering

From this hypothesis the following hypotheses were formulated to test in more detail particular aspects of the sub-hypothesis. These are given, together with a brief justification of the choice of hypothesis.

The literature presented in chapter two suggested that careers advice was varied; interviews with women civil engineering students indicated that the careers advice could possibly depend on the type of school attended. Therefore the following hypothesis was formulated;

Careers advice for women civil engineers varied with the type of school attended.

Although the research studied in the literature appeared to suggest that careers advice could be inadequate, there was no suggestion that women were actually discouraged from choosing civil engineering by careers counsellors. In order to investigate this idea, the following hypothesis was derived.

Women are not discouraged from choosing civil engineering by careers counsellors at school.

Some of the women who were interviewed suggested that they had sought additional careers advice from family and from libraries. The suggestion was that an inadequate careers service at school meant that they had to find information from other sources. The investigation of this suggestion led to the formulation of the following hypothesis;

Alternative careers advice from outside school is likely to have been sought by women students choosing civil engineering.

n the examination of the literature in chapter two, some research suggested that short courses designed to encourage women to consider a career in engineering could be successful. This was confirmed, in part, by the interviews, and led to the formulation of the following hypothesis;

Short courses designed to give women an insight into engineering are a positive

influence on career choice.

In the interviews discussed in chapter two, it appeared that some women who choose civil engineering were of the opinion that they lacked information on what is involved in a civil engineering career. The testing of the following hypothesis investigates this;

Women choose civil engineering with little knowledge of what civil engineers actually do

The interviews discussed in chapter two also seem to point to the time at which career decisions were made as usually after the age of sixteen. The impression from these interviews was that many young women chose their A level subjects and then with these examined what careers were open to them. The investigation of this idea is tested using the following sub-hypothesis;

Women decide on a career in civil engineering after the age of sixteen.

The testing of the above hypotheses allows conclusions about the nature of careers advice for women civil engineers to be made. Any general patterns in the careers advice received by women civil engineers could be identified from these results and thus contribute to the testing of the main hypothesis. The hypotheses stated above were operationalised in a series of questions which allowed these conclusions to be made.

5.2.3.3 INFLUENCE OF TEACHERS

Some of the research analyzed in chapter two suggested that teachers could be a strong influence on career choice of women considering engineering. The results of the interviews discussed in chapter two tended to confirm that for some women physics or mathematics teachers had been important influences in career choice. This led to the formulation of the following sub-hypothesis testing the influence of teachers on the career choice of women civil

engineering degree students;

Science and mathematics teachers play an important role in the career choice of women civil engineers

Particular aspects of this hypothesis were tested further with the formulation of the following minor sub-hypotheses. These were derived from the results of the interviews where the influence of some science and mathematics teachers was implied. These hypotheses are as follows;

a **Science teachers influence career choice**

b **Mathematics teachers play an important part in career choice of women civil engineers**

c **For women on civil engineering courses, science and mathematics teachers influenced their decision to choose civil engineering.**

The testing of the above hypotheses allows conclusions about the influence of teachers on career choice to be determined. Any general patterns in the influence of teachers could be identified from these results and thus contribute to the testing of the main hypothesis. The hypotheses stated above were operationalised in a series of questions which allowed these conclusions to be made.

5.2.3.4 ABILITY IN SCIENCE AND MATHEMATICS

The results of the interviews discussed in chapter two suggested that women who thought that they were good at mathematics and physics at school were likely to consider careers in engineering. What was clear from these interview results was that many of those women who thought of themselves as being better at science subjects than arts subjects had, as a result, tended to examine careers using these subjects. This idea was formulated into the following

sub-hypothesis about the science and mathematics ability of women civil engineers and its relationship to career choice. The sub-hypothesis for this section is;

There is a relationship between women's choice of civil engineering as a degree and their ability in certain subjects

In order to test particular aspects of this hypothesis, the following hypotheses were developed and these are given together with a brief justification for their use. In the discussion of the interviews in chapter two, it appeared that women who choose engineering were likely to be good at mathematics at school. This led to the formulation of the following hypothesis;

Women who choose civil engineering find little difficulty with mathematics at school.

It seemed from the interviews discussed in chapter two that women considered themselves good at physics at school which led to the formulation of the hypothesis stating;

Women who choose civil engineering consider physics as one of their strongest subjects at school.

As mentioned earlier, there was a clear impression from the discussion of the interviews in chapter two, that women who chose civil engineering felt that they were not very good at arts subjects at school. From this the following hypothesis was formulated;

Women who choose civil engineering as a career were not good at arts subjects at school.

Some of the discussion of the review of the literature suggested that women with technical hobbies were likely to choose engineering. Although there was no evidence from the interviews that this was the case, it appeared that, from examining much of the literature, this could be important and was identified as warranting some attention in this research. Therefore the following hypothesis was included;

Women who choose civil engineering have technical hobbies

One reason that appeared as important in the choice of civil engineering for women was discussed in the literature in chapter two and in the interviews in chapter two. This was the opportunity for women to apply mathematics and science qualifications to their career. This led to the formulation of the following hypothesis;

Women who choose civil engineering do so because they want to use their mathematics and science qualifications

The above hypotheses were operationalised in a series of questions examining the relationship between the choice of career and ability in science and mathematics subjects. Any general patterns in the career choice of women civil engineers and its relationship with their perceived ability in science and mathematics can be identified from these results.

5.2.3.5 BENEFITS AND NATURE OF CIVIL ENGINEERING WORK ENCOURAGING WOMEN TO CHOOSE CIVIL ENGINEERING

In chapter two, the discussion of the interviews focused on some of the main reasons women gave for choosing civil engineering. Some women gave reasons for choosing a career in civil engineering which were related to certain features of the work. Further prompting revealed that the reasons given were often similar for many women. Generally, such features as interesting work, working outside, and high salary, amongst others were mentioned. In all, seven features mentioned were isolated as reasons for choosing civil engineering as a career. This led to the formulation of the following sub-hypothesis about the attraction of certain features of civil engineering to women;

The same features of civil engineering are found attractive by women choosing it

The features of civil engineering mentioned in the literature and interviews as warranting further research were formulated into the following hypotheses designed to contribute to the testing of the sub-hypothesis outlined above.

Some women said that the salary was an important reason for choosing civil engineering which led to the hypothesis;

Women who choose civil engineering are attracted because of the prospect of a good salary

Another feature mentioned is included in the following hypothesis;

Women choose civil engineering because they perceive the work as interesting

One women said that she was attracted to civil engineering because it meant that she would not be working with the general public. This was an interesting feature and warranted further research to see how common a feature this was, which led to the hypothesis;

Women choose civil engineering because they would not have to deal with the general public

Another common feature mentioned in chapter two was the belief that engineering provided the opportunity to be involved in problem solving. This led to the formulation of the hypothesis to test this feature for women choosing civil engineering;

Women choose civil engineering because they believe the work involves problem solving.

O her reasons given by some women were that they wanted to work outside and that they wanted a transferable skill. This led to the formulation of the following hypotheses;

Women who choose civil engineering do so because they believe that it involves working outside

and

Women choose civil engineering because they believe it is a profession that is transferable worldwide

The final feature which appealed to some women in interviews was;

Women choose civil engineering because they wanted the opportunity to succeed in a male-dominated field

The hypotheses outlined above were operationalised in a series of questions testing the belief that women who chose civil engineering are attracted to it because of certain features of the work. General patterns in the beliefs of women about these features as tested in the national survey could be identified.

Having identified and formulated hypotheses for the factors involved in the decision of women to choose civil engineering, the next section in this chapter examines the comparative part of the survey about the career choice of male and female civil engineering students leaving higher education.

COMPARATIVE STUDY OF THE CAREER CHOICES OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS LEAVING HIGHER EDUCATION

5.3 INTRODUCTION

In chapter one, the second research objective identified was to investigate whether there are differences in the employment choices made by male and female civil engineering students leaving higher education. Initial investigations of this objective led to an examination of the literature discussed in chapter three. Part of the discussion in chapter three focused on the First Destination Survey results which analyzed the employment location of civil engineering graduates six months after graduation. Analysis of these results over a number of years suggested differences in the career locations of male and female civil engineering graduates. Additional surveys analysed in chapter three tended to confirm the existence of differences for all engineering disciplines. In chapter three, discussion of the results of interviews with final year male and female civil engineering students suggested additional differences and partially confirmed others. In that chapter there was also an examination of some of the factors which appear to be important to male and female engineers when looking for employment where researchers had suggested that there were differences between the sexes in this respect. Analysis of the literature and interviews in chapter three led to the formulation of the main hypothesis used to test research objective two. This hypothesis was;

Female and male civil engineering students leaving higher education choose employment differently

The following section discusses the formulation of the sub-hypotheses used to test this main hypothesis.

5.3.1 THE RESEARCH PROBLEM

Three aspects of career choice for male and female civil engineering students are examined which allow the main hypothesis to be tested and hence conclusions about research objective two to be made. The first is establishing the differences between male and female civil engineering students in relation to their career choice. While the First Destination Survey results are a good starting point for assessing the career choice of male and female civil engineering students, since they give a broad overview of the sectors of employment civil engineering graduates choose, they offer only a very general picture of the career choice of male and female civil engineers because the categories used, eg building and civil engineering work, are so broad. It does appear from the literature, however, that male and female civil engineering students enter different sectors of the civil engineering industry, but detailed analysis of these differences has not been undertaken.

The second aspect of the research in this section is to investigate the process of securing employment, to determine whether there are differences in this process. The investigation of the process of securing employment came when trying to examine the differences in career choice. It appeared from the interviews, whose content was discussed in chapter three of this research, that students made use of various methods of securing employment and that there might be a difference between male and female students.

The third aspect of the career choice of male and female civil engineering students was the investigation of the factors which were important in their choice of employment since the analysis of the literature in chapter three suggested that a number of factors were more important to male students than female students and vice versa. Examination of the three aspects of career choice outlined above will allow conclusions about the main hypothesis to be made and also contribute to the investigation of objective two.

5.3.2 IDENTIFYING THE DIFFERENCES IN THE CAREER CHOICE OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS LEAVING HIGHER EDUCATION.

Exploratory investigations in the form of a literature search and interviews suggested that there were differences in career choice between male and female civil engineering students leaving higher education; that there were differences in the resources that male and female civil engineering students used; and that there were differences in the factors important to male and female civil engineers when choosing employment. These were incorporated into the main hypothesis for this section which was;

Female and male civil engineering students leaving higher education choose employment differently.

Three aspects of this main hypothesis were formulated into three sub-hypotheses designed to test each of these particular aspects. These sub-hypotheses are stated below;

a **Male and female civil engineering students leaving higher education make different career choices**

b **The process of securing employment differs between men and women**

c **Male and female civil engineering students leaving higher education find different factors important when choosing their first employment**

Within the testing of these sub-hypotheses more detailed hypotheses were formulated which dealt with particular aspects of these sub-hypotheses. The following sections formulate these for each of the three sub-hypotheses stated above.

5.3.3 THE DIFFERENCES IN THE CAREER CHOICE OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS LEAVING HIGHER EDUCATION.

The literature and interviews discussed in chapter three suggested that men and women make different career choices which led to the formulation of the sub-hypothesis that;

Male and female civil engineering students leaving higher education make different career choices

Particular aspects of career choice warranted investigation and thus led to the formulation of the following minor sub-hypotheses stated below with a justification of their choice. First Destination Survey results suggested that men and women chose different sectors of the civil engineering industry in different proportions and this led to the formulation of the hypothesis;

The choices of sector of industry made by male civil engineering students leaving higher education are different from the choices made by female civil engineering students leaving higher education.

Within civil engineering there are many specialisations. The suggestion that their choice of sector was different could also mean that the choice of specialisation is different since, as was discussed in chapter two, different sectors of the civil engineering industry perform different functions. This idea led to the following hypothesis aimed at testing the differences between male and female civil engineering students in their choice of specialisation;

The choices of specialisation in employment made by male civil engineering students leaving higher education differ from those made by female civil engineering students leaving higher education.

The discussion of the First Destination Survey results presented in chapter three suggested that women were choosing to work in financial sectors in greater percentages than men. This suggestion led to the formulation of the following hypothesis;

Women are more likely than men to plan to enter an industry other than civil engineering.

During interviews with male and female civil engineering students, the desire to undertake further study to get higher qualifications appeared to be stronger for women than men. The testing of the following hypothesis aims to investigate this;

Women are more likely than men to plan to take further qualifications

Finally, an aspect of graduate choice following higher education appeared to be in the opportunity to take time off following the completion of their degrees. It seemed that many male and female civil engineering students wanted to take some time off before embarking on their chosen career. The investigation of this is covered in the following hypothesis;

An equal number of men and women plan to take more than six months off after completing their degree.

The operationalisation of the hypotheses outlined above took the form of a variety of questions in the questionnaire, which aimed to establish if there were career choice differences between male and female civil engineering students and hence contribute to the main hypothesis testing the idea that male and female civil engineering students choose employment differently. The next aspect of the research problem investigating the career choices of male and female civil engineering students, that of the differences in the process of securing employment, is considered in the next section.

5.3.4 THE DIFFERENCES IN THE PROCESS OF SECURING EMPLOYMENT

This section derives the sub-hypothesis examining the process of securing employment, in order to discover whether there is a difference in the path to securing employment between male and female civil engineering students leaving higher education.

In exploring the difference of the career choice of male and female civil engineering students, initial investigations led to the conclusion that it was important to examine whether there were differences in the process of securing employment. The impression gained from interviews, whose content was discussed in chapter three, was that there appeared to be some differences between male and female civil engineering students and the process of securing employment.

The impression that there were differences in the process of securing employment led to the sub-hypothesis for this section;

The process of securing employment differs between men and women

In order to test this hypothesis, the following hypotheses were formulated which aimed to investigate in more detail the particular aspects of the process of securing employment.

It appeared that men were being more successful at gaining employment than women and also that there appeared to be a difference in the approximate numbers of applications that women and men were making. The investigation of this led to the following hypothesis;

Men make fewer applications per job offered than women

The use of careers services appeared to be one of the main sources of finding out about employment opportunities for both male and female students. The examination of this idea led to the following hypothesis;

Both male and female civil engineering students make use of careers services at college.

Other ways of securing employment were discussed with civil engineering students to examine what other methods students used and to assess whether there were differences between male and female civil engineering students in their use of other sources. The following three hypotheses aim to investigate these methods and any variations between the

sexes in their use.

It appeared that both men and women make use of friends, but it was assessed from the interviews discussed in chapter three, that men make more use than women of friends to secure employment. This led to the hypothesis;

Men are more likely than women to use friends to find out information about employment opportunities.

Whilst it appeared that men make more use of friends, the evidence derived from interviews indicated that women make more use of family. This led to the hypothesis;

Women are more likely than men to use family to find out information about employment opportunities

Another way of securing employment was by using engineering journals to find out about employment opportunities. The most common journal appeared to be the "New Civil Engineer" which is the journal of the Institution of Civil Engineers and which includes employment advertising. Use of engineering journals to find out about opportunities for employment led to the hypothesis investigating the process of securing employment;

The level of use of engineering journals to find out information about employment opportunities is similar for male and female civil engineering students.

Other ways of securing employment were mentioned, for instance, personal contacts or past work contacts. The interviews with male and female civil engineering students appeared to indicate that women were more likely to find other ways of securing employment. This idea led to the formulation of the following hypothesis;

Women are more likely than men to use alternative types of careers information

Overall, the impression gained was that women make more effort to secure employment than

men, which led to the following hypothesis;

Women use more career sources than men to find information about employment opportunities.

The testing of the hypotheses stated above were operationalised in a set of questions aiming to elicit information about the process of securing employment of male and female civil engineering students. The testing of these hypotheses will contribute to the discussion about the difference in the process of securing employment as set out in the sub-hypothesis for this section. This will allow the main hypothesis to be tested and hence will contribute to the examination of the research objective two of this thesis. The next section examines the third aspect of the research problem in the career choice of male and female civil engineering students leaving higher education, that of the factors which are important in choosing first employment.

5.3.5 IMPORTANT FACTORS IN DETERMINING FIRST EMPLOYMENT FOR MALE AND FEMALE CIVIL ENGINEERING STUDENTS LEAVING HIGHER EDUCATION.

During the initial stages of the research, extrinsic reasons why civil engineering students would choose various jobs were identified. These came from the literature presented in chapter three and from interviews with final year civil engineering students looking for employment, whose content was discussed in chapter three. Reasons such as salary, benefits, training policies of companies etc were often quoted by students as being the reason why they would choose one job above another. In all, twenty reasons for choosing a job as identified from the literature and interviews were found to be important. The review of the literature in chapter three discussed some of the factors which appear to be important to male and

female engineers in choosing employment suggesting that there were possible differences between male and female students in this respect. For instance, results of one survey suggested that females placed more emphasis on training and on the quality of the company whereas males placed more emphasis on salary and promotion. This section derives hypotheses to test whether there are differences between male and female civil engineers in the importance of reasons for choosing employment. The results from the testing of the following sub-hypotheses derived to test these differences will allow conclusions about the main hypothesis to be made. The sub-hypothesis for this section is;

Male and female civil engineering students leaving higher education find different factors important when choosing their first employment

In order to test this sub-hypothesis, more detailed hypotheses designed to test particular aspects of this sub-hypothesis were formulated. The first of these aspects to be considered is that the importance of the location of family and close friends to the place of employment appeared to be important to some women. Examination of the evidence from the analysis of the literature in chapter three and interviews led to the following hypothesis;

When choosing their first employment, the location of the organisation is more important to female than to male civil engineering students.

Travel in the UK and overseas also seemed to be important to male and female civil engineering students, although the evidence derived from the interviews suggested that the opportunity to travel was more important to men than women. This led to the formulation of the following hypothesis;

When choosing their first employment, the opportunity to travel is more important to men than to women.

Salary, child-care, company cars and pension plans were all mentioned as reasons for choice

of employment, some reasons appearing in the literature, others in the interviews. Some women mentioned in interviews that child-care was an important consideration when looking for employment, which supported the evidence derived from the literature examined in chapters three and four. Some of the research in chapter three argued that salary was more important to men than women. This evidence led to the formulation of the following hypothesis;

When choosing their first employment, some employment benefits are more important to one sex than to the other.

In chapter three and four, the importance of the type of work was examined. Features such as interesting, varied work, promotional prospects and graduate training programmes were mentioned as important considerations in choosing employment, some from men and some from women. This led to the formulation of the following hypothesis;

When choosing first employment, the level of importance placed on the type of work differs between men and women.

Prestige of the job and of the organisation were mentioned by a few men as being important whereas women were more likely to mention aspects of the working environment as important. The evidence presented in chapter four suggested that the working environment was an important aspect of employment for women. In interviews with male and female civil engineers, women sometimes mentioned the numbers of women engineers in an organisation as being important in deciding what type of employment to choose, but this feature was not mentioned by any men questioned. The evidence derived from interviews and literature led to the formulation of the following hypothesis;

When choosing their first employment, the level of importance of the type of organisation is different for male and female students.

The testing of the hypotheses outlined above allows conclusions to be made about the importance of different factors to male and female civil engineering students. This will, in turn, contribute to the main hypothesis testing whether male and female civil engineering students choose employment differently and hence contribute to the investigation of research objective two of this thesis. The next section in this chapter determines whether the college experiences of women civil engineering students affect their career choices.

THE RELATIONSHIP BETWEEN COLLEGE EXPERIENCES AND CAREER CHOICE

5.4 INTRODUCTION

The aim of this section is to identify the main factors which led to the formulation of the hypotheses for that part of the research concerned with how college experiences of women civil engineering students can influence career choice, drawing on the findings of the interviews whose results are discussed in chapter three and also on the literature analyzed in chapter three. During the initial stages of the research, it became apparent that there was little research on the college experiences of women on civil engineering courses and that certain factors relating to experiences during college and their effect on career decisions were worth examining more thoroughly. This section first states the research objective relating to women's experiences on civil engineering degree courses and the relationship of these experiences to career choice. This section then identifies the main factors in the experiences of women's college experience that might influence career choice as identified in the literature in chapter three and the interviews discussed in chapter three. Following this,

hypotheses are formulated, the testing of which will allow conclusions to be made relating to research objective three of this thesis as identified in chapter one. This objective was to investigate whether there is a relationship between college experiences of women civil engineering students and their career choice.

5.4.1 RESEARCH PROBLEM

There is no identified research which examines whether there is a relationship between the experiences of women on civil engineering courses and the career choices they make when leaving higher education. Much of the literature examined in chapter three discussed some of the experiences that women have when they are on courses like engineering but did not relate this to intended career decisions. The results of interviews and discussions with women civil engineering students were discussed in chapter three. These suggested that there are a number of factors which concern women students on civil engineering degree courses and that some of these could affect women's decisions whether to continue with a career in civil engineering or enter another profession.

Some of the problems identifying the main factors on women's decisions to choose civil engineering were discussed in 5.3.2 and these problems are as valid here. Because little of the literature attempting to link the career choices of women civil engineers with their college experiences was initially identified, there was a greater reliance on the interviews in developing the main hypothesis and sub-hypotheses in this section. However, the findings from the interviews discussed in chapter three did provide enough information to suggest that a relationship might exist and also to enable hypotheses to be formulated to test this relationship. The next section formulates these hypotheses.

5.4.2 FORMULATING THE HYPOTHESES TO TEST THE RELATIONSHIP BETWEEN COLLEGE EXPERIENCES AND CAREER CHOICE

During the interviews, women were asked whether they intended to enter civil engineering work and if so why, and if not, why not. They were asked whether their experiences at college had shaped this decision and how. The following hypotheses were derived from their responses and also from the literature discussed in chapter three. The main hypothesis is;

There is a relationship between the college experiences of women civil engineering students and their career choice

In order to test the main hypothesis, a number of sub-hypotheses were developed from the interviews, discussions and literature. It appeared that women who were enthusiastic about civil engineering were more likely than those who were not to enter civil engineering. Women who had enjoyed the civil engineering course they were studying were more likely than those who did not enjoy the course to choose to stay in civil engineering. The relationship between women's enjoyment of the course and their career choice was formulated into the following sub- hypothesis;

Women on civil engineering degree courses who enjoy the course are more likely than those who do not enjoy the course to enter civil engineering employment

In chapter three, part of the discussion focused on whether women felt at a disadvantage compared to their male colleagues. It appeared that some women did and this led to the formulation of the following sub-hypothesis to investigate whether those who feel at a disadvantage are more likely to leave civil engineering for another profession;

Women who feel at a disadvantage throughout the course, compared with their

male colleagues, are more likely to leave civil engineering than those who do not feel disadvantaged

When interviewing women civil engineering students, there appeared to be evidence to suggest that women who lacked confidence were more likely than those who did not to enter another profession other than civil engineering. This evidence led to the formulation of the sub-hypotheses which was

Women who feel they have a high ability in civil engineering are more likely to enter civil engineering employment than those who feel that they have a low ability

Part of the discussion of the interviews suggested that the ability or not of women to relate to their male peers on a professional basis could affect their decisions to enter civil engineering or enter another profession. It was suggested because of this, some women might then consider careers other than civil engineering when they graduate. This idea led to the formulation of the following sub-hypothesis;

Women who identify with their male colleagues are more likely to enter civil engineering employment than those who do not.

In chapter three it was suggested that lecturing staff can play an important part in the career decisions by providing encouragement and support. Relationships with lecturing staff appeared to be important for women entering civil engineering. This led to the formulation of the following sub-hypothesis;

Women who are satisfied with their lecturing staff are more likely to enter civil engineering than those who are not

The evidence derived from the interviews discussed in chapter three suggested that a few women did not feel part of the social scene provided by engineering departments at college.

Some of the literature in that chapter discussed the feeling of isolation that some women felt on courses where they were in a minority. It was thought that these feelings could discourage women from entering the industry. The following hypothesis assumes that feelings of isolation can be attributed to minority status and asks whether these feelings can affect women's decisions to enter the industry. The investigation of this was covered by testing the following sub-hypothesis;

Feelings attributed to minority status discourage women from entering civil engineering

In chapter three, some of the discussion reviewing the results of the interviews suggested that some women felt that their role in class was determined by their sex. This idea led to the formulation of the following sub-hypothesis

Those women who feel that their role in class is determined by their sex are more likely to enter a profession other than civil engineering.

The investigation of these sub-hypotheses led to a set of questions being prepared in the national questionnaire. Testing of the sub-hypotheses means that conclusions can be made about the main hypothesis which tests the relationship between college experiences and career choice. Conclusions from the testing of these hypotheses relate to the investigation as outlined in objective three of this research.

The final research problem, that of finding a relationship between the career expectations of women civil engineering students and their career choice is discussed in the next section.

CAREER EXPECTATIONS AND CAREER CHOICE

5.5 INTRODUCTION

Chapter four described the role of women in the labour market generally. It also described the role of women in engineering and in construction. Finally it assessed the role of women in civil engineering and presented a review of the results of some interviews conducted with women civil engineering students. The chapter identified a variety of factors of the working environment which concern many women in engineering and construction, and focused on those factors which some researchers suggest are of specific concern to many women in civil engineering.

The aim of this section is to discuss the formulation of hypotheses about the career expectations of final year women civil engineers leaving higher education. This section uses a variety of sources. It uses the literature discussed in chapter four, together with interviews and discussions with women civil engineering students. It also draws on the previous section in this chapter which described the factors affecting female and male civil engineering final year students and their decisions to choose their first job.

5.5.1 RESEARCH PROBLEM

The research problem for this part of the study was derived from the literature analyzed in chapter four, together with the review of the results of the interviews also discussed in chapter four. The review of the literature indicated that, although there is an abundance of information about the different factors affecting the decisions of women about work in the labour market and also some research which has examined the role of women in engineering and construction, there is little empirical data about the career expectations of women with

civil engineering degrees. The evidence derived from the literature and interviews suggests that women, in general, have many concerns about work which affect their decisions to choose particular types of work. This idea is tested in this thesis under research objective four which is to investigate whether there is a relationship between the career expectations women hold of civil engineering and the sector of civil engineering industry they choose. The following main hypothesis and sub-hypotheses were derived and the investigation of the sub-hypotheses will enable conclusions about the main hypothesis to be made. Hence, conclusions can be made relating to research objective four.

5.5.2 FORMULATING HYPOTHESES

The discussion in this section examines the factors chosen to examine the career expectations of women civil engineering students and sets out the hypotheses.

The main hypothesis is;

- **There is a relationship between the career expectations of women civil engineering students and the sector of civil engineering they choose**

This hypothesis was derived from the belief about careers that some women had, as discussed in the account of the interviews in chapter four, and the proposition that their choice of career is affected by these beliefs. In particular, the belief that various sectors had better employment prospects than other sectors was common. That these beliefs existed was supported by one of the surveys discussed in chapter four which suggested that some women appeared to believe that contractors were the worst sector of civil engineering for their treatment of women civil engineers, although, in that survey, possible implications of this belief on career choice were not examined. The sub-hypotheses developed to test this main hypothesis are now discussed. The results of the interviews and of the analysis of the

literature presented in chapter four suggested that women believed that some sectors of civil engineering treated women better than other sectors. This led to the formulation of the sub-hypothesis;

There is a relationship between the beliefs about various sectors of civil engineering held by women civil engineering students and their choice of sector of civil engineering.

Part of the discussion of the literature in chapter two suggested that the different sectors of civil engineering perform different functions. The results of the interviews suggested that some women would not work for a contractor because they would not enjoy working on site. This belief led to the formulation of the sub-hypothesis which said;

There is a relationship between the expected enjoyment by women civil engineering students of some features of civil engineering work and their choice of sector of civil engineering.

In chapter four much of the discussion identified the problem of child-care for women who wanted to have children and a career. Some of the results of surveys analyzed in chapter four suggested that for some women, having and bringing up children and being a civil engineer were believed to be difficult to combine. This belief was confirmed, in part, by interviews where there was an anticipation that combining children with working as a civil engineer could be more difficult in some areas of construction than others; one woman expressed the view that the difficulties associated with having and bringing up children whilst working for a local authority would be easier than having and bringing up children whilst working for a contractor. This led to the formulation of the hypothesis;

There is a relationship between the impressions women have of the availability of child-care facilities and their choice of sector of civil engineering.

The opportunities for women choosing to work in civil engineering were examined. Part of the discussion of interviews suggested that some sectors of civil engineering were believed to have better policies towards the employment and promotion of women than others. This suggestion led to the formulation of the sub-hypothesis;

There is a relationship between opportunities women expect from a civil engineering career and their choice of sector of civil engineering.

Some of the research discussed in chapter four suggested that women civil engineering students believed that a certain amount of discrimination existed, and that, as women, they were likely to encounter some degree of discrimination in and opposition to their career in civil engineering. It was apparent that women who thought that they would receive opposition in employment in some sectors of civil engineering were likely to choose other sectors. This belief led to the formulation of the following sub-hypothesis to test whether the belief of opposition affected the choice of sector of civil engineering;

. **There is a relationship between the degree of opposition women civil engineering students leaving higher education expect to receive and their choice of sector of civil engineering.**

The investigation of these sub-hypotheses enables conclusions about the relationship between career expectations and career choice to be made and hence contribute to the investigation of research objective four as outlined in chapter one of this thesis. The operationalisation of these sub-hypotheses was in the form of a set of questions on the questionnaire to final year women civil engineering students.

The research problems for the four identified questions on career choice are now established. The next chapter examines the research methodology for the research including the methodology for the interviews and the main survey questionnaire.

CHAPTER SIX

RESEARCH METHODOLOGY

6.1 INTRODUCTION

In this chapter the research methodology for the development of the main questionnaire survey is discussed. This chapter describes how the main questionnaire survey was designed, implemented and analyzed.

6.2 THE SCOPE OF THE PROJECT

To select and adapt an appropriate method for examining the four research problems, various social science techniques for gathering information were examined (eg Wright, 1979; Oppenheim, 1976; Van Dalen, 1979; Robson, 1983; etc). The choice among the many approaches specified narrowed to some that provided a feasible means of collecting and examining information for this research project.

There appeared to be two main approaches in the literature, and a decision was made about the suitability of either approach in solving the research problems.

The main choice was between collecting qualitative data and collecting quantitative data. Bryman adequately defined both qualitative and quantitative data. He suggested that qualitative research "...is participant observation, which entails the sustained immersion of the researcher among those whom he or she seeks to study with a view to generating a rounded, in-depth account of the group" (Bryman, 1988, p24), and that quantitative research methods involve "...generating quantifiable data on large numbers of people who are known to be representative of a wider population in order to test theories or hypotheses" (Bryman, 1988, p24). In this research, the choice was ultimately between:

(i) In-depth case studies focusing on the career choices and experiences of final year women civil engineering students in a few institutions

(ii) A broad survey covering all final year women on civil engineering courses at UK institutions

The merits and demerits of both quantitative and qualitative research have been well documented (see for instance; Bryman, 1988; Good, 1972). The following section explains the type of approach chosen and the reasons for this choice.

6.3 APPROACH TAKEN

It was decided that a quantitative research method of collecting data should be used, and that the form taken for this research should be a national questionnaire survey. The questionnaire survey should be sent to all final year women civil engineering students in the UK, and an equivalent number of final year male civil engineering students. This decision was taken after considering many factors, the most significant of which were:

(i) There were small numbers of women at each civil engineering department in the institutions included in this research. This meant that choosing a representative sample would become very difficult. This difficulty would be enhanced by adding to it choices about location, size of departments, numbers of women on courses and other factors.

(ii) Part of the research problem aimed to answer questions relating to career choice and expected employment. It was felt that these questions would be better answered by a large sample where an overview of career choices could be gained. It would be difficult to get an overall view of women's entry into employment if only a few civil engineering departments at universities were considered.

(iii) College experiences amongst women in civil engineering departments where there were few women students were likely to be different from those of women in departments where large numbers of women existed. A questionnaire could cover all departments, and therefore a better picture of the experiences at college of women civil engineering students could emerge.

(iv) There was a lack of information on the profiles of women civil engineers in general, therefore, in a case study tackling this research problem, relating the sample to the wider environment would not have been possible. The validity of the research findings would have been hard to establish. A national sample meant that a broad picture of the intending woman civil engineer, her background, experiences and expectations could be obtained.

(v) Access and travel to civil engineering departments where potential case study subjects might have taken part would have required much extensive planning, cost and resources, to find interested departments. This would have been very time consuming. Postal questionnaires simply required distribution, with minimal disturbance of the individuals concerned.

(vi) Asking students to participate in interviews for case studies would have caused problems, especially since the most desirable time to elicit information about their career choices was likely to be just before they left higher education, and in most cases this would have been just before final examinations. This meant that the study may have disrupted examination timetables of the students, or encountered an unwillingness on their part to participate. A postal questionnaire was relatively quick and easy to complete, requiring the minimum of effort by the respondent.

(vii) Confidentiality is easily assured in questionnaires. In interviews, confidence needs to

be gained, and even then students may be unwilling to divulge information.

(viii) It was felt that, in interviews for the main study, it might be hard to remain objective, especially given that the study was being conducted by a female civil engineer who had experience of studying and working in civil engineering. A national questionnaire eliminated this problem in part because the conclusions can be publicly verified against the results.

(ix) It is sometimes claimed that larger samples produce more reliable data. For instance Healey suggests that "... decisions based on larger samples....can be regarded as more trustworthy than decisions based on small samples" (Healey, 1990, p183). In the absence of data from large samples of women civil engineering students, the decision to undertake a study based on a national questionnaire survey was taken.

The above list is by no means comprehensive; it does, however, list the main reasons for choosing the questionnaire over case studies for this particular research problem. The next section discusses the methodology used to develop the questionnaire where the description of the nature, number and content of interviews and discussions which led to the formulation of the hypotheses set out in chapter five is given.

6.4 METHODOLOGY: INTERVIEWS AND DISCUSSIONS

In chapters two, three and four the literature on the background reasons for women choosing civil engineering, the differences between male and female civil engineering students' career choice, the experiences of women on civil engineering courses and the career expectations of women civil engineering students was analyzed. At the end of each chapter part of the discussion focused on interviews conducted during this research which clarified many of the

points in the literature and added additional points for each of the areas under investigation. The aims of this section is to describe the number, nature and content of these interviews together with the methods adopted for these interviews whose results were reviewed in chapters two, three and four. Following this a section is provided on the many discussions which took place during the early stages of the research which assisted in the development of the questionnaire survey.

6.4.1 INTERVIEWS AND DISCUSSIONS

Interviews and discussions took place throughout the development of the main questionnaire survey. Between October 1990 and March 1992, forty three interviews took place with women and ten interviews with men (the number and nature of these is discussed in section 6.4.3.1). Numerous discussions about the research and the development of questions for the questionnaire also took place during this period (these are discussed in section 6.3.3.1). The main aim of the interviews and discussions was to explore and elicit more background information to supplement the literature and to assist in the design of questions on the questionnaire.

Owing to the lack of information on women in civil engineering identified in the initial stages of the literature search, there was clearly a need to find out as much as possible from any alternative source available. These discussions and interviews were planned throughout the development of the questionnaire alongside a continuing literature review. Initial exploratory interviews were used to explore the themes in this research. According to Van Dalen "Non-structured interviews are not ordinarily employed when one is testing and verifying hypotheses, but this informal approach is very helpful in the exploratory stage of the research" (Van Dalen, 1979, p160).

Once a general understanding of some of the factors involved had been gained and some information on the experiences of women in civil engineering had been collected and analyzed, a more focused approach was taken. This included designing an interview sheet which was used during the majority of the semi-structured interviews. This interview sheet was refined as more discussions and interviews took place and more issues came to light. The final version of the interview sheet can be found in appendix A.

Because examining the literature and conducting the discussions and interviews were continual processes, some of the literature covered the points that discussions and interviews also brought out. Where previous research had been conducted, the interviews and discussions were used to supplement this information. It was apparent quite early in the research project that little research had been conducted that dealt specifically with women in civil engineering as distinct from women in other engineering or building professions. In some of the research areas under investigation, the reliance on the information gathered from sources other than literature was greater in shaping the hypotheses than for others. Therefore, much of the information gained from interviews and discussions with women in civil engineering was used in the design of the main questionnaire survey.

Contacts for the interviews were made in several ways. Some women were contacted through, or met at, a number of seminars and conferences such as the Women's Engineering Society Annual Conference 1990, the Ninth International Conference of Women Engineers and Scientists 1991, and personal contacts, together with other seminars and conferences attended in the earlier stages of the research. Women on civil engineering courses were usually contacted through personal contacts and informal networks, as were male civil engineering students. Different situations called for different techniques to be adopted. Where interviews took place confidentiality was always assured. For this reason no identification of

any of the subjects is made in the thesis.

6.4.2 TYPE OF INTERVIEWS AND DISCUSSIONS

Semi-structured interviews took place using an interview sheet as a guide. During the interviews, the interview guide was referred to, but not explicitly followed. This was because, occasionally, other factors emerged during the interviews and these were probed for more detailed information. Usually, the interviews took place face to face, but in three cases where the respondent lived quite far away, telephone interviews were used. Notes were taken during the interviews with women in twenty three cases, and in twenty cases tape recordings were made. Notes were taken during all the interviews with male civil engineering students. The following section discusses the number and nature of these interviews together with references to chapters two, three and four where the detailed content of the interviews is discussed.

6.4.2.1 NUMBER AND NATURE OF INTERVIEWS

Sixteen semi-structured interviews were conducted with women on civil engineering degree courses. Nine of these were with final year civil engineering students and the remaining seven were with women at other stages of their civil engineering degree course.

Seven semi-structured interviews were conducted with women students studying for a Higher National Diploma in civil engineering or building. All these interviews were with women in the final year of the course.

Nine semi-structured interviews were conducted with recently graduated women civil engineering students. These were with women who had graduated within two years of leaving higher education with civil engineering degrees.

Eleven semi-structured interviews were conducted with women who had graduated with civil engineering degrees more than three years or were working as civil engineers. Three of these were telephone interviews.

Ten semi-structured interviews were conducted with male civil engineering students in the final year of a civil engineering degree.

6.4.2.2 CONTENT OF THE INTERVIEWS (WOMEN)

In all the cases the reasons for women choosing civil engineering were ascertained. Any influences of people on these choices were identified. A detailed discussion of the main points of these reasons have been covered in chapter two, section 2.8.

The emphasis of the interviews with the sixteen female final year students (both degree and HND students) was on the career decisions they were making to determine their career choices including what they were looking for in employment. Results of the interviews in this section are compared with the results of similar questions to ten male civil engineering students and can be found in chapter three, section 3.5.

In thirty two of the interviews with women their experiences at higher education were investigated. These were all the women students (sixteen degree and seven HND), and all the nine women who had graduated within two years. Any problems and difficulties encountered were isolated. For the sixteen final year women students (nine degree and seven HND) particular emphasis was placed on their experiences in relation to their career choice. Specifically, they were asked if they found that their experiences at higher education encouraged or discouraged their participation in civil engineering. The details of the discussions about the experiences in higher education can be found in chapter three, section 3.6.

All the women students were asked about their career expectations and all the women working in civil engineering were asked about their experiences. Particular emphasis was placed on their career histories, what they liked and disliked and any problems they had encountered or anticipated. The content of these interviews and its relevance to this thesis can be found in chapter four, section 4.6.

6.4.2.3 CONTENT OF THE INTERVIEWS (MEN)

The interviews with male civil engineering students concentrated on the career decisions they were making when leaving higher education using the interview sheet in appendix A as a guide. The interview content and its comparison with women civil engineering students can be found in chapter three, section 3.5.

6.4.3 DISCUSSIONS AND UNSTRUCTURED INTERVIEWS

According to Wright, "Unstructured interviewing tends to resemble conversation style with no set questions, following a broad outline of topics" (Wright, 1979, p51). Discussions and unstructured interviews took with people who had met for seminars and conferences. These conferences and seminars were usually concerned with women in construction, technology, or engineering. Small group discussions of up to five people, large group discussions and conversations were participated in and relevant points noted. Active participation in the discussion took place and in many cases the discussion could be brought round to women in civil engineering. Where a person-to-person conversation took place, the details were recorded after the discussion. These methods of extracting information yielded some interesting general points and meant that the issues significant in the lives of women in civil engineering could be explored and current research and thinking identified.

No formal format was used during these discussions but wherever possible, interesting or relevant points were often followed up by in-depth conversations. The following section discusses the attendance at these seminars and gives general details of their usefulness to the research project. As more experience was gained in using these techniques to gauge current thinking and issues, more focus on the themes of this thesis could be made.

6.4.3.1 PRE-QUESTIONNAIRE DESIGN DISCUSSIONS

The following outlines the discussions which took place in the initial stages of the research and identified the usefulness of these to the research.

(i) Women's Engineering Society Annual Conference, September 1990

Discussions with women engineers took place at this conference and helped establish a network of women willing to discuss the research project. Notes from the discussions on the papers and individual discussions with women engineers and scientists contributed to the depth of knowledge and gave an understanding of why women choose engineering and science together with discussions of experiences of women in engineering and science education and employment.

(ii) Gender and the Labour Market Seminars, Nuffield College, Oxford University, January-March 1991

These weekly seminars consisted of a paper being presented by well known academics specialising in gender and the labour market. Following this, discussions on the paper and other related subjects took place. Useful seminars included Susan McRae on returning to work after motherhood which discussed results from a national survey, Cynthia Cockburn whose paper focused on gender and equality and Cristel Lane who discussed the role of women in the labour market in Britain compared with women

in France and Germany. Useful data from these seminars yielded more reference sources and help to build up a network of contacts interested in this research. Reference to the work of McRae and Cockburn can be found in chapters two, three and four.

(iii) Women's Experience in Britain Today Course, May-July 1991

This course took place every week for one term. The course consisted of a lecture and seminar once a week where topics on the role of women in society were discussed. Relevant subjects to this thesis investigated in the course were the current position of women in education and the labour market. The literature and discussions on the role of women in education and the labour market provided many references used in the earlier part of this thesis.

(iv) Women in Technology Conference, Dublin, May 1991

Discussions at this conference contributed to the development of both the interview sheet and the questionnaire. The role of women in technology was discussed and personal histories examined. Women from academic institutions and business were represented. Current research interest in the topics of women in engineering and women in science were identified during many of the discussions.

(v) Ninth International Conference of Women Engineers and Scientists, Warwick, July 1991

This conference assisted in the consolidation of the first year's information and data gathering from the interviews. Four days of papers and discussions took place and thorough immersion in the subject of women in engineering, technology, science and construction was gained. These discussions helped focus some of the intended questions for the questionnaire especially where personal histories of women civil

engineers and women civil engineering students were recounted. A paper for this conference was written (see appendix G(i)) and referred to in the literature section of this thesis.

(vi) Study visit to the United States of America September 1991 - December 1991

Four month study visit to the USA took place during the initial investigations for the thesis. During the study visit advantage was taken of a number of activities which greatly benefited the research in that they provided additional depth and understanding to the study. The main activities and their relevant benefits to this research are listed below:

(vii) Women in Science Course at the Department of the History of Science, Harvard University, Cambridge, Massachusettes.

This course looked at the history of women's participation in science from the seventeenth century to the present day. It was mainly a discussion based course where set texts were studied and discussed. Examples of the topics discussed were: women in the scientific revolution which examined how women were involved in science in the pre-industrial revolution period; women and the professionalisation of science which explored how women managed to do science during and after the industrialisation period, including discussion of the exclusion of women from professional institutions; current debates on science as "masculine" and studies of theories which try to explain why women are not more active in science at present; women's education, including the development of an education curriculum with specific emphasis on the science curriculum. The above areas, together with other aspects of the course contributed to the discussions found in chapter two, specifically about the "masculine" image of science (see section 2.5.3.1).

(viii) Comparative Education Course in the Graduate School of Education at Harvard University.

This course explored aspects of modern education systems. These included organisation of education systems, curriculum development, expansion of education systems, equality in schools, administration, testing and exams, choice in education, and formal and informal education. The course examined these topics plus others in five countries - the United Kingdom, United States of America, Japan, Russia and Germany. Of particular relevance for this research were the investigation and comparisons of the education systems in the US and the UK.

(ix) Attendance at The Society of Women Engineers meeting at MIT, Boston.

From discussions at The Society of Women Engineers (student group) at Massachusetts Institute of Technology more detailed understanding of the experiences of women on engineering courses was gained. This acted as a check on the relevant literature discussed in chapter three where details of the experiences of women on courses is analyzed (see section 3.4).

(xi) Attendance at The Society of Women Engineers meeting at Northeastern University, Boston.

More detailed discussions on the experiences of women on courses where they are in a minority also contributed to a greater understanding of their situation.

(xii) Conducting interviews with women working in the Construction Industry.

Through a contact met at the Ninth International Conference of Women Engineers and Scientists held at Warwick University, July 1991, a network of contacts with American women was established. From these eight women were interviewed about their experiences of civil engineering as a career. All these women had more than five

years' experience, one ran her own company and another was a senior manager. These women gave interesting and useful accounts of the US construction industry. A paper was written incorporating some of this data (see appendix G(iii)) and referred to in the literature.

(xiv) Policy Analysis Forum: Women in Science Seminar, London, February 1992.

This research seminar focused on the relative lack of women in science education and was attended by academics interested in researching and promoting the role of women in science. Group and individual discussions at this seminar contributed to the development of the questionnaire and assisted in the focusing of the literature in chapter two.

(xv) Taste of Technology Residential course for sixth form girls, April 1992.

Participation in this course took place to examine the motives behind girls potentially choosing a career in engineering, science and technology. A pre and post questionnaire to the sixty students examined their attitudes towards engineering. Discussions with women managing the engineering workshops took place on their insights into women working in engineering together with many discussions with the sixth form participants. For more detailed information in the form of a conference paper written from the results of these questionnaires and referred to in the literature, see appendix G(iv).

(xvi) Research Seminars at the women lecturers' forum.

Research and discussions took place at regular intervals during the development of the questionnaire at the women lecturers' forum at Oxford Brookes University. Current research on topics relating to women plus research methodologies were discussed. Other related seminars attended during the development of the

questionnaire at Oxford Brookes University included: women in management seminar; social aspects of technology; opportunity 2000 seminar; seminar on the place of women's studies in the education curriculum.

(xvii) Discussions with experts in the research topics.

Telephone and individual discussions took place with a number of experts researching on women in construction. Regular contact and discussions took place with Andrew Gale and Angela Srivastava, both researchers in the field of women in building and construction. Current issues and research methodologies were often discussed. Many more discussions took place with academics throughout the UK.

(xviii) Tutoring for Civil Engineering and Building Courses.

For the duration of the thesis tutoring of civil engineering and building students took place. Behavioural observations and comments relevant to the research were noted. These assisted by providing a framework within which to understand the experiences of women on such courses.

The continued immersion in the research community via attendance at conferences and seminars took place after the development and administration of the questionnaire. The above details are given to indicate the extent of knowledge gained in order to formulate and design the national questionnaire.

6.5 PROBLEMS OF USING THE MULTI-FACETED APPROACH

There were many problems with using a multi-faceted approach to gathering data. This section considers some of the main problems in using this approach.

(i) Ensuring Consistency

It was hard to ensure consistency of information when using this approach. What tended to happen, if an adequate amount of control was not used, was that the respondent wandered onto other subjects. It was easy to ensure consistency with an interview sheet where questions were followed in an ordered format. However, it was not possible to ensure consistency during discussions and conversations. This is not a major problem since the main reason for recording information from interviews and discussions was to obtain additional background information, and therefore extracting information was more relevant than ensuring consistency.

(ii) Separating opinion and fact

In discussions and conversations, it was sometimes hard to separate the subjective opinions of the person from objective factual information. Attempts to clarify what was fact, ie what actually happened, and what was subjective opinion, ie what was believed, were made throughout the discussion and conversations. This was done by further discussions and clarifications with the respondent.

(iii) Time and Resources

There was not always enough time to follow up particular points during discussions because of the limited time available at conferences and seminars. Similarly, it was impossible to interview all the women met at conferences and through informal networks. In most cases, the interviews were set up so that they required the minimum of time and resources spent, for instance, on travelling but this also meant that limited numbers could be interviewed.

The main points elicited from interviews and discussions have been covered in chapters two, three and four and were used in the development of the formulation of the hypothesis as discussed in chapter five. The next section discusses the research methodology for the design,

administration and analysis of the questionnaire. Results of the questionnaire follow in subsequent chapters.

6.6 FORM OF QUESTIONNAIRE

In chapter five, the discussion focused on the formulation of the hypotheses for the four identified research problems. Following consultation with an expert statistician during the development of the questionnaire design, and after literature focusing on questionnaire design had been consulted (eg Oppenheim, 1976; Fowler, 1984; Bryman, 1988), the form of questionnaire was decided upon. Logically, the questionnaire for women progressed from background decisions, college experiences, and career expectations to factors influencing first job. The questionnaire for male students had only one section, that of factors influencing decisions to choose first job. It was decided, after consultations with questionnaire design experts and statisticians, that the form of questionnaire should start with the profile data. The questionnaire for women should follow the order of; profile data, background reasons for choosing civil engineering, college experiences, career expectations, and factors influencing choice of first employment. The questionnaire for the male students should follow the same order, omitting the sections for women only (ie without background reasons, college experiences and career expectations). A copy of both questionnaires can be found in appendix B. A brief discussion of the particular types of questions in each of part of the questionnaire follows.

6.6.1 PROFILE DATA

In order to discover differences between male and female civil engineering students or between groups of female civil engineering students, a series of profile questions were

devised. These are standard questions which aim to build up a picture of the student. Extensive profile data on male and female civil engineering students was included in the questionnaire which ranged from age, marital status, fathers' and mothers' occupations, schooling of the student to work experience during degree. Inclusion of such questions meant that useful comparisons could be made between the sexes or between groups of students of the same sex, and an indication could be gained of whether people from various groups, ie with the same educational background, answered the questions of the survey in the same way. Decisions about the types of profile questions to use were made during the development of the research problems. In order to test many of the hypotheses, profile information needed to be gathered. An example of this is when analyzing the background reasons for women choosing civil engineering, one of the hypotheses related fathers' occupations to decisions to choose civil engineering. The profile questions were both open-ended, for instance asking about qualifications to enter degree courses, and closed, such as asking the student to tick the relevant age group to which they belonged.

6.6.2 DATA COLLECTED FOR CAREER CHOICE OF WOMEN CIVIL ENGINEERING STUDENTS

In the development of the research problem, three sections testing different aspects of the career choice of women civil engineering students were included. These were background reasons for choosing civil engineering, the influence of college experiences on career choice and the influence of career expectations on career choice. A further section examining the different factors important to male and female civil engineers in choosing first employment was also included. To keep the questionnaire as simple and quick to answer as possible, and given the inclusion of extensive profile data, the same format for the three sections on the

career choice of women civil engineering students was decided upon. This led to the adoption of a common format using statements asking the respondent to answer on a scale from strongly agree to strongly disagree. For information on the use of these type of scales, see for example, Oppenheim, 1976 or Robson, 1983. Adoption of these scales meant that the student could respond to many questions in a short time, limiting the amount of time they spent answering the questionnaire, and also meant that all of the required statistical tests relevant to test the hypotheses could be used (refer to 6.11.2 for details). Another important reason for using these scales was the ease with which the data could be coded. Similar types of surveys have been helpful in suggesting the use of these scales, amongst other things such as questions, format and design (eg Coopers Union, 1989; IVL, 1989). The section in the questionnaire for male and female civil engineering students used to examine the importance of various factors in choosing first employment was a slight variation on the other parts of the questionnaire to women only where, instead of having to respond on a scale from strongly agree to strongly disagree, the scale chosen was very important to not important.

6.7 CONSTRAINTS ON THE SURVEY

There were many constraints on this survey. Attempts were made to minimise the impact of these on the survey at the beginning of the research. Nethertheless, the constraints listed below are part of the many problems that were considered when conducting a survey of this magnitude. The following section identifies some of the main constraints facing this survey.

6.7.1 TIME CONSTRAINTS

One of the chief aims of the survey was to establish what type of employment the male and female students were looking for. It was therefore important that the information collected

from the students came from the period at which the students were making decisions about their intended careers. The best time for this was in the final term of their final year. This was because the students would be leaving higher education and probably moving into the labour market. A detailed timetable was drawn up which included details of when to send questionnaires out and when to do follow-ups. A copy of this timetable can be found in appendix C.

6.7.2 FINANCIAL CONSTRAINTS

The costs of printing, postage and pre-paid envelopes were met by Oxford Brookes University's School of Construction and Earth Sciences, Civil Engineering and Building Division. Through its generosity, it was possible to conduct a national questionnaire. All telephone conversations, initial and follow-up, were met by the division's research fund. In order to keep the cost to a minimum, two actions were taken.

(i) . All telephone conversations were kept to a minimum amount of time, and as few made as possible.

(ii) Exact numbers of questionnaires were printed, to keep printing costs to a minimum.

6.7.3 DISTRIBUTION CONSTRAINTS

Because this research was relying on the goodwill of many people in institutions around the country, there were constraints placed on the questionnaire distribution. Instructions to institutions about the distribution of the questionnaires had to be easy to follow, and had to give the distributor the minimum of inconvenience. To ensure this, special sampling procedures were adopted (see section on sampling 6.8). The interest of the distributors in the research was one of the key factors in the success of the survey and therefore an ease of

distribution had to be ensured.

The next section in this chapter examines the sampling techniques adopted for this research.

6.8 SAMPLING

Part of any questionnaire design includes making decisions about whom to sample. Such decisions include determining who the respondents should be, and how many, and where the sample should come from. The research required a high number of responses if a reliable picture was to be obtained, and finding people to respond to the questionnaire became a major issue. The sections below discuss the decisions made about the choice of respondents and where these respondents came from.

6.8.1 SAMPLING PLACES

A decision had been taken to collect qualitative data by conducting a national survey incorporating all civil engineering courses at polytechnic, universities and, in a few cases, colleges of technology, in the UK. To find out which polytechnic and universities had civil engineering courses, literature on applying to university and polytechnic was consulted (PCAS Handbook, 1991; UCCA handbook, 1991). Where courses were combined with other subjects such as civil and structural engineering or civil and environmental engineering, a decision was made to include the course only if the course met the requirements of the Institution of Civil Engineers for an accredited civil engineering degree course. This seemed a sensible way of deciding which combined courses should be included on the list of institutions. However, it was decided that non-accredited pure civil engineering courses should be included in the survey since these courses were concerned only with civil engineering, and being non-accredited was not a sufficient reason to remove them from the

survey. Eventually, a list of institutions and their courses was compiled. From this information, actual numbers of final year female students were gained by direct contact with every civil engineering department at these institutions. The number of respondents varied in each institution, since some institutions had a high number of students on civil engineering courses and others had a low number. The process of collecting this information is described in more detail in the main survey section.

6.8.2 SAMPLING PEOPLE

Who to sample proved more problematic than which course to accept in the survey. The initial decision here was whether the sample should be female students only, or should include male students. Since one of the research problems discussed in chapter five concerned male civil engineers as well as female civil engineers, the problem was resolved.

Another question, which arose during decisions about sampling, was who should actually receive a questionnaire, ie which final year women civil engineers and which final year male civil engineers. Given that these two groups were of differing sizes, this question had to be addressed. It was calculated that there were approximately 335 final year women civil engineering degree students in the UK (these calculations were based on the initial telephone survey discussed in this chapter under the heading of the main survey, section 6.10). A national survey incorporating all these women was not an unrealistic proposition and it was therefore decided to survey the whole population. However, decisions relating to which male civil engineering students should receive a questionnaire were more complex. Clearly, it would have been impractical to survey the whole population, given that there were approximately 3,000 such students. In any case, the main focus of the survey was on final year women civil engineers.

In the end it was decided to send the questionnaire to all female students on the final year of civil engineering courses in the UK and an equivalent number of male civil engineering students at each institution, in the final year of their civil engineering degree courses. Therefore, the whole population of final year women civil engineering students in the UK were included in the study, making sampling procedures unnecessary for this part of the research. For the male questionnaire, a non-random sampling procedure was adopted and followed. The method used was systematic matching sampling (Dixon, 1987, p140). This allows the research to compare two groups of very different sizes whilst keeping the numbers of people surveyed in both groups the same. Matching the male students to the female students caused some problems. According to the literature, matching should occur in certain features that are deemed important to the consideration of the problem (Dixon, 1987, p140). However, while this process is fairly straightforward if the sample sizes are small, trying to match the characteristics of 335 male and female civil engineering students was unrealistic. It would have caused many problems, in particular there would have been major distribution problems if an attempt had been made to specify which male civil engineering students should receive a questionnaire by matching their characteristics to the characteristics of female civil engineering students. Therefore, instead of specifying matching features such as age, education and marital status, the only matching features chosen were that the sample of male civil engineers should be on the same course as the female civil engineers. There would obviously be limitations on drawing conclusions about the wider population from this sample of male civil engineering students. As Dixon put it "Technically, the conclusions drawn from a study of a non-random sample, are limited to that sample and cannot be used for generalizations" (Dixon, 1987, p140). However, this limitation does not apply to the questionnaire to final year female civil engineers and any analysis done on that questionnaire.

The limitations apply to the comparative analysis between the final year women civil engineers and the sample of final year male civil engineers.

6.9 PILOT STUDY

Three pilot studies were undertaken in sequence, to test whether the questionnaire could be understood by the intended respondents of the main survey. Sample respondents for the pilot studies were chosen because they represented exactly the intended respondents of the main survey, ie they were all final year civil engineering students about to complete their degrees. The three pilot studies were carried out on the following samples:

(i) Five female students in the final year of a civil engineering degree at a university department in the UK. All students were citizens of the UK.

(ii) Four female students in the final year of a civil engineering degree at a polytechnic in the UK. All students were citizens of the UK

(iii) Three male students on civil engineering courses at a polytechnic in the UK. One student was from overseas and the other two students were citizens of the UK.

In depth discussions with some of the pilot study respondents followed the completion of the pilot questionnaires. In most of the pilot studies the time to answer the questionnaire was noted.

The next sections examine the results of the pilot studies and discuss the changes made.

6.9.1 FIRST PILOT STUDY

The first pilot study was carried out on five students at a university in the UK. All students were female and undertaking the final part of their civil engineering degrees. The university was chosen for the following reasons;

(i) The contact at the university was interested in this research and was therefore keen to assist in contacting the students and encouraging them to take part.

(ii) There was ease of access by public transport to the university, minimising time taken to administer the questionnaire.

(iii) The sample represented exactly those women who were to be the subject of the main questionnaire survey in that they were all final year women civil engineering students.

Two methods of executing the pilot study were used. The first method used direct contact with two students in a controlled environment, and the second method relied on a contact in the civil engineering department distributing the questionnaire, and the students filling it in and returning it.

In the former case, the two students were asked to complete the questionnaires, only speaking when there was a query or a question in the questionnaire that they could not answer. Following this, there was a general discussion on the contents of the questionnaire, to pick up on individual questions which were too general or appeared ambiguous. The students were asked questions relating to content, length, type and format of the questionnaire. The students were also asked whether there was anything else which they thought should be included in the questionnaire, and for any general points that the student wanted to raise about the research.

In the latter case, three students received the questionnaire through the internal mail and were asked to send the pilot study back via a contact in the department, completed and with any comments. The latter method of piloting the questionnaire was used because not all students were available on that particular day and were, in any, case rarely all together at the same time.

The first pilot study yielded the following points about the questionnaire;

(i). The time taken to complete the questionnaire in the first case took eleven and a half minutes and in the second case fourteen minutes. The questionnaire had been designed to take between ten and fifteen minutes to complete.

(ii). The students did not have any difficulty understanding the questions and no problems occurred during its completion.

There were, however, a number of important points raised about the content of the questionnaire during the discussion and on the three returned questionnaires. These were as follows:

(i) "Civil engineering design" ought to be incorporated into the question asking about preferences of specialization in employment.

(ii) There should be a question about working overseas, since it was felt that many students consider acquiring overseas experience and a questionnaire about choices in employment should incorporate this.

(iii) There should be a question on the issue of computing. It was noted that one student felt strongly that she was at an initial disadvantage to the men on the course. She explained that almost all the men had some computing knowledge prior to the course and that most of the women on the course did not. A similar comment was made about technical drawing, although the student felt that this was not as much of a problem as the computing issue since technical drawing was perceived as an easier subject to master by the student.

(iv) The statement "location of organisation to family" was thought to be a bit ambiguous as "the family" could mean either parents or husband.

(v) The statement stating "having children" should be changed to "If I had children" since this would cover any women who were not intending ever to have children. One

student explained that she had no intention of having children and that the question implied that all women were likely to have children.

(vi) That the statement "I enjoy working on site" could not be answered by those who have never worked on site. This should be changed to "I would like to work on site at the beginning of my career" or something similar, so that women who have worked on site and those who have not can answer the question.

Overall, both of the students who completed the questionnaire by the direct method were happy with the content. They thought it was not too long. They also thought that it was simple to answer and the directions were straightforward. One student remarked that she was pleased that work was being carried out only on civil engineering students and felt that the questionnaire was particularly targeted towards civil engineering experiences.

Following the discussion, amendments to the questionnaire were made, taking into account the above comments. These amendments were as follows:

(i) A question about computing was added to the college experience section of the questionnaire to women.

(ii) The statement "having children" was changed to "If I had children".

(iii) The statement "I enjoy working on site" was changed to "I will enjoy working on site."

Consideration was given to the other points raised but it was decided to make no changes because of them. These decisions were made for the following reasons.

(i) "Civil engineering design" was not incorporated into the questionnaire as a specialization in employment. This was because it was felt that the question was trying to ascertain which particular area of specialisation the respondent prefers and that incorporating civil engineering design in a category by itself might cause

confusion, as it is an amalgamation of many of the specializations on the list.

(ii) It was felt that the query relating to overseas work had been covered in the section containing statements about important factors in choosing the first job.

(iii) The statement "location of organisation to family" was kept in the questionnaire and not changed. This decision was taken mainly because further discussions revealed that both students had taken the statement to mean the person or people that they regarded as closest to them; in both cases they were parents. This was how the question was intended to be answered and it was thought that the further pilot studies would reveal whether other students found the statement ambiguous.

After editing, the questionnaire was piloted on the second sample.

6.9.2 SECOND PILOT STUDY

The second pilot study was carried out on four students at a polytechnic in the UK. All students were female and undertaking the final part of their civil engineering degrees. The polytechnic was chosen for the following reasons:

(i) Ease of access.

(ii) The sample represented exactly the polytechnic population for the main survey.

(iii) A willingness on the part of the students to take part.

The procedure adopted for this pilot study was similar to the first pilot study. The students were asked to complete the questionnaire, asking questions only to clarify any ambiguities. Following this, there was a general discussion which lasted forty-five minutes about the content of the questionnaire and its objectives. Answering the questionnaire took between ten and fifteen minutes and produced many comments and points about the clarity of the questionnaire. Generally, the points raised fell into three main categories. These were:

(i) Checking understanding and meaning.

(ii) Asking that statements be made more realistic, so that the students were able to relate to them more easily.

(iii) Asking for extra statements which the students thought were particularly relevant to them.

A copy of all the points raised in the second pilot study and the solutions adopted can be found in appendix D. Examples of the types of comments and queries in the second pilot and the solutions adopted are:

(i) Checking understanding and meaning. One student was unclear what "socially useful" meant. After discussions, this was statement was removed from the section.

(ii) Asking that statements be made more realistic. The statement "I did not like arts subjects at school" was changed to " I was not good at arts subjects at school", as the students in the sample felt that this situation was a more usual reason for choosing to study science at school.

(iii) Asking for extra statements. To the phrase "type of work" an example was added, which was "eg working on site with a contractor". This made clear what was required.

The second pilot study produced some interesting results. The discussion was particularly useful since it helped clarify the main points and issues which the questionnaire was trying to explore. No amendments were made before the final pilot study of the questionnaire was undertaken. This was partly because many of the changes were for the "women only" part of the questionnaire, and also because it was expected that the third pilot study would not produce too many amendments in addition to the second pilot study.

6.9.3 THIRD PILOT STUDY

The third pilot study was distributed to three male civil engineering students at the same institution as respondents to the second pilot. It was felt that despite the questionnaire for female civil engineers having been piloted twice, some minor changes might be needed in the smaller questionnaire for the male sample. In addition to this, none of the questionnaires had been piloted on any international students and it was important that they should be able to understand and complete it because it was envisaged that they would take part in the survey.

As expected, the third pilot produced few changes. The questionnaire took between six and eight minutes to complete and the students had no problems answering the questions. In addition to repeating some of the comments from the second pilot study, the third pilot study discussion produced the following points:

(i) Some men answering the questionnaire might find the statement "percentage of women engineers in the organisation" quite "strange". This was the same for "child-care policies and programmes", although the students thought that it could be answered without much difficulty. Because of the type of analysis being carried out in this section of the questionnaire, it was decided that these statements had to be retained.

(ii) The overseas student thought that the section on education might be difficult to answer since some students might have international qualifications. However, he did think that the question "what entry qualifications did you have for your degree?" adequately covered this point.

Following the completion of all the amendments to the questionnaire, the main survey was prepared and carried out.

6.10 THE MAIN SURVEY

Before the questionnaire was sent out all the ground work had to be completed. This included contacting all the institutions whose civil engineering courses were deemed eligible for the survey. It was necessary to collect some information from the civil engineering departments before the questionnaire could be administered. All departments were asked three questions initially, and one further question. The three initial questions were:

(i) How many final year women students are there on a particular civil engineering degree course?

(ii) Who would be the best person to send the questionnaire to for distribution?

(iii) When did the summer term begin?

All the departments contacted provided answers to the above questions. The responses were generally helpful and gave enough information to go ahead with the next stage, sending the questionnaires. General responses to and any potential problems with these questions are listed below:

(i) To the question about the numbers of women on the identified courses, most institutions gave an immediate response. Providing actual numbers of women on the courses was not a problem for the institutions with few women students, ie up to about ten students. This was because the person contacted usually knew all the students personally. However, providing actual numbers of women students appeared to be a slight problem for some of the institutions where there were larger numbers of women students. This was because the contact had to examine various lists and in some cases an approximate number was given and usually later confirmed.

(ii) Answers to the question about who should be contacted were again straightforward. In some cases the question was referred to a particular member of the institution's

staff, usually the Head of Department or the final year tutor. In other cases, the administrator in the general office agreed to distribute the questionnaire. All persons contacted agreed to distribute the questionnaire. Some of the distributors agreed to distribute the questionnaire only after examining it.

(iii) The actual term beginning date varied. In most cases, the date given was the 27th April 1992; some institutions said that officially the term started on the 21st April 1992, but that since all contact with the students had ceased, the students would be seen only at about examination time. Some institutions gave slightly later dates.

Once the information on these questions had been answered, the research was explained to the person who was going to distribute the questionnaire. It was explained that there would be two questionnaires sent, one for male final year civil engineering students and one for female final year civil engineering students, and that these would have different coloured covers. The person who was going to distribute the questionnaire was then asked the following questions;

(i) How are the questionnaires likely to be distributed?

(ii) When is the most convenient time to send the questionnaires?

The answers to this question are recorded below;

(i) Various means of distributing the questionnaire were agreed between the researcher and the contact at the institution. The most common distribution means was that the distributor agreed personally to hand the questionnaire to the students. Some of the distributors agreed to place the questionnaire in the student's pigeon holes, and another one decided that the best means of reaching the students would be via a notice on the notice board. A recurring problem about distribution was the closeness of final

civil engineering examinations to the intended distribution dates of the questionnaire. Many contacts asked for the questionnaires to arrive for the beginning of the final term so that the questionnaire did not interfere with revision.

(ii) Most of the contacts said that they would prefer to receive the questionnaires in either the first or second week of term, in which case they could then automatically hand them out. The week before the beginning of term was not favoured by many, since preparations for the next term meant a heavy schedule.

Once all the preliminary work for administering the survey had been carried out, the main survey was administered to all those departments taking part in the survey. A copy of the letter sent with the questionnaires can be found in appendix E

6.11 RESPONSE RATE

Fowler stated that "there is no doubt that the problem of non-responses is central to the use of mail surveys.....if one simply mails questionnaires to the general population sample without appropriate follow-up procedures, the return rate is likely to be less than 30 per cent" (Fowler, 1984, p66). By response rate he means the calculation made to evaluate how successful the data collection has been. Generally it is expressed, as a percentage, of the number of people sampled, divided by the total number of people surveyed. In this research, the total number of people surveyed included all those students who had received a questionnaire. It did not include those institutions who returned the batch of questionnaires unanswered for any reason. This was the case in two of the institutions, one university, one (then) polytechnic, where all the questionnaires were returned without being distributed. In the first case, the contact felt that the questionnaires were too long for the students to complete during the examination period. Ten questionnaires to women and ten questionnaires

to men were returned. In the second case, the students were unable to be contacted since they had, in fact, completed the course and left the institution. Three questionnaires to women and three questionnaires to men were returned. Both these institutions were removed from the survey and their numbers were not included in the final response rate.

To ensure as high a response rate as possible, social survey procedures were followed (for instance, Dunsmuir and Williams, 1991; Wright, 1979; Bryman, 1988; Fowler, 1984). This meant, in this case, making follow-up telephone calls to find out, amongst other things, whether the questionnaires had been received and administered and whether they were being completed by the students and being returned.

6.11.1 FOLLOW-UP

The first follow-up occurred two weeks after the questionnaires had been sent out. Telephone calls were made to any institution from which no questionnaires had been returned. Enquiries were made in order to establish whether they had been received and distributed. Some problems arose at this stage. These were:

(i) Contacts in some universities were unable to deliver the questionnaires to the students. Particular incidents occurred because students were not seen personally after the Easter vacation, and came into the university only for individual tuition and examinations.

(ii) The questionnaires had been passed onto another person for distribution.

(iii) In the larger universities, in particular, distribution was never guaranteed. In fact, in one university distribution was reliant on a message on the general notice board informing the students of the research and asking them to collect a questionnaire.

(iv) One university had miscounted the actual numbers of women on the course, and returned some questionnaires after the follow-up telephone call.

Subsequent follow-ups revealed more distribution problems. These again were primarily to do with the distribution of the questionnaires during the examination period. The total number of undistributed questionnaires returned was 24 questionnaires intended for women and 24 questionnaires intended for men.

Because of some distribution problems, it was suggested that all questionnaires not reaching the students should be returned and they were then removed from the survey.

The response rates for each institution were monitored and more follow-up telephone calls were made as and when necessary.

The following table summarises the response rates.

TABLE 6.1 RESPONSE RATES TO THE QUESTIONNAIRE

response rate	male respondents			female respondents		
percentage	no of male q'naires	Total number of q'naires	no of institutions	no of female q'naires	total number of q'naires	number of institutions
100	41	41	13	33	33	9
75-99	68	86	14	48	61	9
51-74	16	26	5	34	54	9
50	20	40	7	35	70	14
26-49	15	44	5	10	31	5
1-25	7	48	5	6	42	4
0	0	26	6	0	20	5
totals	167	311	55	166	311	55

Table 6.1 shows

(i) Response rate band. The bands were decided after all the questionnaires had been

returned and an analysis carried out.

(ii) The total number of questionnaire returns, in actual numbers, for male and female respondents.

(iii) How many questionnaires, in actual numbers, this accounted for.

(iv) The number of institutions returning the questionnaire in each response rate bracket.

In can be seen that the majority of institutions (39 out of 55 for male, and 41 out of 55 for female) had response rates above 50%. However, the total response rate for the whole questionnaire was 53.7% for the male questionnaire and 53.4% for the female questionnaire. This is because there were some institutions which accounted for a high number of questionnaires, for instance in the male questionnaires five institutions accounted for forty eight questionnaires, an average of 9.6 questionnaires per institution. Their response rates fell into the band 1-25%. By contrast, in the 100% response rate band, 13 institutions accounted for 41 questionnaires, an average of 3.1 questionnaires per institution.

As mentioned earlier, the larger institutions found it more difficult to control and monitor questionnaire distribution. This partly accounts for the lower response rates amongst the universities with a high number of female students.

Another point worth mentioning is that there were four institutions from which no questionnaires were received back from either male or female respondents. There are many reasons which could explain this, but the most likely are listed below

(i) There were problems with follow-up telephone calls, usually because the contact was unavailable, making it hard to check on the distribution of the questionnaires

(ii) The questionnaires were passed onto several people before distribution and may have not been distributed.

(iii) The students had received the questionnaires late and found that they did not have enough time before their examinations to complete them.

Generally, the overall response rate for the male and female questionnaires was good. It is hard to see what other precautions could have been taken to ensure a higher response rate, especially since the procedures adopted followed those set out in social science survey literature (for instance Bryman, 1988; Phillips and Orenstein, 1978).

6.11.2 NON-RESPONSES

Some amount of bias in the results cannot be denied in questionnaire surveys. Fowler suggested that "...samples of data resulting from returns of 20 or 30 per cent, which are not uncommon for mail surveys that are not followed up effectively, usually look nothing at all like the sampled population"(Fowler, 1984, p49). However, this survey produced overall response rates of 53.7% for the male questionnaire and 53.4% for the female questionnaire. Given these response rates it is clear that some useful conclusions can be drawn from the data collected. The next sections in this chapter discuss the methods of data coding and analysis carried out after the questionnaires had been returned.

6.12 CODING

Coding instructions in questionnaire surveys can take either of two forms; numerical form or alphabetic form (Frude, 1992, p13). According to Frude, the particular statistical package chosen to analyze the results of this research survey, SPSS/PC+, could handle only a small amount of alphabetic data (Frude, 1992, p13). Therefore, to make the analysis of the survey results straightforward, all the coding instructions for this survey were numerical, and, to

further simplify the process, all the data were integer, ie contained no decimal points. Some of the data, for instance age and number of job applications, were collected in numerical form. Other data, such as sex and marital status were collected in categorical form and coded numerically, for example, one was the code for female and two was the code for male. Other data was collected in written form and categories devised and allocated a code.

An example of the coding instructions for the question "did you consider any other degree courses?" were as follows:

0 no other courses considered or courses unspecified
1 only other engineering courses considered
2 building-related courses considered excluding architecture
3 only architecture considered
4 only pure maths or pure science considered
5 arts subjects such as law, history and geography considered
6 only maths related courses considered
7 combination of building, engineering, science, or technology considered
8 other combinations considered

Decisions about what subject should be coded in which category were made after all the questionnaires were returned and an understanding of the range of answers gained.

For a full listing of the coding instructions and codes used see appendix F

The same coding instructions were applied to each respondent from either sex and the positioning of each code for each variable was the same for each respondent. For answers to the questions asking the respondent to choose an answer from "strongly agree" through to "strongly disagree", the questions were already coded. That is to say, that the respondent had to choose from one through to five, where one equalled "strongly agree" to five equalled "strongly disagree".

For respondents who failed to return questionnaires with all the answers complete, another strategy was adopted. The data were treated as missing and either given a code of their own, (eg marital status unspecified was coded 0), or else it was allocated to "no or unspecified",

and given that particular code, usually zero. In the latter case, a decision was made about the code depending upon the individual question and the usefulness of a "no" answer. Thus, for the example above, relating to consideration of other courses, it was felt that the most useful category for an unspecified answer should be within the category labelled "no other courses or courses unspecified".

Once the coding instructions were decided upon, each questionnaire was coded and the information typed into the computer. For the questionnaire put to women there were five rows per case. For the questionnaire put to men there were three rows per case, since there was no data collected on their background reasons for choosing civil engineering, college experiences or career expectations. For the part of the analysis requiring the comparative study of men and women, there were three rows per case; the last two rows containing the information on background reasons for choosing civil engineering, college experiences and career expectations were removed from the dataset (ie matrix of codes) of the questionnaire to women. Each variable, now in the form of codes, for every case (ie respondent) was presented in the same position, on the same row, for each case. Thus, columns one, two and three, row one, held the subject number for both the male and female questionnaire; column nineteen, row one, contained the codes relating to the question of whether the respondent's father was an engineer or not. Three data sets were created, one containing the data set of women only, one containing the data set of men only, and one containing the data set of both men and women. Therefore, after the coding instructions had been determined and the questionnaires coded, there were three files to use in the analysis.

6.13 ANALYSIS

Quantitative data were collected, and this type of data lends itself to detailed statistical

analysis. Two expert statisticians familiar with computer statistics packages designed to analyze questionnaires were consulted, together with literature on questionnaire design and analysis (eg, Frude, 1992; Siegal, 1988; Leach, 1979). The most user-friendly package appeared to be the Statistical Package for the Social Sciences, microcomputer version (SPSS/PC+). The university mainframe had this package installed, and familiarity with it was gained during a statistics course. SPSS/PC+ was also chosen for the following reasons:

(i) The package was menu-based and had built-in explanations about the types of tests and their use.

(ii) Many members of the university staff were familiar with the package and could offer advice and help.

(iii) Data entry and manipulation data (eg merging codes and adding variables) were easy to perform.

(iv) The package contained all the tests that needed to be carried out.

The tests used in the research are discussed in 6.11.2. The next section discusses the convention used when testing the hypothesis. Subsequent section discuss the types of scales and statistical tests used in the design and analysis of the questionnaire.

6.13.1 HYPOTHESIS TESTING

When making conclusions about the hypotheses, decisions about the conventional terms to use were made. It became clear that there was no consensus in the literature as to how to describe the conclusions in relation to the testing of the hypotheses. Some researchers use the terms "support", some use the terms "accept or reject" and others use "confirm or disconfirm". Thus, for example, Weirsma states that "The testing of the hypothesis does not prove or disprove the hypothesis, it merely sustains or rejects the hypothesis." (Weirsma,

1969, p20), whereas Novick and Johnson who suggest that "If the data do not lead one to reject a hypothesis (at some chosen significance level), one "accepts" it" (Novick & Johnson, 1974, p244). Van Dalen argues that the final step to hypothesis testing is "collecting facts that will either support or not support the hypothesis" (Van Dalen, 1979, p203) and goes on to say that "Empirical support merely confirms, strengthens, or substantiates the hypothesis; it does not *prove* something is absolutely true for all time" (Van Dalen, 1979, p209). Furthermore he provides a framework for drawing conclusions about the hypotheses which is "...If H1 [the research hypothesis] is true, then the facts are observable; empirical tests reveal that these facts are or are not observable; therefore the conclusion can be drawn that H1 is confirmed or disconfirmed" (Van Dalen, 1979, p224). From the literature, there appears to be no one set of conventional terms to use when drawing conclusions about the hypothesis. In this thesis the terms used by Van Dalen will be adopted, which are that evidence from the empirical data collected in this thesis either confirms or disconfirms (or neither confirms or disconfirms) the hypothesis. Discussions and conclusions about the hypotheses tested in this thesis can be found in chapter eleven.

6.13.2 TYPE OF SCALES

The types of tests that are appropriate for the analysis of the results depends largely upon the types of measurement used in the collection of the data. This section describes the types of measurements that were in the final questionnaires in this research.

6.13.2.1 NOMINAL OR CATEGORICAL SCALES

Siegels provides a clear and concise definition of these scales, which is that they are "...measurement at its weakest level exists when numbers or other symbols are used simply

to classify an object, person or characteristic" (Siegel, 1988, p23). Extensive use of these scales was made in the questionnaires, for instance in the questions on age, marital status, nationality amongst others.

6.13.2.2 ORDINAL OR RANKING SCALES

The definition, according to Siegel, of these scales is that "...the objects in one category of a scale are not only different from the objects in other categories of that scale but also stand in some kind of *relation* to them. Typical relations among classes are: higher, more preferred, more difficult, more disturbed, more mature etc" (Siegel, 1988, p25). In this research, all the results on the statements asking respondents to answer on a scale of one to five, from strongly agree to strongly disagree are classed as ordinal or ranking scales.

6.13.3 USE OF APPROPRIATE STATISTICAL TESTS

For the analysis of the data, the initial investigation of appropriate techniques to be used focused on whether to use Parametric or Non-Parametric tests. After consultations with expert statisticians, it was decided that the use of non-parametric statistical tests were more appropriate for the analysis of the questionnaire designed in this research. This was because according to Siegel and others, non-parametric tests make fewer assumptions about the data (Siegal, 1988, p45; Kerlinger, 1970, p257; Leach , 1979, p34; Bryman and Cramer, 1990, p115; amongst others). Parametric statistics, on the other hand,"...make a large number of assumptions regarding the nature of the underlying population distribution" (Leach, 1979, p34). Leach went on to suggest that "...parametric techniques will only be strictly valid if the population frequency distribution has a particular shape. By their very nature, such assumptions are frequently untestable, so in using parametric techniques of data analysis we

are taking a gamble" (Leach, 1979, p45). Another reason for choosing non-parametric techniques is because much of the data of the questionnaires used in this research was collected and coded in categorical form. Rowntree suggested that "...the idea of a normal distribution is inappropriate for category data" (Rowntree, 1981, p124). This was confirmed by Siegel who stated that "Nonparametric methods are available to treat data which are simply classificatory or categorical,...No parametric techniques apply to such data" (Siegel, 1988, p35).

Siegel also suggested that "with ordinal scaling, hypotheses can be tested using that large group of nonparametric statistical tests which are sometimes called ranking statistics or ordered statistics" (Siegel, 1988, p27).

Finally, it seemed, after examining the literature and discussing the choice of the use of these two techniques with two expert statisticians, that the non-parametric methods of data analysis were more appropriate for the types of testing of the results required. Leach summed this up when he stated that "...non-parametric procedures often test different hypotheses about the population than do parametric procedures" (Leach, 1988, p34).

6.13.3.1 ANALYSIS OF THE RESULTS - TYPE OF TESTS

Both descriptive statistics, ie statistics used to describe the data, and inferential statistics, ie statistics used to draw conclusions about the data, were used. Where inferential statistics, such as Chi-squared, Mann-Whitney and other tests were used, a 5 per cent probability criterion was used. According to Frude, and statisticians consulted during this research, this is the common criterion, with a data base of the size used in this research, for deciding whether a result is significant or likely to have occurred by mere chance (Frude, 1992, p66).

Following extensive consultations with two statisticians, the types of tests were decided upon.

The statistical tests which were carried out fell into the following categories.

1. **Frequencies** and **Crosstabulations** were used for information on the profile data for both the male and female samples. The frequency distributions for each variable were calculated together with occasional other statistics such as mean, mode, median and standard deviations where necessary.

   Crosstabulations (crosstabs) were used when frequencies of a number of variables were needed. So, for instance, crosstabs of the numbers of males and numbers of females attending different types of school were listed.

2. To test the significance of the differences between two or more samples when the responses in the data were in a categorical form, **Chi-square** tests were used. Chi-squared tests were used on male and female differences in categorical measures, eg categories of variables such as age, marital status, nationality etc, or where a test for significance was required of the same sex but between those women who had attended different types of school and say, whether the respondent's father was an engineer. When using Chi-squared tests, the minimum expected frequency should not be less than five, since, according to Frude "...some statisticians would doubt the validity of the chi-square statistic obtained" (Frude, 1992, p68).

3. To test whether two independent groups have been drawn from populations with the same medians, where the data is in ordinal measurement, the **Mann-Whitney test** was used. So, for example, the test could see whether there was a significant difference between male and female engineers and their responses to the various questions about the level of importance of some factors in choosing their first employment, such as salary.

4 The **Kruskall-Wallis** test was used to compare the medians of more than two groups.

This test was used to see whether there was a significant difference in the responses of more than two groups to questions on an ordinal scale. In this research it was used to test whether there was a significant difference in the responses of women entering various different sectors of industry and their responses to questions of career expectations.

5 The **Kendall Rank-Order Correlation Coefficient** was used to measure the correlation, or in other words the association, between two variables where both variables were in ordinal measurement (eg questions on background decisions to choose civil engineering). According to Rowntree, and others, the rank correlations coefficients are used when the data are in ranked form, the closer the relationship between the rankings, the bigger the correlation coefficient (Rowntree, 1981, p163). Thus the coefficient expresses the degree to which pairs of variables are associated (Frude, 1992, p109). In this research the test was used to check the measure of association between the responses to questions, all of which were are termed ordinal, ordered or ranked measurement (as described in section 6.13.2.2), in the parts of the questionnaire dealing with background reasons for choosing civil engineering, college experiences and career expectations. Correlation can be either negative or positive. According to Frude "a high value of one variable tends to be associated with a high value of the other variable and that a low value of one variable tends to be associated with a low value of another variable" (Frude, 1992, p109). He suggests that a negative correlation means that the high values of one variable tend to be associated with low values of other variables (Frude, 1992, p109). Labels are often attached to correlation coefficients. For this research, the labels supplied by Rowntree are used which are;

0.0 to 0.2 very weak, negligible
0.2 to 0.4 weak, low
0.4 to 0.7 moderate
0.7 to 0.9 strong, high, marked
0.9 to 1.0 very strong, very high (Rowntree, 1981, p170)

After consultation with statisticians, it was decided that any significant correlations, however weak, should be reported if they provide additional important information.

6. The **confidence level** in this thesis is 95%. The confidence level is equal to 100(1-alpha)% where alpha is the significance level (Excell Function Reference, 1992, p61). As previously discussed, throughout this thesis a conventional significance level of 0.05 was used (hence making the confidence level 95%). According to Healey "...using the 95% confidence level, means that over the long run the researcher is willing to be wrong only 5% of the time" (Healey, 1990, p129). A 95% confidence level was used in the statistical tests in this research where a conventional 0.05 significance level was used (see section 6.13.3.1 for a justification of the significance level used). Significant level results less than $5x10^{-5}$ are recorded as zero.

6.14 CONCLUSIONS

In this chapter the research methodology used for the main questionnaire survey was reviewed. Justifications for the type of methodology chosen were made and a discussion of the response rates and the types of statistical analysis used were presented. The next chapters in this research present the results of the statistical analysis of replies to the questionnaires. Chapter seven describes the profile data of male and female civil engineering students and then discusses the results of the questionnaire, analyzing the background reasons why women choose to study civil engineering. Chapter eight discusses the results of the questionnaire, analyzing the differences in career choices made by male and female civil engineering degree

students leaving higher education. Chapter nine discusses the results of the questionnaire, analyzing the relationship between college experiences and choice of career. Chapter ten discusses the results of the questionnaire, analyzing the relationship between career expectations of women civil engineers and career choice. Chapter eleven draws final conclusions from the main findings from the analysis of the hypothesis and chapter twelve discusses the conclusions to the thesis in relation to the objectives. It assesses the wider implications of the research and suggests possible further research projects.

CHAPTER SEVEN

THE BACKGROUND OF FINAL YEAR MALE AND FEMALE CIVIL ENGINEERING STUDENTS

7.1 INTRODUCTION

The last chapter examined the research methodology for this research. It explained how the questionnaire was designed, implemented and analyzed. The next chapters in this thesis analyze the results of the questionnaires in order to test the hypotheses for the four research problems developed in chapter five. Before these hypotheses can be tested, the results of the background profiles of both male and female civil engineering students need to be presented, and this is done in this section, because, much of the later tests of the hypotheses use these background results. This section details the background results for male and female civil engineering students who answered the questionnaires. Most of these results are purely descriptive, ie frequencies and cross-tabulations, and aim to establish the profiles of the male and female respondents of the questionnaire survey in relation to their background (eg type of school attended, parents' occupations etc). Following each table, a commentary on the results is given. Statistical tests were carried out on these results and where there were significant differences between the male and female respondents, these results are reported. Once these results have been presented and discussed, the remainder of the chapter is concerned with the testing of the first research problem, as identified in chapter five, which examines the background reasons for women choosing civil engineering.

7.2 BACKGROUND OF MALE AND FEMALE CIVIL ENGINEERS

The following tables and discussion present the results of the analysis of questionnaire data

on the backgrounds of male and female civil engineering students answering the questionnaire survey.

As stated in 6.9.1, of the returned questionnaires, 167 were returned by final year male civil engineers and 166 were returned by final year female civil engineers. These were returned from 55 universities, polytechnics and colleges where civil engineering as a degree course was studied.

Table 7.1 shows the age of female and male final year civil engineering students.

TABLE 7.1 AGE OF FEMALE AND MALE RESPONDENTS

sex	18-21 yrs (%)	22-25 yrs (%)	26-30 yrs (%)	over 30 (%)	total (N)
female	42.8	50.6	6.0	0.6	166
male	32.3	58.1	6.0	3.6	167

Table 7.1 shows the average age bands of male and female respondents. As can be seen, the majority of both male and female respondents are between the ages of 22-25 (50.6% , N=84 female, 58.1%, N=97, male). At the completion of their degrees, there are slightly more males than females aged 26 and over [female 6.6% (N=11), males 9.6% (N=16)]. The marital status of the respondents is presented in the next table.

TABLE 7.2 MARITAL STATUS OF MALE AND FEMALE RESPONDENTS

sex	married (%)	separated (%)	single (%)	total (N)
female	6.6	0.6	92.8	166
male	7.6	1.8	90.4	167

Examining Table 7.2 it can be seen that almost all of the respondents of the sample were single when they had completed their degree (female 92.8%, N=154, male 90.4%, N=150).

Few were married and fewer still separated or divorced. This is unsurprising given the general age of the respondents as presented in Table 7.2

TABLE 7.3 COUNTRY OF CITIZENSHIP

sex	United Kingdom (%)	Europe (%)	others (%)	total (N)
female	84.8	3.6	11.6	166
male	89.8	4.2	6.0	167

Table 7.3 shows that most of the respondents are citizens of the UK (female 84.8%, N=140, male 89.8%, N=150). The main countries represented in the "other" category were from South East Asia (Hong Kong, Singapore, Malaysia, Taiwan) where females accounted for 7.3% (N=12) and males accounted for 2.4% (N=4). The next few tables examine the family occupations of the respondents to the questionnaire, including the socio-economic status of both mothers and fathers of the respondents.

TABLE 7.4 SOCIO-ECONOMIC STATUS OF THE MOTHERS OF THE MALE AND FEMALE RESPONDENTS

sex	unemployed (%)	professional (%)	managerial (%)	housewife (%)	skilled (%)	partly skilled (%)	unskilled (%)	N
Female	0.6	6.9	38.4	25.2	22.0	4.4	2.5	159
Male	0.0	3.9	39.2	22.9	24.8	8.5	0.7	153

Examining Table 7.4, it can be seen that there are some small differences in the socio-economic status of mothers of male and female civil engineering students. Slightly more mothers of female civil engineers are in the professional category (female 6.9%, N=11; males 3.9%, N=6). Similarly slightly more mothers of female civil engineers are housewives

(females 25.2%, N=40; males 22.9%, N=35). However, the category with the highest percentages, the managerial category, has virtually the same percentages for males and female civil engineering students (females 38.4%, N=61; males 39.2%, N=60).

TABLE 7.5 MOTHER OF MALE AND FEMALE CIVIL ENGINEERS WORKING AS ENGINEERS OR BUILDING-RELATED PROFESSIONS

sex	YES (%)	NO (%)	N
female	2.6	97.4	154
male	0.7	99.3	153

Table 7.5 shows that for almost all respondents the mothers are not employed as engineers or in building-related professions such as architects, town planners or surveyors (females 97.4%, N=150, males 99.3%, N=152).

TABLE 7.6 SOCIO-ECONOMIC STATUS OF THE FATHERS OF THE RESPONDENTS

sex	unemployed (%)	professional (%)	managerial (%)	housewife (%)	skilled (%)	partly skilled (%)	unskilled (%)	N
Female	3.2	58.4	27.3	0.0	10.4	0.6	0.0	154
Male	0.0	29.7	57.4	0.0	12.3	0.6	0.0	155

Table 7.6 shows that many more fathers of female civil engineers than male engineers are employed in professional employment (eg accountant, engineer, lawyer) (females; 58.4%, N=90; males, 29.7%, N=46). The table also shows that many more fathers of male civil engineers than of female civil engineers are employed in the managerial employment category (eg teacher, manager, farmer) (males 57.4%, N=89; females 27.3%, N=42). A chi^2 test of significance of difference was carried out on the socio-economic status of fathers of male

and female civil engineers in categories professional, managerial or skilled. This revealed that there was a significant difference between the socio-economic status of the fathers of male and female civil engineers ($chi^2 = 0.0000$). The fathers of female civil engineers were significantly more likely to be employed in a professional capacity, whereas the fathers of male civil engineers were significantly more likely to be employed in a managerial capacity.

Table 7.7 NUMBER OF FATHERS OF THE RESPONDENTS WHO ARE ENGINEERS OR IN BUILDING-RELATED PROFESSIONS

sex	engineering father (%)	not an engineering father (%)	father in building-related professions (%)	total (N)
female	36.7	51.1	12.2	147
male	20.8	66.4	12.8	149

Table 7.7 shows that the fathers of female civil engineers are more likely than the fathers of male civil engineers to be employed as engineers (females 36.7%, N=54, males 20.8%, N=31). The table also shows that a similar percentage of male and female civil engineering students have fathers employed in building-related professions such as quantity surveying, town planning, building, bricklaying etc (females 12.2%, N=18, males 12.8%, N=19). A chi^2 test on the results showed there was a significant difference between the male and female civil engineers in whether their fathers were engineers or not (chi^2 sig=0.00845). Examining Table 7.7, female civil engineers were significantly more likely than male civil engineers to have fathers who were engineers.

TABLE 7.8 PERCENTAGE OF RESPONDENTS WITH A BROTHER AS AN ENGINEER OR IN A BUILDING-RELATED PROFESSION (OF THOSE WHO HAVE BROTHERS).

sex	engineering brother or building-related profession (%)	not an engineering brother (%)	total (N)
female	37.1	62.9	108
male	18.4	81.6	102

Table 7.8 shows that a much higher percentage of female civil engineers than male engineers had brothers who were either engineers or in building-related professions (females 37.1%, N=40, male 18.4%, N=18). A chi^2 test on the results showed that women were significantly more likely to have brothers who were in engineering or a building-related profession (chi^2 = 0.03261).

TABLE 7.9 PERCENTAGE OF RESPONDENTS WITH A SISTER IN ENGINEERING OR BUILDING-RELATED PROFESSIONS

sex	engineering sister or building-related profession (%)	not an engineering sister (%)	total (N)
female	7.5	92.5	94
male	2.0	98.0	101

Table 7.9 shows that slightly more female civil engineers than male civil engineers have sisters who are in engineering or building-related professions (females 7.5%, N=8, males 2 0%, N=2), although most respondents do not have sisters in these professions. The next few tables examine the factors such as school attended and qualifications gained.

TABLE 7.10 TYPE OF SECONDARY SCHOOL ATTENDED

sex	state single sex (%)	private single sex (%)	state mixed (%)	private mixed (%)	other	total (N)
female	19.3	20.5	56.6	3.6	0.0	166
male	16.8	16.8	59.3	5.4	1.2	167

Table 7.10 shows that the majority of both male and female civil engineers went to state mixed schools (females 56.6%, N=94; males 59.3%, N=99). There were a few differences in the results where it seemed that women civil engineers were slightly more likely than male civil engineers to attend private single sex schools (females 20.5%, N=34, males 16.8%, N=28). The other category contains those respondents who said either that they frequently changed schools, or that they attended a European school.

TABLE 7.11 SCHOOL CHANGE AFTER GCSE/O LEVELS

sex	no change (%)	sixth form college (%)	college of further education (%)	changed other (%)	Total (N)
female	60.2	15.7	13.3	10.0	166
male	63.5	11.4	16.8	8.3	167

Table 7.11 shows that more male than female civil engineering students changed school to attend a college of further education (male 16.8%, N=28, female 13.3%, N=22), and more female civil engineers than male civil engineers changed school to attend a sixth form college (females 15.7%, N=26, males 11.4%, N=19).

TABLE 7.12 ENTRY QUALIFICATIONS FOR A DEGREE IN CIVIL ENGINEERING

sex	A levels or Scottish higher (%)	BTEC HND, HNC or equivalent (%)	Others (unspecified/ international) (%)	Total (N)
female	77.1	17.5	5.4	166
male	77.9	18.5	3.6	167

Table 7.12 shows that the majority of male and female civil engineers enter the civil engineering course with A level or Scottish higher qualifications (females 77.1%, N=128, males 77.9%, N=130). Almost equivalent percentages of male and female civil engineers entered a civil engineering degree with BTEC qualifications (females 17.5%, N=29, males 18.5%, N=31).

TABLE 7.13 A LEVEL MATHEMATICS AT ENTRY, WITH GRADES.

sex	No A level in maths or unspecified grade (%)	A grade in maths A level (%)	B grade in maths A level (%)	C grade in maths A level (%)	D grade in maths A level (%)	E grade in maths A level (%)	F grade in maths A level (%)	Number
female	25.3	16.9	22.9	12.7	12.0	9.6	0.6	166
male	32.9	13.2	14.4	15.0	9.6	15.0	0.0	167

Table 7.13 shows that more males than females on civil engineering courses had no A level in maths or did not specify a grade (females 25.3%, N=44, males 32.9%, N=55). The table also shows that more females than males had high grade A levels (A and B grades) in mathematics (females A grade 16.9%, N=28, males A grade 13.2%, N=22; females B grade 22.9%, N=38 males B grade 14.4%, N=24).

TABLE 7.14 A LEVEL PHYSICS AT ENTRY, WITH GRADES.

sex	No A level in physics or unspecified grade (%)	A grade in physics A level (%)	B grade in physics A level (%)	C grade in physics A level (%)	D grade in physics A level (%)	E grade in physics A level (%)	F grade in physics A level (%)	Number
Female	30.1	10.2	18.7	16.3	10.8	9.6	4.2	166
Male	34.1	7.8	15.0	15.6	16.2	11.4	0.0	167

Table 7.14 shows that fewer female than male civil engineers had no A level physics (or did not specify a grade) when entering civil engineering as a degree course (females 30.1%, N=50, males 34.1%, N=55). However, more women than men appeared to have slightly higher grades at A level physics (females A grade 10.2%, N=17, males A grade 7.8%, N=13; females B grade 18.7%, N=31; males B grade 15.0%, N=25)

TABLE 7.15 MALE AND FEMALE RESPONDENTS WHO CONSIDERED OTHER DEGREE COURSES

sex	did consider other courses (%)	did not consider other courses (%)	Total (N)
female	50.0	50.0	166
male	62.3	37.7	167

Table 7.15 shows that more men than women considered courses other than civil engineering (females 50.0%, N=83, males 62.3%, N=104). Of those considering other courses, the most usual courses were other engineering courses (females 13.9%, N=23, males 13.8%, N=23). Building-related or architecture courses were considered by 6.6% of females (N=11) and 6.6% of males (N =11). A combination of other courses were considered by the other respondents, including arts courses, law, business,etc. A chi^2 test on the results showed that there were significant differences between male and female civil engineers in their consideration of other degree courses (chi^2 sig=0.02399). Male civil engineers were

significantly more likely than female civil engineers to have considered courses other than civil engineering.

TABLE 7.16 SPONSORSHIP OF RESPONDENTS DURING DEGREE

sex	No sponsorship	sponsored by a contractor	sponsored by a consultant	sponsored by a local authority	Other	N
female	72.3	7.8	7.8	4.8	7.3	166
male	70.7	13.8	7.8	2.4	5.3	167

Table 7.16 shows that more male civil engineers than female civil engineers are sponsored by contractors such as Laings or Tarmac (females 7.8%, N=13; males 13.8%, N=23) and that a higher percentage of females are sponsored by local authorities (females 4.8%, N=8, males 2.4%, N=4). Sponsorship in the "other" category included sponsorship by the army, an overseas government, British Rail, or Utilities. Generally, slightly more males than females are sponsored during their degree courses (females 27.7%, N=46; males 29.3%, N=49).

TABLE 7.17 SOCIETY MEMBERSHIP

Sex	No membership (%)	Institution of Civil Engineers only (%)	Institution of Structural engineers only (%)	Membership of both institutions (%)	Others (%)	Total (N)
female	25.3	39.8	8.4	23.5	3.0	166
male	28.7	43.1	1.2	23.4	3.6	167

Table 7.17 shows that the most usual society for male and female civil engineering students to belong to is the Institution of Civil Engineers. Almost a quarter of male and female civil engineers belonged to both the Institution of Civil Engineers and the Institution of Structural

Engineers

The following table presents the results of the question examining the type of work experience relevant to their civil engineering degree that final year male and female civil engineering students had during or before their course. Because some students had more than one type of work experience, the work experience of the longest duration was recorded.

TABLE 7.18 WORK EXPERIENCE

sex	no work experience (%)	local authority(%)	contractor (%)	Utilities (gas and water) and British Rail (%)	technician /civil engineering office, no sector specified (%)	consultancy (%)	site work no sector specified (%)	others (%)	N
Female	15.1	11.4	26.5	6.0	6.6	27.7	5.4	1.2	166
Male	13.2	11.4	37.1	2.4	2.4	22.2	10.2	1.2	167

Table 7.18 shows that the most common work experience for men was working with a contractor and the most common work experience for women was working with a consultancy (contractor female 26.5%, N=44, male 37.1%, N=62; consultancy female 27.7%, N=46, male 22.2%, N=37). The next most common category for work experience, where equal percentages of male and female civil engineers worked, was for local authorities (female 11.4%, N=19, males 11.4%, N=19). The "others" category included civil engineering work such as voluntary work, marketing, research or sales. The next table examines the durations, in weeks, of these work experiences.

TABLE 7.19 DURATION OF WORK EXPERIENCE

sex	no work experience or no duration specified (%)	12 weeks or less (%)	13 to 24 weeks (%)	25 to 36 weeks (%)	37 to 48 weeks (%)	49 to 52 weeks (%)	1 to 2 years (%)	over 2 years (%)	N
Female	15.1	42.2	13.3	7.2	2.4	10.2	4.2	5.4	166
Male	14.4	43.7	9.6	6.0	4.2	8.4	6.6	8.2	167

From Table 7.19, shows that the most common duration for male civil engineers for work experience was twelve weeks or less, as was the work experience duration for women (male 43.7 %, N= 73, females 42.2%, N=70). In most categories, the duration of work experience of male and female civil engineers was similar.

7.2.1 CONCLUSION

The results presented above show that there are some differences in the backgrounds of male and female civil engineers. In particular, there are significant differences in the occupations and socio-economic status of their father and in the occupations of their brothers. The results also suggest that significantly more male than female civil engineering students consider other courses. There are small but insignificant differences in many of the other categories, as the results have shown. The next chapter uses some of the data on women civil engineers presented in this section to test the hypotheses about the background reasons for women choosing civil engineering, as formulated and operationalised in chapter five.

INITIAL REASONS FOR WOMEN CHOOSING CIVIL ENGINEERING

7.3 INTRODUCTION

The following results and discussion concern the background family influences on a woman's decision to choose civil engineering as a degree. Chapter two discussed the importance of various factors on women's decisions to choose civil engineering. From this analysis of the literature and the analysis of interviews, a number of hypotheses were developed and operationalized in chapter five. The aim of the remainder of this chapter is to test these hypotheses using statistical data gathered from the national questionnaire. The main hypothesis for this research as related to the initial reasons for women choosing civil engineering is that;

There are general patterns in the initial career choices of women on civil engineering degree courses

From the initial stages of the research five aspects of the initial reasons for women choosing civil engineering were identified and formulated into sub-hypotheses to be tested in this thesis. These were the influence of families; careers advisors; teachers on decisions to choose civil engineering together with ability in science and mathematics and features of civil engineering.

FAMILY INFLUENCES ON THE BACKGROUND REASONS FOR WOMEN CHOOSING CIVIL ENGINEERING

This section tests the sub-hypothesis and additional minor sub-hypotheses formulated to examine the family influences on women civil engineering degree students. First the sub-hypothesis and minor sub-hypotheses are restated. The testing of the minor sub-hypotheses

enable conclusions about the sub-hypothesis to be made. These conclusions will then contribute to the main hypothesis dealing with the initial reasons for women choosing civil engineering.

7.3.1 THE HYPOTHESES RESTATED

The sub-hypothesis about the relationship between family influence and career choice, as developed in chapter five is that;

Families are important in encouraging women to choose civil engineering

In chapter three it was argued that fathers, brothers and mothers, amongst other relatives, can provide encouragement and support in women's decisions to choose civil engineering. Since it was unrealistic to test the influence of all family members, fathers, mothers and brothers were chosen, since the analysis of the literature and interviews in chapter two tended to indicate that these family members provided the most support. The following hypotheses and their subsequent results are designed to test aspects of the family hypothesis stated above. These are:

(a) Fathers who are in professional occupations provide more encouragement to their daughters' decisions to choose civil engineering than fathers in other occupations

(b) Fathers who are engineers or in building-related professions provide more encouragement to their daughters' choosing civil engineering than those in other professions.

(c) Brothers who are engineers or in building-related professions provide more encouragement to women choosing civil engineering than brothers in other professions.

(d) Mothers of women civil engineering students discourage their daughters' choice of

civil engineering.

The following sections test these hypotheses in order to draw conclusions about the family influences on women in civil engineering.

7.3.2 RELATIONSHIP BETWEEN ENCOURAGEMENT OF FATHER AND CAREER CHOICE OF WOMEN CIVIL ENGINEERS

This section examines the results of the questions about influence of fathers on the career choice of women in civil engineering in relation to hypothesis (a) and hypothesis (b) stated above. These hypotheses were:

(a) **Fathers who are in professional occupations provide more encouragement to their daughters' decisions to choose civil engineering than fathers in other occupations**

and

(b) **Fathers who are engineers or in building-related professions provide more encouragement to their daughters' choosing civil engineering than those in other professions**

Table 7.6, and the subsequent tests on the results, showed that women civil engineering students, replying to this questionnaire survey, were significantly more likely than replying male civil engineering students to have fathers who were in professional occupations. Table 7.7, and the subsequent tests on the results, showed that of the respondents stating fathers' occupations, women on civil engineering courses were significantly more likely than men on civil engineering courses to have fathers who were engineers. This table also showed that nearly half of the women (48.9% (36.7 + 12.2), N= 72) who had given their fathers' occupations had fathers who are in engineering or building-related professions. The following tables examine whether fathers of different occupation bands and fathers of different

professions provide different levels of encouragement for their daughters' choice of civil engineering. Table 7.20 examines the responses of the questionnaire survey to women civil engineers in relation to the question of encouragement in their choice of civil engineering from fathers in different occupational bands. The bands were chosen from Table 7.6 where the results suggested that the majority of fathers of women on civil engineering courses were in professional, managerial or skilled occupations.

TABLE 7.20 ENCOURAGEMENT FROM FATHERS IN VARIOUS OCCUPATIONAL BANDS

	My father encouraged me to study civil engineering					
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
father is in a professional occupation	14.4	17.8	35.6	15.6	16.7	90
father is in a managerial occupation	9.5	9.5	42.9	11.9	26.2	42
father is in a skilled occupation	6.3	12.5	50.0	6.3	25.0	16
all respondents	11.4	14.5	39.2	14.5	20.5	166

Note: Column 'all respondents' includes all those who answered the question "My father encouraged me to study civil engineering" which is more than those specifying their fathers' occupations in the three bands given.

From Table 7.20 it appears that, for all respondents, more fathers do not provide encouragement than do [agree 25.9% (11.4 + 14.5), N=43 disagree 35.0% (14.5 + 20.5, N=58)], although the over a third of the respondents were neutral (36.1% N=65). Table 7.20 also shows that more women with fathers in the professional category than in other categories agreed that their fathers encouraged them to study civil engineering [professional category, agree 32.2% (14.4 + 17.8); managerial category, agree 19.0% (9.5 + 9.5); skilled occupation 18.8% (6.3 + 12.5)]. However, a Kruskall-Wallis test on the results showed that there were no significant differences between the fathers' occupations in the

three groups mentioned and the responses to the question of encouragement (K-W chi^2 sig=0.6637).

This suggests that, from these results, encouragement of women in their initial choice to study civil engineering does not vary significantly with fathers' occupational band.

Table 7.21 examines the responses of the questionnaire survey to women civil engineers in relation to the question of encouragement in their career decisions from fathers to examine whether fathers who engineers or in building-related professions provided more encouragement.

TABLE 7.21 ENCOURAGEMENT FROM FATHERS

	My father encouraged me to study civil engineering					
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
father is an engineer or in a building-related profession	18.1	22.2	36.1	11.1	12.5	72
father is not an engineer or in a building-related profession	6.7	6.7	41.3	17.3	28.0	75
All respondents	11.4	14.5	39.2	14.5	20.5	166

Note: Column 'all respondents' includes all those who answered the question "My father encouraged me to study civil engineering" which is more than those specifying their fathers' occupations in the two bands given.

The results presented in Table 7.21 suggests that more fathers who were either engineers or in professions related to building were likely to provide encouragement that those who were not in these professions [father is an engineer or in building-related professions, agree 30.3% (18.1 + 22.2); father is not an engineer or in a building-related profession, agree 13.4%, (6.7 + 6.7)]. A Mann-Whitney test of significance was carried out to test whether there were significant differences in the two groups in their responses to the question of encouragement

from fathers (M-W sig=0.0002).

This suggests fathers who are engineers or who are in building- related professions are significantly more likely than fathers in other professions to provide encouragement to their daughters to study civil engineering.

This tends to support earlier research, reported in chapter two, which suggested that women with engineering fathers are likely to be encouraged in their decision to choose civil engineering.

7.3.3 RELATIONSHIP BETWEEN ENCOURAGEMENT OF BROTHER AND CAREER CHOICE OF WOMEN CIVIL ENGINEERS

The hypothesis designed to test the encouragement in the reasons for women choosing civil engineering from brothers was formulated into the following hypothesis:

Brothers who are engineers or in building-related professions provide more encouragement to women choosing civil engineering than brothers in other professions

Table 7.8, and the subsequent discussion of the results suggested that women on civil engineering courses were significantly more likely than men on civil engineering courses to have brothers who are in engineering or building-related professions. The table also showed that over a third of women on civil engineering courses in this questionnaire survey had brothers in these categories (37.1%, N=40).

The following table and discussion examines the hypothesis that brothers in these categories provide more encouragement to their civil engineering sisters than brothers in other occupations.

TABLE 7.22 ENCOURAGEMENT FROM BROTHERS

	my brother provided encouragement in my choice of an engineering career					
	strongly agree (%)	somewhat agree (%)	neutral	somewhat disagree (%)	strongly disagree (%)	N
brother is an engineer or in a building-related profession	10.0	25.0	25.0	17.5	22.5	40
brother is not an engineer or in a building-related profession	0.0	5.9	33.8	10.3	50.0	68
all respondents	3.7	13.0	30.5	13.0	39.8	108

Referring to Table 7.22, which shows that of those respondents answering the questionnaire survey who had brothers (N=108), a higher percentage of women answering the questionnaire had brothers who did not provide encouragement than brothers who did provide encouragement [all respondents; agree 16.7% (3.7 + 13.0) disagree 52.8% (13.0 + 39.8)]. However, when comparing the results of the responses of women who had encouragement from brothers who were engineers or in building-related professions and those whose brothers who were not, the results suggest that more brothers provided encouragement if they were engineers or in building-related profession than brothers in other professions [are engineers or in building-related professions, agree 35.0% (10.0 + 25.0); are in other professions, agree 5.9% (5.9 + 0.0)]. A Mann-Whitney test revealed a significant difference between the responses of women with brothers who were engineers or in building-related professions and those in other professions, and their responses to the question of encouragement in their choice of civil engineering as a career (M-W sig = 0.0006). A Kendall correlation showed a very weak but significant relationship between women's agreement with the statement of encouragement of brother in choice of civil engineering as

a career and their agreement with the statement about encouragement from fathers (Kendall corr. coeff. = 0.1861, sig = 0.021).

Overall, the results suggests women on civil engineering degree courses answering this questionnaire, who have brothers who are engineers or in building-related professions were significantly more likely to receive encouragement in their choice of an engineering career from their brothers than women who had brothers in other professions.

This tends to support earlier research, as outlined in chapter two, which suggested that brothers can be influential in the career choice of engineering for women choosing that career.

7.3.4 RELATIONSHIP BETWEEN ENCOURAGEMENT OF MOTHER AND CAREER CHOICE OF WOMEN CIVIL ENGINEERS

The following table examines the results of the responses to the question of whether the mothers of women on civil engineering courses discouraged them from choosing civil engineering as a career as formulated in the following hypothesis;

Mothers of women civil engineering students discourage their daughters' choice of civil engineering

TABLE 7.23 ENCOURAGEMENT FROM THE MOTHERS OF WOMEN CIVIL ENGINEERING STUDENTS

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
My mother did not want me to choose civil engineering as a career (all respondents)	3	5.4	24.1	8.4	59.0	166

The results presented in table 7.23 tend to suggest that mothers of women civil engineering

students do not generally dissuade women from choosing civil engineering [disagree on the question of discouragement; 67.4% (59.0 + 8.4)]. This result suggests that a majority of women did not receive opposition to their choice of civil engineering as a degree from their mother, as only a small percentage of the women replying to the questionnaire survey agreed that their mother did not want them to choose civil engineering (agree 8.4% (3.0% + 5.4%). **So, in general it appears that women are not discouraged in their choice of civil engineering as a career by their mothers.**

7.3.5 SUMMARY OF MAIN FINDINGS IN RELATION TO SUB-HYPOTHESIS ON FAMILY INFLUENCES

The sub-hypothesis for this section stated that;

Families are important in encouraging women to choose civil engineering

The encouragement of fathers, brothers and mothers was assessed in order to test this sub-hypothesis. More fathers did not encourage their daughters' decision to choose civil engineering than did, although a third of respondents were neutral. This result held across fathers' occupational band, although fathers in engineering and building-related professions were significantly more likely to encourage their daughters' decisions. Similar results held for brothers. In general, mothers did not discourage their daughters' decisions. A more extensive discussion of the results in relation to this hypothesis can be found in chapter eleven.

The next section examines the hypotheses relating to the influences schools exert on women's decisions to choose civil engineering.

CAREER ADVISORS' INFLUENCE ON DECISIONS

7.4 INTRODUCTION

The results of the questions in this research used to test the relationship between careers advice at school and women's decisions to choose civil engineering as a degree are discussed in this section. Chapter two examined the role that careers services and teachers in schools play in women's career decisions. This section examines the role of careers services in women's decisions to choose civil engineering, and section 7.5 examines the role that teachers play in this decision.

The analysis of the literature and interviews presented in chapter two concluded that careers guidance, especially for women wanting to pursue any engineering career, ranged from excellent to non-existent. In chapter two, it was also suggested that, from the interviews with women on civil engineering degree courses conducted for this research, there appeared to be some indication women received different careers advice, dependent on the type of school they had attended.

This section examines what part, if any, careers service played on the women who have chosen civil engineering as a degree. It examines whether the careers services at schools encouraged or discouraged women's entry into civil engineering and also whether there is a relationship between the type of school attended and careers advice received. First the sub-hypothesis and minor sub-hypotheses developed in chapter five are restated, following this, the results and analysis of the questionnaire survey testing the minor sub-hypotheses are presented. This enables conclusions about the influence of careers advisors to be made which then means that conclusions about the overall main hypothesis about the general patterns in

the initial reasons for women choosing civil engineering to be made.

7.4.1 THE HYPOTHESES RESTATED

The sub-hypothesis and additional minor sub-hypotheses for this section were developed in chapter five. This section restates these hypotheses.

The sub-hypothesis for this section is;

Careers advice is inadequate for women choosing civil engineering.

From this hypothesis, a number of hypotheses were formulated which test in more detail aspects of this hypothesis. These are;

(a) Careers advice for women civil engineers varied with the type of school attended.

(b) Women are not discouraged from choosing civil engineering by careers counsellors at school.

(c) Alternative careers advice from outside school is likely to have been sought by women students on civil engineering degree course.

(d) Short courses designed to give women an insight into engineering are a positive influence on career choice.

(e) Women choose civil engineering with little knowledge of what civil engineers actually do

(f) Women decide on a career in civil engineering after the age of sixteen.

The next sections tests the hypotheses outlined above.

7.4.2 THE RELATIONSHIP BETWEEN CAREERS ADVICE AND SCHOOL TYPE

The first hypothesis in this section was;

(a) **Careers advice for women civil engineers varied with the type of school attended**

Table 7.10 showed that the most common type of school attended by women on civil engineering degree courses was state mixed schools (56.6%, N=94). State single sex schools and private single sex schools were attended by almost the same numbers of women on civil engineering degree courses (state single sex 19.3%, N=32 ; private single sex 20.5%, N=34). The table also showed that few women attended private mixed schools (3.6%, N=6).

The following table examines the responses of women from different school types, single sex or mixed, in relation to careers advice at school.

TABLE 7.24 SCHOOL TYPE BY CAREERS ADVICE

	I found careers advice at school unhelpful					
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
Student went to a single sex school	33.3	15.2	24.2	18.1	9.1	66
student went to a mixed sex school	41.0	19.0	7.0	11.0	22.0	100
all respondents	33.7	15.1	24.1	17.5	9.6	166

Table 7.24 shows that almost half of the women surveyed agreed that careers advice at school was unhelpful (48.8%, N= 81). A Mann-Whitney test of significance on the data revealed that there was no significant difference between women attending single sex and mixed sex schools and finding careers advice at school unhelpful (M-W sig= 0.9647).

In the course of the exploration of this hypothesis, further tests were also carried out which coded the types of schools as either state or private. These tests also showed no significant difference between women answering the questionnaire who attended private schools or state

schools in finding careers advice unhelpful (M-W sig= 0.9286).

Concluding, the results suggest that there is no significant difference between the type of school attended by women civil engineering degree students and finding careers advice unhelpful at school. Generally, it appears from these results that almost half of the respondents to the survey found careers advice at school unhelpful.

7.4.3 ADVICE FROM CAREERS COUNSELLORS

This section tests whether women on civil engineering degree courses are discouraged from choosing civil engineering by careers counsellors. The following hypothesis was formulated to do this;

> **Women are not discouraged from choosing civil engineering by careers counsellors at school**

The following table illustrates the results of the questionnaire in relation to advice from careers counsellors.

TABLE 7.25 CAREERS COUNSELLORS

	strongly agree (%)	somewhat agree (%)	neutral	somewhat disagree (%)	strongly disagree (%)	N
I was advised by a careers counsellor at school not to choose civil engineering (all respondents)	6.6	5.4	18.7	18.7	50.6	166

Table 7.25 shows that most women in the questionnaire survey (69.3%, N =115) were not actively discouraged from choosing civil engineering by careers counsellors. In the course of the analysis of the results, further tests were conducted which suggested that there was no

significant difference between those women in the questionnaire survey who had attended single sex or mixed schools in being discouraged from choosing civil engineering by careers counsellors (M-W sig =0.4837), neither was there any significant difference between women attending private or state schools (M-W sig= 0.2226) in being discouraged from choosing civil engineering. What did emerge from the analysis of the results was a weak but significant correlation between women being advised not to choose civil engineering by careers counsellors and finding careers advice unhelpful. Those women who agreed with the statement that they were advised not to choose civil engineering by a careers counsellor tended to agree with the statement that they found careers advice unhelpful (Kendall corr. coeff. = 0.3022, sig= 0.000).

There appears to be no evidence from these results that most women are actively discouraged from choosing civil engineering by careers counsellors at school.

7.4.4. RELATIONSHIP BETWEEN SEEKING EXTRA CAREERS ADVICE AND SCHOOL TYPE

It was suggested in chapter two that careers advice was often sought from outside school, particularly if the advice at school was inadequate. This section tests whether women on civil engineering degree courses answering this questionnaire sought careers advice from outside school. The following hypothesis was formulated to do this;

Alternative careers advice from outside school is likely to have been sought by women students on civil engineering degree course

The following results and subsequent statistical analysis test this hypothesis.

TABLE 7.26 SEEKING CAREERS ADVICE FROM OUTSIDE SCHOOL

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I sought careers advice on engineering from outside school (all respondents)	25.9	28.9	15.1	10.8	19.3	166

Table 7.26 shows that over half of the women in the questionnaire survey, 54.8% (N=91) are likely to have sought careers advice from outside school. In examining the responses to the question of seeking careers advice from outside school, further investigations revealed that there were no significant differences between the women seeking careers advice from outside school and the type of school they attended, state or private schools (M-W sig= 0.2746) or mixed or single sex schools (M-W sig=0.6325). Correlation of the results suggested a weak but significant relationship between those women who had agreed with the statement that they sought careers advice from outside school and agreement with the statement that they were advised not to choose civil engineering by careers counsellors (Kendall corr. coeff. = 0.1614, sig= 0.013).

However, in the course of the exploration of this hypothesis, further analysis found that there was a significant difference between those women whose fathers were engineers or in building-related professions, and those women with fathers in other professions, and seeking advice from outside school (M-W sig=0.0437). Women who had fathers who were engineers or in building-related professions were significantly more likely than women who had fathers in other professions to agree that they sought careers advice from outside school. This tends to complement the results in 7.3.2, where it was suggested that those women in the questionnaire survey who had fathers who are engineers or who are in building-related

professions are significantly more likely than those women with fathers in other professions to provide encouragement to their daughters to study civil engineering. Further analysis of the results showed a very weak but significant correlation between those women who agreed that they had sought careers advice from outside school and agreement with the statement that they had been encouraged by their fathers in their choice of civil engineering.

It is clear from the results presented in this section that many women on civil engineering degree courses had sought advice from outside school. This is especially the case for women who have fathers as engineers or in building-related professions.

7.4.5 CAREERS ADVICE FROM SHORT COURSES

The results of the literature review presented in chapter 2 suggested that short courses can be successful in encouraging women to consider engineering as a career. The hypothesis for this section formulated to test this idea is;

- **Short courses designed to give women an insight into engineering are a positive influence on career choice**

Table 7.27 presents the results of the responses to the questionnaire survey in relation to short courses.

TABLE 7.27 INFLUENCE OF SHORT COURSES

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I was influenced by a short course which gave girls an insight into engineering (all respondents)	18.1	14.5	17.5	7.8	42.2	166

The results presented in Table 7.27 suggest that about a third of women answering the questionnaire survey agreed that they were influenced in their decision to choose civil engineering by short courses which gave girls an insight into engineering (32.6% (18.1 + 14.5), N=54).

These results imply that, for a substantial minority of women, short courses designed to give women an insight into engineering appear to be successful in influencing women's decisions to choose civil engineering.

7.4.6 PERCEIVED KNOWLEDGE

The hypothesis formulated for this section to test for women's perceived knowledge of civil engineering before entering the degree course was;

Women choose civil engineering with little knowledge of what civil engineers actually do

The following table examines the responses to the question of perceived knowledge of women civil engineers.

TABLE 7.28 PERCEIVED KNOWLEDGE

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I chose civil engineering with little knowledge of what civil engineers actually did (all respondents)	17.5	29.5	11.4	19.9	21.7	166

The results presented in Table 7.28 suggest that nearly half of women (47% (17.5 + 29.5),

N= 78), responding to the questionnaire survey felt that they chose civil engineering with little knowledge of the work done by civil engineers. In exploring this further, results of statistical tests showed that there was a significant difference between those women who had fathers who were engineers and in building-related professions and those with fathers in other professions in their perceived knowledge. Women who had fathers who were engineers or in building-related professions were significantly less likely to agree that they choose civil engineering with little knowledge of what civil engineers do (M-W sig=0.0371). The results also showed a weak but significant correlation between the following variables; those women who agreed with the statement that they chose civil engineering with little knowledge of what civil engineers actually do tended to disagree with the statement that they sought careers advice from outside school (Kendall corr. coeff. = -0.2041, sig = 0.001).

The findings show that many women chose a career in civil engineering with inadequate knowledge. The findings also suggest that women with fathers who are engineers or in building-related professions are likely to have greater knowledge of civil engineering than those women with fathers in other professions.

7.4.7 TIME CAREER DECISION WAS MADE

In interviews with women civil engineers it appeared that, in most cases, they tended to make their career decisions after they had selected their Advanced level subjects. The timing of career decisions appeared to warrant investigation which led to the formulation of the following hypothesis designed to test this;

Women decide on a career in civil engineering after the age of sixteen

The following table and subsequent statistical tests examine this hypothesis.

Table 7.29 TIME CAREERS DECISION WAS MADE

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I decided to study civil engineering after the age of sixteen (all respondents)	41.6	19.9	6.0	11.4	21.1	166

Table 7.29 shows that over half of the respondents (51.5% (41.6 + 19.9), N=85) decided to study civil engineering after the age of sixteen. In exploring this hypothesis, further statistical tests were carried out. A Kruskall-Wallis statistical test of significance showed that there were significant differences between those women who changed school after GCSE/O level and those women who had not in deciding to study civil engineering after the age of sixteen (K-W sig= 0.0218). It seemed that women on civil engineering degree courses who changed schools after GCSE/O levels were significantly less likely to decide to choose civil engineering after the age of sixteen (particularly those who had changed to the college of further education and sixth form college). Further investigations revealed that women choosing civil engineering who changed schools after GCSE/O Levels were significantly more likely to take BTEC qualifications in civil engineering rather than Advanced level qualifications (chi^2 sig= 0.01297). This appeared to suggest that women deciding to study civil engineering who change school are likely to have made their career decisions before age sixteen.

The findings suggest that over half of the respondents decided to study civil engineering after the age of sixteen. The results also suggested that women changing school after GCSE/O levels are significantly more likely than those who have not changed schools after GCSE/O levels to have made a decision to chose civil engineering before the age of sixteen

7.4.8 SUMMARY OF MAIN FINDINGS IN RELATION TO THE SUB-HYPOTHESIS ON CAREERS ADVICE.

The sub-hypothesis for this section stated;

Careers advice is inadequate for women choosing civil engineering

The results and analysis of the questionnaire survey confirm this hypothesis.

A range of issues were assessed to test this sub-hypothesis. Almost half the women responding to the survey found the careers service inadequate. Although careers counsellors do not generally discourage women from entering civil engineering, many women enter civil engineering with little knowledge of what it involves. Many women seek advice from outside school. These results suggest that careers advice is inadequate for women choosing civil engineering. For further discussion of these results, including their relationship to the main hypothesis and their limitations see 11.2.3.

INFLUENCE OF TEACHERS ON CAREER DECISION

7.5 INTRODUCTION

The results of the questionnaire survey testing the relationship between teacher's influence and women's decisions to choose civil engineering as a degree course is discussed in this section. Some of the research discussed in chapter two suggested a relationship between encouragement in career choice from science and mathematics teachers and choosing engineering as a career. In interviews, some women confirmed this, suggesting that they had been given advice and encouragement in their decisions to choose civil engineering from either science, usually physics, or mathematics teachers. The aim of this section is to

examine whether, in general, women are encouraged in their decision to choose civil engineering by either their mathematics teachers, or their science teachers, or both. First the sub-hypothesis for this section are restated together with a number of minor sub-hypotheses designed to test particular aspects of the sub-hypothesis. Following this, the analysis of the results from testing these hypotheses are presented.

7.5.1 THE HYPOTHESES RESTATED

For this section the sub-hypothesis relating to the influence of teachers is;

Science and mathematics teachers play an important role in the career choice of women civil engineers

To test particular aspects of this hypothesis, the following hypotheses were developed in chapter five;

(a) Science teachers influence career choice

(b) Mathematics teachers play an important part in career choice of women civil engineers

(c) For women on civil engineering courses, science and mathematics teachers influenced their decision to choose civil engineering.

These hypotheses are tested in the next sections.

7.5.2 ROLE OF SCIENCE TEACHERS IN CAREER CHOICE

The following analysis of the results of the questionnaire survey test the hypothesis (a) above which stated;

Science teachers influence career choice

The following results and subsequent statistical analysis test this hypothesis.

TABLE 7.30 ROLE OF SCIENCE TEACHERS IN CAREER CHOICE

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
My science teacher influenced my decision to choose civil engineering	9	13.9	26.5	17.5	33.1	166

Table 7.30 shows that 22.9% (9.0 + 13.9, N=38) of women answering the questionnaire survey thought that science teachers influenced their decisions to choose civil engineering as a degree. However, for just over half of the women answering the questionnaire no such influence on their decision to choose civil engineering was observed (disagree 50.6% (33.1 + 17.5), N=84). In exploring this hypothesis, it became apparent that there was no significant difference between those girls at single sex schools or at mixed sex schools and science teacher's influence (M-W sig=0.4289).

Concluding then, for a minority of women on civil engineering courses, some influence from science teachers in their initial career decisions is detected. Further analysis of the results showed that there is no significant difference between influence from science teachers and type of school attended.

7.5.3 ROLE OF MATHEMATICS TEACHERS IN CAREER CHOICE

The following analysis of the results of the questionnaire survey test the hypothesis formulated for this section which stated;

> **Mathematics teachers play an important part in career choice of women civil engineers**

The following results and subsequent statistical analysis test this hypothesis.

TABLE 7.31 MATHEMATICS TEACHERS' INFLUENCE ON CAREER DECISION

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I was influenced by my mathematics teacher who suggested engineering as a career	4.8	7.2	20.5	24.7	42.8	166

Table 7.31 shows that only 12.0% (4.8 + 7.3), N=20 agreed that they were influenced in their choice of civil engineering by their mathematics teacher. The majority of respondents disagreed with the statement that their mathematics teacher had influence in their career choice (67.5% (24.7 + 42.8), N=112). In exploring this hypothesis, further analysis of the results of this questionnaire survey showed that women who went to single sex schools were no more likely than women who went to mixed sex schools to have been influenced by their mathematics teacher in their career choice of civil engineering (M-W sig=0.7712).

Concluding, for the majority of women on civil engineering courses, there had been no perceived influence on their career choice from mathematics teachers in either single sex or mixed sex schools.

7.5.4 INFLUENCE FROM SCIENCE AND MATHEMATICS TEACHERS

This section examines to what extent both science and mathematics teachers have an influence on women's career decisions as formulated in the following hypothesis for this section;

> **For women on civil engineering courses, science and mathematics teachers influenced their decision to choose civil engineering.**

The following table and subsequent statistical analysis on these results test this hypothesis.

TABLE 7.32 CROSSTABULATION OF BOTH INFLUENCES

	my science teacher influenced my decision				
I was influenced by my maths teacher		yes (%)	neutral	no (%)	N
	yes(%)	6.6	3.6	1.8	20
	neutral	7.2	10.2	3.0	34
	no (%)	9.0	12.7	45.8	112
	N	38	44	84	166

From table 7.32 it can be seen that many women had no influence from either mathematics or science teachers (45.8%, N=76) and that only 6.6% of women (N=11) had influence from both teachers in their decisions to choose civil engineering. A Kendall correlation showed a moderate and significant relationship between two variables. Those women who had thought that science teachers influenced their decision to choose civil engineering tended to agree that they were also influenced by their mathematics teachers (Kendall corr. coeff. = 0.4398, sig =0.000).

From these results it can be concluded that there is little evidence to suggest that both science and mathematics teachers influence the career choice of women civil engineers.

7.5.5 SUMMARY OF FINDINGS IN RELATION TO SUB-HYPOTHESIS EXPLORING TEACHERS' INFLUENCE

The hypothesis for this section stated that;

Science and mathematics teachers play an important role in the career choice of women civil engineers

This hypothesis is disconfirmed.

For most women, neither science or mathematics teachers influence career choice. For further discussions of these results in relation to this sub-hypothesis and the main hypothesis

see chapter eleven.

PERCEIVED ABILITY IN MATHEMATICS AND SCIENCE SUBJECTS

7.6 INTRODUCTION

The last three sections in this chapter examined the role some important people play in women's decisions to choose civil engineering. They concluded that parents, careers advisors, science and mathematics teachers have varying degrees of influence on women's decisions to choose civil engineering as a career. However, not only people play an important part in influencing career decisions; ability in certain subjects has been put forward in the literature examined in chapter two as influencing career choice. The analysis of the literature in chapter two suggested that anyone who chooses civil engineering as a career is required to be competent at mathematics and physics subjects at school, especially since to enter a civil engineering degree course these subjects must be studied, usually to A level standard or equivalent.

This section examines the extent to which women who chose civil engineering perceived these subjects as being their strongest subjects at school.

7.6.1 THE HYPOTHESES RESTATED

The sub-hypotheses developed in chapter five for this section is;

There is a relationship between women's choice of civil engineering as a degree and their ability in certain subjects

To test particular aspects of this hypothesis, the following minor sub-hypotheses were developed;

(a) Women who choose civil engineering find little difficulty with mathematics at school.

(b) Women who choose civil engineering consider physics as one of their strongest subjects at school.

(c) Women who choose civil engineering as a career were not good at arts subjects at school.

(d) Women who choose civil engineering had technical hobbies

(e) Women who choose civil engineering do so because they want to use their mathematics and science qualifications

These hypotheses are tested in the following sections.

7.6.2 PERCEIVED ABILITY IN MATHEMATICS

The following analysis of the results of the questionnaire survey test the hypothesis formulated for this section which stated;

- **Women who choose civil engineering find little difficulty with mathematics at school.**

Table 7.12 showed that most women (77.1 %, N=128) had Advanced level or Scottish Higher qualifications at entry to civil engineering degree course and that few women by comparison had BTEC qualifications (17.5%, N=29). Analysis of the A level results of mathematics, presented in table 7.13, suggested that more women civil engineering students than male engineering students were likely to have higher grades at mathematics at A level. The following results examine the relationship between qualifications and perceived ability in mathematics.

TABLE 7.33 QUALIFICATIONS BY ABILITY IN MATHEMATICS

	I found maths difficult at school					
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
A level/ Scottish Highers	6.3	14.6	16.4	22.7	39.8	128
BTEC	13.9	17.2	17.2	24.1	27.6	29
Others	11.1	11.1	22.2	22.2	33.3	9
All respondents	7.8	15.1	16.9	22.9	37.3	166

Note "Others" refers to international or unspecified qualifications (see table 7.12).

Table 7.33 shows that the majority of women did not find mathematics difficult at school (all respondents disagree 60.1% (37.3 + 22.9) N=166). The table also shows that, of those women with A level and BTEC qualifications entering a civil engineering degree, the majority of women in both groups did not tend to find maths difficult at school (disagree, A levels/ Scottish Highers; 62.5% (22.7 + 39.8) N=128, BTEC 51.7% (24.1 + 27.6), N=29). However, in both of these groups a minority of women did find mathematics difficult at school (agree, A levels/ Scottish Highers; 21.1% (6.3 + 14.8) N=128, BTEC 31.1% (13.9 + 17.2), N=29). In exploring the results testing the relationship between ability in mathematics and qualifications obtained, some statistical tests were carried out. A Mann-Whitney test showed that there was a significant difference between those women with BTEC qualifications and those with A level qualifications in their responses to the question of finding mathematics difficult (M-W sig= 0.0157). Women who took BTEC qualifications were significantly more likely to agree that they found maths difficult at school.

Further exploration of the results showed that there was no significant difference between women stating that they found maths difficult at school in attending mixed sex or single sex schools (M-W sig=0.3359). There was also no significant difference between women

attending state or private schools and finding maths difficult at schools (M-W sig=0.8033). In investigating the ability of women in mathematics further, some more statistical tests were carried out. These showed that there was no significant difference between women civil engineers attending different types of schools, mixed or single sex, in grade of A level in mathematics (chi^2 sig= 0.73657), or between women attending state schools and private schools (chi^2 = 0.97979) in grade of A level in mathematics.

It is clear from these results that the majority of women who choose civil engineering as a career did not tend to find mathematics difficult at school. However, for a minority of students this was not the case. The results show that there are significant differences between those who had not obtained A level qualifications in maths and those who had. Those women with BTEC qualifications were significantly more likely to find mathematics difficult at school.

7.6.3 PERCEIVED ABILITY IN PHYSICS

Analysis of the A level results presented in table 7.14 showed that of those women with A levels in physics, women were likely to have slightly higher grades than men. This section examines to what extent the impressions of women who choose civil engineering were that physics was their strongest subjects at school. The following hypothesis was formulated to test this;

> **Women who choose civil engineering consider physics as one of their strongest subjects at school.**

The following results and subsequent statistical analysis test this hypothesis.

TABLE 7.34 QUALIFICATIONS BY ABILITY IN PHYSICS

	Physics was my strongest subject at school					
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
A level/ scottish highers	10.9	16.4	26.6	26.6	19.5	128
BTEC	6.9	24.1	13.8	13.8	41.4	29
Others	0.0	33.3	11.1	33.3	22.2	9
All respondents	9.6	18.7	23.5	24.7	23.5	166

Note "Others" refers to international or unspecified qualifications (see table 7.12).

Table 7.34 shows that generally women did not perceive physics as their strongest subject at school (agree all respondents 28.3% (9.6 + 18.7) N=166). Similarly, of those women with A level and BTEC qualifications entering a civil engineering degree, most women in both groups did not find physics their strongest subject at school (agree A levels/ Scottish Highers 27.3% (10.9 + 16.4) N=128, BTEC 31% (6.9 + 24.1) N=29). In exploring these results, statistical tests showed that there was no significant difference between women with A levels or Scottish Highers and women with BTEC qualifications in perceiving physics as their strongest subject at school (M-W sig= 0.2149). Further exploration showed that those women who obtained the highest grades in physics, either A or B, at Advanced level, were significantly more likely than those with lower grades to say that physics was their strongest subject at school (K-W chi^2= 9.0353, sig = 0.0109). Further investigations showed that there was no significant difference between women attending mixed sex or single sex schools in stating that physics was their strongest subject at school (M-W sig=0.1263). There was also no significant difference between those women attending state or private schools in finding that physics was their strongest subject at school (M-W sig=0.2001). In investigating the ability of women in physics further, some more statistical tests were carried out. These

showed that there was no significant difference between women civil engineers attending different types of schools, mixed sex or single-sex (chi^2 sig= 0.59079) in grade of A level in physics, or women attending state schools and private schools (chi^2 = 0.37966) in grade of A level in physics.

Concluding, there is little evidence to suggest that the majority of women who choose civil engineering rated physics as their strongest subject at school, even though most women who enter civil engineering courses did achieve A level qualifications in physics.

7.6.4 ABILITY IN ARTS SUBJECTS

During interviews discussed in chapter two, the general impression was that women who chose civil engineering did so because, amongst other reasons, they were better at science subjects that arts subjects. It was argued there that not being good at arts subjects might mean that women are more likely to look at the scientific subjects for qualifications. The following analysis of the results of the questionnaire survey test the hypothesis formulated for this section which stated;

> **Women who choose civil engineering as a career were not good at arts subjects at school.**

The following results and subsequent statistical analysis test this hypothesis.

TABLE 7.35 ABILITY IN ARTS SUBJECTS

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I was not good at arts subjects at school	8.4	16.3	16.9	21.1	37.3	166

Table 7.35 shows that almost a quarter of women responding to the questionnaire (24.7% (8.4 + 16.3) N=41) thought that they were not good at arts subjects at school. This means that for those women, choices in careers may have been directed towards science subjects. However, since over half of the women (58.4% (21.1 + 37.3) N=57) disagreed with the statement in table 7.35, this suggests that these women were able in both science and arts subjects. From this, it is possible to infer that for many women, not being good at arts subjects at school was probably not a sufficient reason for choosing to study mathematics and science at school and ultimately to seek a career in civil engineering.

For only a minority of women the perception that they were not good at arts subjects at school may have led them to choose a science based career such as civil engineering. However, the majority of respondents disagreed that they were not good at arts subjects at school.

7.6.5. TECHNICAL HOBBIES

The evidence presented in the surveys discussed in the literature in chapter two suggested that hobbies may be particularly important for women in the development of an interest in physics and a career in engineering. However, in interviews with women in civil engineering there was little evidence to suggest that women had technical hobbies. Despite this, it was decided that the idea that hobbies were part of the initial reasons for women choosing civil engineering warranted further investigation. This led to the formulation of the following hypothesis;

Women who choose civil engineering had technical hobbies

The following table and subsequent statistical analysis test this hypothesis.

TABLE 7.36 TECHNICAL HOBBIES

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
My hobbies were of a technical nature	6.0	19.3	34.3	26.5	13.9	166

Table 7.36 shows that 25.3% [(6.0 + 19.3), (N=42)] of the women answering the questionnaire agreed that they had technical hobbies. On examining the result of this, further tests on the results showed that there was no significant difference in the likelihood of women having technical hobbies between those women who had fathers who were engineers or in building-related professions and those who did not (M-W sig = 0.1808). What did emerge from the analysis was a very weak but significant correlation between agreement with the statement that physics was their strongest subject and agreement with the statement that their hobbies were of a technical nature. Those women who agreed that they had technical hobbies tended to agree that physics was their strongest subject.

Having a technical hobby, may, for some women, have led to a career in civil engineering, although the majority of women did not have technical hobbies and this cannot be seen as a main influence on their choice of civil engineering as a career.

7.6.6 USE OF MATHEMATICS AND SCIENCE SUBJECTS

One reason that appeared as important in the choice of civil engineering for women was discussed in the literature in chapter two and in the interviews in chapter two. This was the opportunity to apply mathematics and science qualifications. This led to the formulation of the following hypothesis;

> **Women who choose civil engineering do so because they want to use their mathematics and science qualifications**

The following results and statistical analysis test this hypothesis.

TABLE 7.37 USE OF MATHEMATICS AND SCIENCE WITHOUT SPECIALISING

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I wanted to use my science and maths background without specialising in either	40.4	33.1	17.5	4.2	4.8	166

Table 7.37 shows that the majority of women [73.5% (40.4 + 33.1), (N=122)] agreed that they wanted to use their science and maths background without specialising in either.

It appears, from these results, that the opportunity to combine mathematics and science subjects is a common reason for women to choose a career in civil engineering.

7.6.7 SUMMARY OF FINDINGS IN RELATION TO SUB-HYPOTHESIS ON THE RELATIONSHIP BETWEEN ABILITY AND CAREER CHOICE

The hypothesis for this section stated;

There is a relationship between women's choice of civil engineering as a degree and their ability in certain subjects.

This hypothesis is confirmed.

Several questions were asked to test this hypothesis. Important results which confirm it are that women civil engineering students did not generally find mathematics at school hard. Furthermore, many women choose civil engineering because it gave them the chance to combine their mathematics and science qualification. The results suggest a relationship

between ability and choice. However, there is little evidence to suggest that women rated physics as their strongest subject. Few of the women had technical hobbies and few felt that they were not good at arts subjects at school. These results show that some possible links, as tested in this research, between subject ability and career choice probably do not exist. For further discussion of these results in relation to the main hypothesis see chapter eleven.

THE EXTENT TO WHICH BENEFITS AND NATURE OF CIVIL ENGINEERING WORK ENCOURAGED WOMEN TO CHOOSE CIVIL ENGINEERING

7.7 INTRODUCTION

This section examines to what extent women chose civil engineering because of the nature of the work involved and their suitability for it. In interviews, one of the reasons that women gave for choosing a career in civil engineering was because they said that they were attracted by certain features of the work. Further prompting revealed that the reasons given were often similar for many women. Such features as interesting work and working outside amongst others were mentioned. In all, seven features were isolated as reasons for choosing civil engineering as a career. This section examines how commonly felt these feature were as reasons for choosing civil engineering.

7.7.1 THE HYPOTHESES RESTATED

The sub-hypotheses designed to test the relationship between benefits and nature of the work and career choice is;

The same features of civil engineering are found attractive by women choosing it.

The most common features of civil engineering that women mentioned in interviews and were derived from the literature were formulated into the following hypotheses;

(a) Women who choose civil engineering are attracted because of the prospect of a good salary

(b) Women choose civil engineering because they perceive the work as interesting

(c) Women choose civil engineering because they would not have to deal with the general public

(d) Women choose civil engineering because they believe the work involves problem solving.

(e) Women who choose civil engineering do so because they believe that it involves working outside

(f) Women choose civil engineering because they believe it is a profession that is transferable worldwide

(g) Women choose civil engineering because they wanted the opportunity to succeed in a male-dominated field

The following section tests these hypotheses.

7.7.2 RESPONSES TO QUESTIONS ABOUT BENEFITS AND NATURE OF WORK

Table 7.38 shows the responses to various questions testing the extent to which women were attracted to civil engineering because of the features outlined above.

TABLE 7.38 RELATIONSHIP BETWEEN CHOOSING CIVIL ENGINEERING AND FEATURES ABOUT THE WORK

	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I was attracted to engineering because of the high salary	0	10.8	28.3	28.9	31.9	166
Engineering provided the opportunity to do interesting work	48.2	44.0	5.4	2.4	0	166
I wanted a career where I did not have to deal with the general public	1.2	6.0	16.9	28.3	47.6	166
I wanted the challenge of solving problems	33.1	46.4	16.9	3.6	0	166
I wanted to work outside most of the time	19.9	37.3	32.5	7.2	3.0	166
I wanted a profession that is transferable throughout the world	36.1	34.9	25.3	3.0	0.6	166
I wanted to succeed in a male dominated world	12.0	24.7	41.0	8.4	13.9	166

On examining table 7.38, it is clear that almost all women (92.2% (48.2 + 44.0), N=153) agreed that engineering provided the opportunity to do interesting work. Similarly, the majority of women (79.5% (33.1 + 46.4), N=132) agreed that they chose civil engineering because it provided the challenge of problem-solving. These were two commonly mentioned features in interviews, and the questionnaire replies confirm that some of the reasons for choosing civil engineering stated in interviews were widely held. Seeing civil engineering as a transferable profession was also a reason given by many women for choosing civil engineering (71% (36.1 + 34.9), N=118). All these questions seem to indicate that women were attracted to a certain notion of what was involved in a career in civil engineering.

In addition to these, over half of the women 57.2%, [(19.9 + 37.3), N=95] stated that they

chose civil engineering because they wanted to work outside most of the time, and over a third of women in the survey (36.7% (12.0 + 24.7), N=61) said that succeeding in a male-dominated world was also a reason for choosing civil engineering. The results showed moderate but significant correlations between two variables. Those women who tended to agree that they chose civil engineering because it provided the opportunity to do interesting work were likely to agree with the statement that they chose civil engineering because they wanted the challenge of solving problems (Kendall corr. coeff. = 0.4268 sig = 0.000). Further correlations showed a very weak but significant relationship between those women who agreed that they wanted to work outside most of the time and agreement with the statement that they wanted to succeed in a male dominated environment (Kendall corr. coeff. =0.1412 sig = 0.031).

The other two features in table 7.38, having a high salary and not dealing with the general public, were not given by many women as reasons for choosing civil engineering, although these were given as reasons for choosing civil engineering in the earlier interviews.

7.7.3 SUMMARY OF THE FINDINGS IN RELATION TO THE SUB-HYPOTHESIS ABOUT THE BENEFITS AND NATURE OF THE WORK

The hypothesis for this section stated

The same features of civil engineering are found attractive by women choosing it.

On the evidence of the results presented in this section, this hypothesis is confirmed.

Most women appear to have chosen civil engineering because of the belief that it provided the opportunity to do interesting work and solve problems and was a transferable profession. Less widely held but still frequent reasons for their choice of civil engineering were working

outside and the opportunity of success in a male dominated world. Generally, it can be said that there are certain features about civil engineering which attract women who enter a civil engineering degree course. A more detailed discussion of these findings and their limitations in relation to the main hypothesis can be found in chapter eleven.

7.8 GENERAL CONCLUSION ON BACKGROUND REASONS FOR CHOOSING CIVIL ENGINEERING

The main hypothesis formulated to test the initial reasons for women choosing civil engineering stated;

There are general patterns in the initial career choices of women on civil engineering degree courses

This hypothesis is confirmed

The findings of this chapter have examined the background reasons for women choosing civil engineering and in the results some general patterns were evident. The results have shown that families can be important in encouraging women to choose civil engineering. In the results of the analysis for family influence, careers advice and teachers' influence general patterns can be detected from the results. A similar case exists in the analysis of the results examining the ability of women civil engineers and their decisions to choose civil engineering in relation to the benefits and nature of the work involved. A more extensive discussion of these results and their relationship to the main hypothesis can be found in chapter eleven.

CHAPTER EIGHT

THE DIFFERENCE IN EMPLOYMENT CHOICES OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS

8.1 INTRODUCTION

The results of the questionnaire survey analyzing the employment choices made by male and female civil engineering students leaving higher education is discussed in this chapter. In chapter one, the second research objective identified was to investigate whether there are differences in the employment choices made by male and female civil engineering students leaving higher education. Initial investigations of this objective led to an examination of the literature discussed in chapter three suggesting that there were possible differences in the employment choices of male and female civil engineering students leaving higher education. The evidence from the literature and interviews in chapter three led to the formulation of the main hypothesis used to test research objective two which was discussed in chapter five. This hypothesis was;

Female and male civil engineering students leaving higher education choose employment differently

As outlined in chapter five, three aspects of the differences in the employment choices of the students were identified as warranting further research. The following sections present the analysis of the results testing the hypotheses for these three aspects of career choice. Section one reports the findings from the analysis of the results relating to the preferred career choices of male and female civil engineering students leaving higher education. Section two examines the process of applications for employment and section three discusses some of the results establishing important factors in career choice.

SECTION ONE: THE CHOICE OF EMPLOYMENT MADE BY MALE AND FEMALE CIVIL ENGINEERING STUDENTS

8.1 INTRODUCTION

Chapter three discussed the First Destination Survey results, which analyzed the employment location of civil engineering graduates six months after graduation. These showed that women civil engineering graduates tend to enter local authority and public utility work in consistently higher proportions than men. The results of these surveys also suggested that the proportion of women entering building and civil engineering work was consistently lower than men. While these First Destination Survey results are a good starting point for assessing the career choice of male and female civil engineering students, since they give a broad overview of the sectors of employment civil engineering graduates choose, they offer only a very general picture of the career choice of male and female civil engineers because the disciplines used, eg building and civil engineering work, are so broad. In addition to this, the First Destination Surveys assess the employment to which civil engineering graduates actually went, whereas the survey done for this research assesses, amongst other things, their preferred choice of employment at the point of leaving higher education.

From this starting point, together with the review of the literature presented in chapter three, and the subsequent discussion of the research problem and formulation of the hypotheses in chapter five, this section aims to examine any differences in the career choice of male and female civil engineering students as found in the analysis of the questionnaire survey.

8.1.1 THE HYPOTHESES RESTATED

The sub-hypothesis examining the first aspect of the choice of employment by male and female civil engineering students were developed in chapter five. This was;

Male and female civil engineering students leaving higher education make different career choices.

From this sub-hypothesis, five minor sub-hypotheses were formulated in chapter five which were designed to test particular aspects of the career choices of male and female civil engineering students. These hypotheses are;

(a) The choices of sector of industry made by male civil engineering students leaving higher education are different from the choices made by female civil engineering students leaving higher education.

(b) The choices of specialisation in employment made by male civil engineering students leaving higher education differ from those made by female civil engineering students leaving higher education.

(c) Women are more likely than men to plan to enter an industry other than civil engineering.

(d) Women are more likely than men to plan to take further qualifications

(e) An equal number of men and women plan to take more than six months off after completing their degree.

These hypotheses are tested in the following sections using the results of the national survey.

8.1.2 MALE AND FEMALE CIVIL ENGINEERING STUDENTS AND PREFERRED SECTOR OF INDUSTRY.

The first hypothesis outlined above designed to test an aspect of the difference in career

choice between male and female civil engineering students was;

The choices of sector of industry made by male civil engineering students leaving higher education are different from the choices made by female civil engineering students leaving higher education

A further breakdown of the disciplines used in the First Destination Survey into more specific sectors of industry was used to fully assess the relationship between male and female civil engineering students and their choice of sector of industry. The following results are used to test for differences in choice of sector between female and male civil engineering students.

TABLE 8.1 PERCENTAGE OF MALE AND FEMALE FINAL YEAR CIVIL ENGINEERING STUDENTS ENTERING DIFFERENT SECTORS OF INDUSTRY

Sector of industry	female (%)	male (%)
Local Authority	11.1	10.0
Consultancy	47.2	43.3
Utilities ie gas, water	6.3	3.3
Higher Education	1.4	1.3
Small Contractor (less than 50 employees)	3.5	6.7
Large Contractor	19.4	27.3
Specialist Research Organisation	6.9	2.7
Other	4.2	5.4
Total (N)	144	150

Table 8.1 shows quite clearly that consultancy is the sector of civil engineering preferred by both female and male civil engineering students leaving higher education. The next most preferred option is working for a large contractor. A chi^2 test on these results could not be carried out because the minimum expected frequency value was too low (MEF =

1.595). (Refer to section 6.13.3.1 for details of Minimum Expected Frequencies). Therefore, the data was recoded into five broader sections so that a chi^2 test could be carried out. Table 8.2 illustrates these results.

TABLE 8.2 RECODED DATA RELATIONSHIP BETWEEN THE PREFERRED SECTOR OF INDUSTRY OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS.

	female (%)	male (%)
local authority and utilities	17.4	13.3
consultancy	47.2	43.3
higher education and research organisation	8.3	4.0
small and large contractors	22.9	34.0
others	4.2	5.3
total (N)	144	150

Having recoded the results, a chi^2 test of significance showed that there was no significant difference between the career choice made by male and female final year civil engineering students of the sector of industry ($chi^2 = 0.15580$).

The First Destination Survey results suggested that women enter the group "local authorities and utilities" in consistently higher percentages than male civil engineering students. The results of this questionnaire, although showing no significant differences, suggest that there are some observational differences which are interesting to note. The results of the survey suggest that 17.4% (N= 25) of females chose local authorities and utilities as their preferred sector compared with 13.3% (N= 20) of male civil engineering students leaving higher education. However, the largest difference between male and female civil engineering students can be observed in their choice of large and small contractors (34.0%, N=51 men and 22.9%,

N=33 women, a difference of 11.1%). Other differences in the preferred choice of sector between male and female civil engineering students can also be observed and are interesting to note. The results suggest that women are more likely to enter specialist research organisations than men (table 8.1, 6.9%, N= 10,female, 2.7%, N=4 male), and that women appear to enter consultancy work in slightly higher percentages than men (47.2%, N= 68 and 43.3%, N= 65 respectively).

In conclusion there appears to be no significant difference between the career choices of male and female civil engineering students when the sectors of industries that they chose are examined.

8.1.3 MALE AND FEMALE CIVIL ENGINEERING STUDENTS AND PREFERRED SPECIALISATION

The hypothesis, designed to test another aspect of the difference in career choice of male and female civil engineering students, that of preferred specialisation, was formulated into the following hypothesis which stated;

The choices of specialisation in employment made by male civil engineering students leaving higher education differ from those made by female civil engineering students leaving higher education.

The following table examines the responses to the question of preferred specialisation.

TABLE 8.3 PERCENTAGE OF SPECIALISATION

Specialisation	Female (%)	Male (%)
Structural	19.6	24.7
Materials Technology	1.8	1.2
Construction Management	11.0	17.5
Transportation Engineering	10.4	13.9
Public Health Engineering	9.2	7.2
Hydraulics and Hydrology	10.4	11.4
Geotechnical Engineering	11.7	9.0
Computer Technology	0.6	4.2
Environmental Engineering	11.0	4.2
Other	14.1	6.6
Total (N)	163	166

In the case of the above specialisations, attempting a chi^2 test of significance would be invalid because they contained too low a number of responses, and therefore the minimum expected frequency was too small for the results to be meaningful. These specialisations were materials technology (1.8%, N=3 for female, 1.2 %, N= 2 for male) and computer technology (0.6% N= 1 for female, 4.2% N = 7 for male). These were recoded into category "other". A chi^2 test on the recoded data then showed that there was no significant difference between the sexes in first preferred specialisation (chi^2 = 0.12386). However, on examining Table 8.3 (data before recoding), it could be seen that men are more likely than women to prefer structural engineering as a specialisation (19.6%, N=32 female, 24.7%, N=41, male) although both groups chose this as their main preference. Men were also more likely than women to prefer construction management (17.5%, N=29 men, 11.0%, N=18, women). Women were more likely than men to prefer geotechnical engineering (11.7%, N=19 women, 9.0%, N=15, men), and environmental engineering (11%, N=18 women, 4.2%,

N=7, men). Women were also more likely than men to specify another preference, in the "other" category. Preferences expressed in this section were specialisations such as health and safety, surveying, petroleum engineering, third world engineering, aviation planning and interior design.

Concluding, statistically there is no significant difference between career choice specialisation by the sexes.

8.1.4 THE DIFFERENCE BETWEEN MALE AND FEMALE STUDENTS AND PLANNING TO LEAVE THE INDUSTRY

The analysis of the literature in chapter three suggested that more women than men were likely not to choose employment in engineering. In chapter five this was formulated into the following hypothesis restated at the beginning of this section;

Women are more likely than men to plan to enter an industry other than civil engineering.

The following results and subsequent statistical analysis test this hypothesis.

TABLE 8.4 MALE AND FEMALE CIVIL ENGINEERING STUDENTS AND PLANNING TO ENTER ANOTHER INDUSTRY

	not planning to enter another industry (%)	planning to enter another industry (%)	Number (N)
female	84.9	15.1	166
male	85.6	14.4	167

Table 8.4 shows that the majority of students, both male (85.6%, N=143) and female (84.9%, N=141) were not planning to enter an industry other than the civil engineering. A chi^2 test on these results showed that there were no significant differences between the sexes in this respect (chi^2 sig=0.1824). The results given here support the results in chapter three which

examined the First Destination Survey results and suggest that civil engineering students generally enter building and civil engineering work or local authority and public utility work. Although no significant difference was found in between the sexes in intentions to enter civil engineering, it is interesting to note that of those planning to enter another industry (15.1%, N=25 for female and 14.4%, N=24 for male), there were a variety of industries which they wished to enter. Although the numbers of students wishing to enter another industry was small, there was a noticeable difference between female and male choices of alternative industries. The most common alternative industries for male civil engineers were banking, investment and marketing (2.4%, N=4), accountancy or actuarial work (2.4%, N=4), and the armed forces (army, navy or air force 2.4%, N=4). The most common alternative industries for women were teaching (3.6%, N=6) and management consultancy (3.6%, N=6). A small number of both men and women responded that they planned to enter another industry but were unsure what to change to (women 2.4%, N=4, men 3.6% N=6). Other industries that were cited by respondents in even smaller numbers (fewer than three male and female respondents) were information technology, broadcasting, entertainment and aviation. The First Destination Survey results showed that men graduating with civil engineering were entering accountancy, banking, insurance and other commercial employment in greater percentages than women. The results of this questionnaire survey, although providing very small numbers of students entering these professions, tended to support these results. However, for all respondents answering this question there are no significant differences between the sexes.

Concluding, it appears that both male and female civil engineering students leaving higher education intend to find work in the civil engineering industry and there are no significant differences between the sexes in this respect.

8.1.5 MALE AND FEMALE CIVIL ENGINEERING STUDENTS AND PLANNING TO TAKE FURTHER QUALIFICATIONS

The following section examines the difference between male and female civil engineers in taking further qualifications. Hypothesis (d) stated above was designed to test for any differences. This hypothesis was;

Women are more likely than men to plan to take further qualifications

The following table presents the results of the responses to the questionnaire survey testing this sub-hypothesis.

TABLE 8.5 PERCENTAGE OF MALE AND FEMALE CIVIL ENGINEERS PLANNING TO TAKE FURTHER QUALIFICATIONS

	not planning to take a course to obtain further qualifications (%)	planning to take a course to gain further qualifications (%)	Number (N)
female	74.7	25.3	166
male	67.7	32.3	167

A chi^2 test of significance showed that there was no significant difference between female and male civil engineering students leaving higher education in planning to take a course to obtain further qualifications (chi^2 sig=0.19501). Although no significant difference was apparent, on examining the table above, it can be seen that a slightly higher percentage of men than women (men 32.3%, N=54, women 25.3%, N=42) were planning to take courses to obtain further qualifications. Further analysis of these results can be found in the following table which examines the types of courses that students are planning to take.

TABLE 8.6 TYPES OF COURSES STUDENTS WERE PLANNING TO ATTEND.

further courses	female (%)	male (%)
MSc related to civil engineering	14.5	12.6
masters course unspecified	3.0	5.4
Post Graduate Certificate in Education (teaching)	3.6	0.6
yes but undecided	1.2	1.8
MSc architecture	0.6	0
Information Technology	0.6	0.6
MBA business course or accountancy	0.6	6.6
PhD	1.2	4.8
total (N)	42	54

The most common courses that were chosen by both male and female civil engineering students were MSc courses related to civil engineering (14.5% N= 24 female, 12.6% N=21 male). There were distinct variations between male and female civil engineering students in four categories. These were Post Graduate Certificate in Education (3.6% N=6 female, 0.6%, N=1 male), unspecified masters courses (3.0%, N=5, female and 5.4% N=9 male), MBA business course or accountancy (0.6%, N=1 female and 6.6 %, N=11 male) and PhD (1.2% N=2 female and 4.8% N=8 male). Some of these results correspond with the results presented in section 8.1.4, where it was observed that women were more likely to enter teaching as an alternative industry and men were more likely to enter accountancy or actuarial employment and banking, investment or marketing employment.

It is clear from the results that the differences between the proportion of male and female civil engineering students planning to take further qualifications are not significant.

8.1.6 MALE AND FEMALE STUDENTS: DIFFERENCES IN TAKING TIME OFF

As discussed in chapter five and stated above the following hypothesis was formulated which was designed to test for differences in male and female civil engineering students in taking time off after their degree;

An equal number of men and women plan to take more than six months off after completing their degree.

The following table examines the differences between male and female civil engineering students in taking time off after their degree.

TABLE 8.7 DIFFERENCES BETWEEN MALE AND FEMALE STUDENTS IN TAKING TIME OFF

Sex	are taking time off (%)	are not taking time off (%)	Number (N)
female	59.6	40.4	166
male	62.3	37.7	167

Table 8.7 shows that both male (62.3%, N= 103) and female (59.6%, N=99) civil engineering students leaving higher education plan to take some time off after their degree. A chi^2 test showed that there was no significant difference between male and female students in taking time off after their degrees (chi^2 sig=0.70331). Table 8.7 indicated that over half of both male and female students stated that they were going to take time off after their degree. The main activities during this time off were for travelling and holidays (26.5%, N=44 female, 32.3%, N=54 male). Alternative main activities were voluntary work (6.6 %, N=11 female, 1.8%, N=3 male) or learning a language abroad (2.4%, N=4 female,

1.2%, N=2 male).

TABLE 8.8 EXPECTED DURATION OFF

sex	Duration					Number (%)
	no time off or unspecified duration (%)	three months or less (%)	three to six months (%)	six to twelve months (%)	more than twelve months (%)	
female	68.7	16.3	4.2	8.4	2.4	166
male	66.5	19.8	5.4	6.6	1.8	167

Of those who were taking time off and who had specified a duration (results presented in table 8.8), the most frequent duration was three months or less for both females (16.3%, N=27) and males (19.8%, N=33).

In summary, there appears to be no significant difference between male and female civil engineering students in taking time off after the completion of their degree. A high percentage of both male and female civil engineering students are likely to take time off after their degree, the most common length of time being three months or less.

8.1.7 SUMMARY OF FINDINGS ON CAREER CHOICE OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS LEAVING HIGHER EDUCATION IN RELATION TO THE SUB-HYPOTHESIS FOR THIS SECTION.

The sub-hypothesis stated for this section of the research was;

Male and female civil engineering students leaving higher education make different

career choices.

This hypothesis is disconfirmed

The evidence presented from this questionnaire survey shows that there were no significant differences in career choices of male and female civil engineering students leaving higher education. A variety of factors were tested. There were no significant differences between the sexes in the choice of sector of industry and specialisation. Nor were there any significant differences between the sexes in intention to leave the industry and decisions to take further qualifications and time off on completing their degrees. Hence the hypothesis is disconfirmed. A more detailed discussion of these results in relation to the main hypothesis can be found in chapter eleven.

SECTION TWO: THE PROCESS OF SECURING EMPLOYMENT

8.2 INTRODUCTION

In the last section, the differences in the career choices of male and female civil engineering students leaving higher education were examined. The conclusion was that there were no significant differences in the career choices made by male and female civil engineering students leaving higher education. This section examines the second aspect of the main hypothesis, that of the process of securing employment, in order to investigate whether there is a difference in the path to securing employment between male and female civil engineering students leaving higher education.

In exploring the differences in the ways male and female civil engineering students choose employment through the literature and interviews discussed in chapter three, detailed

investigation was warranted which would examine whether there were differences in the process of securing employment. The impression gained from interviews discussed in chapter three with male and female civil engineering students indicated that there might be differences between male and female civil engineering students and the process of securing employment.

From these interviews, hypotheses were derived to test the relationship between the sexes and process of securing employment. The testing of these hypotheses form the basis of this section.

8.2.1 THE HYPOTHESES RESTATED

The hypotheses examining the relationship between the sexes and the process of securing employment were developed in chapter five. This section restates the sub-hypothesis for this section together with more specific minor sub-hypotheses derived to test aspects of this sub-hypothesis.

The sub-hypothesis for this section is:

The process of securing employment differs between men and women

The minor sub-hypotheses for this section are:

(a) Men make fewer applications per job offered than women

(b) Both male and female civil engineering students make use of careers services at college.

(c) Men are more likely than women to use friends to find out information about employment opportunities.

(d) Women are more likely than men to use family to find out information about

employment opportunities

(e) The level of use of engineering journals to find out information about employment opportunities is similar for male and female civil engineering students.

(f) Women are more likely than men to use alternative types of careers information

(g) Women use more career sources than men to find information about employment opportunities.

The following sections test the above hypotheses in order to draw conclusions about the sub-hypothesis and to contribute to the discussion about the main hypothesis.

8.2.2 THE DIFFERENCES BETWEEN THE SEXES IN THE NUMBER OF APPLICATIONS PER JOB OFFERED

Hypothesis (a) above stated;

Men make fewer applications per job offered than women

In order to test this hypothesis, the following tables are provided and explained.

TABLE 8.9 NUMBER OF JOB APPLICATIONS OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS

	none (%)	1-5 (%)	6-10 (%)	11-15 (%)	over 15 (%)	Number
female	30.7	16.9	23.5	10.8	18.1	166
male	37.1	16.2	11.9	10.2	24.6	167

Table 8.9 shows the number of job applications of male and female civil engineering

students. Examining this table, it can be seen that more male (37.1%, N=62) civil engineering students than female (30.7%, N=51) civil engineering students made no job applications. Similarly, more male (24.6%, N=41) civil engineering students than female (18.1%, N=30) civil engineering students made over fifteen job applications. However, a chi^2 test of significance on the results showed that there was no significant difference between the sexes in the number of job applications (chi^2 sig = 0.6268).

The following table examines the number of job offers of male and female civil engineering students, and uses a chi^2 statistics test to examine whether there is a difference between them in respect of the number of jobs offered.

TABLE 8.10 NUMBER OF JOB OFFERS OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS

	none (%)	one (%)	two (%)	three or more (%)	Number (N)
female	63.9	25.9	6.0	4.2	166
male	59.3	27.5	5.9	7.2	167

Examining table 8.10, it can be seen that more female (63.9%, N=106) civil engineering students than males (59.3%, N=99) received no job offers. The table also shows that more male (7.2 %, N=12) civil engineering students than female (4.2%, N=7) civil engineering students received three or more job offers. However, a chi^2 test of significance on the results showed that there was no significant difference between the sexes in the number of job offers received (chi^2 sig = 0.64393).

Having established these results, the following table gives the mean number of job applications and mean number of job offers of male and female civil engineering students, together with their mean number of job applications per job offer.

TABLE 8.11 MEAN NUMBER OF JOB APPLICATIONS, JOB OFFERS AND JOB APPLICATIONS PER JOB OFFERS OF MALE AND FEMALE CIVIL ENGINEERING STUDENTS.

	mean number of job applications (1)	mean number of job offers (2)	mean number of job applications per job offers (1)/(2)	number (N)
female	9.4578	0.5361	17.6419	166
male	9.5749	0.6407	14.9444	167

Table 8.11 indicates that, over the whole sample, men on average tend to make slightly more job applications than women (mean numbers 9.5749 and 9.4578 respectively) and men also seem, on average, to receive slightly more job offers than women (mean numbers 0.6407 and 0.5361 respectively). Having established this, column four table of 8.14 shows the mean number of job applications per job offer for the whole sample. It shows that women appear to make 2.6975 (17.6419 - 14.9444) more job applications per job offer than men.

However, in order to test the significance of this difference, only those students who had received any job offers could be considered (this was because the actual calculation of job applications per job offer of each case often resulted in the division by zero). All those cases where there were no job offers, 205 (106 female, 99 male) were reported by the statistical analysis as missing in order that the analysis could be carried out. Therefore in order to test for significance, using the Mann-Whitney test, only those with job offers were used.

Table 8.12 presents the results considering only those men and women who received job offers.

TABLE 8.12 MEAN NUMBER OF JOB APPLICATIONS PER JOB OFFER OF THOSE RESPONDENTS WHO RECEIVED JOB OFFERS.

	mean number of job applications per job offer	Number of respondents with any job offers
female	7.6650	60
male	5.6422	68

Table 8.12 shows that when job applications per job offer are calculated, taking into account only those who have received job offers, women still make 2.0232 (7.6650 - 5.6422) more job applications per job offer than men. A Mann-Whitney test on these results showed that there was a significant difference between the sexes in the number of job application per job offer (M-W sig=0.0453). The evidence suggests that women make more job applications per job offer than men. Results of the survey examining the sources of job information used by the students, including combinations of sources, are considered in the next section.

Concluding then, it appears from these results that there is a significant difference in the number of job applications per job offer between male and female civil engineering students. The evidence suggests that women make on average two more job applications per job offer than men.

8.2.3 THE DIFFERENCES BETWEEN MALE AND FEMALE STUDENTS IN THEIR USE OF THE CAREERS SERVICE AT COLLEGE

Hypothesis (b) of this section stated;

Both male and female civil engineering students make use of careers services at college.

In interviews with male and female civil engineering students, the use of careers services at

college was discussed. It seemed that the use of these services at college appeared to be the most common method of finding information about employment opportunities for both male and female students. The following table presents the results of the relationship between male and female civil engineering students in their use of careers services at college.

TABLE 8.13 USE OF CAREERS SERVICE AT COLLEGE

	did not use careers service at college (%)	did use careers service at college (%)	Number (N)
female	23.5	76.5	166
male	28.9	71.1	167

The results suggest that both female and male civil engineering students do indeed make use of careers services at college (76.5 %, N=127 female and 71.1 %, N=119). A chi^2 test on the results revealed that there was no significant difference between male and female civil engineering students in the use of careers service (chi^2 sig = 0.33439).

This appears to confirm earlier results from the discussions showing that the majority of students, male and female, make use of careers services at college.

Concluding then, it seems that the majority of both male and female civil engineering students leaving higher education make use of careers services, and that there is no significant difference between the sexes in this respect.

8.2.4 THE DIFFERENCES BETWEEN MALE AND FEMALE STUDENTS IN THEIR USE OF FRIENDS TO FIND INFORMATION ABOUT EMPLOYMENT

Hypothesis (c) for this section stated;

Men are more likely than women to use friends to find out information about employment opportunities.

For some students, family and friends were used to find out about employment opportunities. The impression given from discussions with civil engineering students was that men were more likely than women to use friends to find out about employment opportunities. This hypothesis is tested in this section. The following table examines the relationship between male and female civil engineering students in the use of friends as a source of employment information.

TABLE 8.14 DIFFERENCE BETWEEN MALE AND FEMALE CIVIL ENGINEERING STUDENTS IN THE USE OF FRIENDS AS A SOURCE OF EMPLOYMENT INFORMATION.

	did not use friends (%)	did use friends (%)	Number (N)
female	69.9	30.1	166
male	68.3	31.7	167

The results suggest that almost a third of female and male civil engineering students make use of friends to find out about employment opportunities (30.1 %, N=50 female and 31.7 %, N=53 male). A chi^2 test on the results revealed that there was no significant difference between the sexes in the use of friends for information about employment opportunities (chi^2 sig = 0.84113).

This does not appear to confirm earlier impressions where it was indicated that men were more likely than women to use friends to find out about employment opportunities.

Concluding then, it seems that almost a third of both male and female civil engineering students leaving higher education make use of friends to find out about employment opportunities and there is no significant difference between the sexes in this respect.

8.2.5 THE DIFFERENCES BETWEEN THE SEXES IN THEIR USE OF FAMILY TO FIND OUT ABOUT EMPLOYMENT OPPORTUNITIES

Hypothesis (d) for this section stated;

Women are more likely than men to use family to find out information about employment opportunities

As mentioned in section 8.2.4, the impression gained from civil engineering students was that some of them received information about job opportunities from family and friends. In addition to this, it appeared that women were more likely than men to use family to find out about employment opportunities. The following table examines the relationship between female and male civil engineering students in the use of families as a source of employment information.

TABLE 8.15 THE DIFFERENCES BETWEEN FEMALE AND MALE STUDENTS IN THE USE OF FAMILY TO FIND OUT ABOUT CAREERS INFORMATION.

	did not use family (%)	did use family (%)	Number (N)
female	76.5	23.5	166
male	74.3	25.7	167

The results of table 8.15 suggest that almost a quarter of both female and male civil engineering students make use of their families to find out about employment opportunities (23.5 %, N=39 female and 25.7 %, N=43 male). A chi^2 test on the results revealed that there was no significant difference between the students of both sexes in the use of family to find out about employment opportunities (chi^2 sig = 0.72613).

This does not confirm earlier impressions where it appeared that women were more likely

than men to use family to find out about employment opportunities.

Concluding then, it seems that both male and female civil engineering students leaving higher education make use of family to find out about employment opportunities in almost equal percentages and there is no significant difference between the sexes in this respect.

8.2.6 THE DIFFERENCE BETWEEN THE SEXES IN THE USE OF ENGINEERING JOURNALS

Hypothesis (e) for this section stated;

> **The level of use of engineering journals to find out information about employment opportunities is similar for male and female civil engineering students.**

The following results and subsequent statistical analysis test this hypothesis.

TABLE 8.16 DIFFERENCES BETWEEN THE SEXES IN THE USE OF ENGINEERING JOURNALS

	did not use journals (%)	did use journals (%)	Number (N)
female	49.4	50.6	166
male	55.1	44.9	167

Both female and male civil engineering students said, during preliminary discussions, that they used engineering journals as a source for finding out about employment opportunities (50.6%, N=84, 44.9%, N=75 respectively). The most frequently used journal, accounting for 28.9% (N= 48, female) and 26.3% (N= 44, male) was the New Civil Engineer, journal of the Institution of Civil Engineers. The Structural Engineer, journal of the Institution of Structural Engineers, was used by only a few students (3.0% N=5, female and 1.2%, N=2

male). Some students stated that they did use journals but did not specify titles (18.7%, N=31 female and 17.4%, N=29 male).

A chi^2 test on the results showed that there was no significant difference between the sexes in the use of engineering journals (chi^2 sig = 0.35233).

Concluding then, it seems that a large percentage of both male and female civil engineering students leaving higher education make use of engineering journals to find out about employment opportunities and there are no significant differences between the sexes in this respect.

8.2.7 USE OF OTHER SOURCES OF CAREERS INFORMATION

Hypothesis (f) for this section stated;

Women are more likely than men to use other types of careers information

There are many other ways of finding information about employment opportunities. In the initial stages of the research, it seemed that some students choose other sources such as newspapers and personal contacts to gather information about employment opportunities. The following table indicates the extent to which male and female civil engineering students used other sources to find out about employment opportunities. The subsequent table shows what these other sources were.

TABLE 8.17 DIFFERENCES BETWEEN THE SEXES IN THE USE OF OTHER CAREERS INFORMATION.

	did not use other sources (%)	did use other sources (%)	Number (N)
female	66.9	33.1	166
male	72.5	27.5	167

A chi^2 test on the results presented in table 8.17 showed that there was no significant difference between the sexes in the use of other sources to find out about employment opportunities (chi^2 sig = 0.32225).

Of those who specified use of other careers information, the following table shows the use of additional ways of finding out about employment opportunities.

TABLE 8.18 OTHER CAREERS INFORMATION USED

	female (%)	male (%)
no other careers service used	66.9	72.5
Civil engineering careers literature, Newspapers, General graduate careers literature	23.5	17.9
past work contacts, personal inquires to companies	7.8	6.6
visits from companies to college, lecturers at college	1.8	3.0
Total (N)	166	167

Table 8.18 confirms some of the impressions given in the initial stages of the research, ie students use other sources such as newspapers and personal inquiries. It also shows that neither visits to colleges by companies nor lecturers at college were mentioned often as alternative information sources. By far the most frequently mentioned additional methods of finding employment opportunities were careers literature, specific or general, together with newspapers (23.5% N=39, female, 17.9%, N=30 male). **Concluding then, about a third of both male and female civil engineering students use other types of careers sources, the most frequent being specific and general careers literature together with newspapers. However, there appears to be no significant difference between the sexes in their use of alternative sources.**

8.2.8 COMBINED USE OF CAREER SERVICES

Hypothesis (g) for this section stated;

Women use more career sources than men to find information about employment opportunities.

It is rarely the case that students use only one source for information about employment opportunities. The results of the previous sections show that the most frequently used source for finding out about employment opportunities was the careers service at college (used by 76.5% N=127 of females and 71.1%, N=119 of males). The next most frequently used careers information source, ahead of family and friends and other sources, was engineering journals (used by 50.6%, N=84 females and 44.9%, N=75 of males). Friends and other sources were used by about thirty percent of students (friends 30.1%, N=50 female, 31.7%, N=53 male; Other sources; 33.1%, N=55 female, and 27.5%, N=46 male). Finally, family seemed to be the least frequently used source, accounting for about a quarter of students (23.5%, N=39 female, 25.7%, N=43 male). It is clear from these results that many students are using more than one source of information. This section combines the results of the five previous sections (use of careers service at college, friends, family, engineering journals, other sources) to discover how many sources students tend to use. The following table presents these results.

TABLE 8.19 OVERALL USE OF CAREERS SOURCES

	used none (%)	used one (%)	used two (%)	used three (%)	used four (%)	used five (%)	Number (N)
female	7.2	27.1	29.5	21.1	10.8	4.3	166
male	10.2	30.5	25.2	17.9	14.4	1.8	167

The table shows that a higher percentage of women (29.5%, N=49) than men (25.2%, N=42) tend to use two sources. Similarly, a higher percentage of women (21.1 %, N=35) than men (17.9%, N=30) tend to use three sources, as was the case with five sources (4.3% N=7 female, 1.8%, N=3 male). However, a higher percentage of men (14.4%, N=24) than women (10.8%, N=18) tend to use four sources. Also, a higher percentage of men than women tend to use only one source (30.5%, N=51 male, 27.1%, N=45 female). The most frequent number of information sources used by women was two (29.5%, N=49) and the most frequent number of sources used by men was one (30.5%, N=51).

A chi^2 test on the results showed that there was no significant difference between the sexes in number of careers information sources used (chi^2 sig = 0.45768).

In summary then, there was no significant difference between the sexes in frequency of careers sources used.

8.2.9 SUMMARY OF THE FINDINGS IN RELATION TO THE HYPOTHESIS ABOUT THE PROCESS OF SECURING EMPLOYMENT TESTED IN THIS SECTION

The sub-hypothesis stated;

The process of securing employment differs between men and women

This hypothesis is disconfirmed. It is clear from the results presented in this section that, with one exception,there are no significant differences between the sexes in the process of securing employment. The exception is to be found in the result that women make on average two more job applications per job offer than men. In the other results designed to test this hypothesis - use of careers service, use of friends, use of family, use of engineering journals, use of alternative information sources and number of sources used - there were no significant

differences between the sexes. Hence the hypothesis is disconfirmed. For a more detailed discussion of these results in relation to the main hypothesis see chapter eleven.

SECTION THREE: IMPORTANT FACTORS IN DETERMINING FIRST EMPLOYMENT

8.3 INTRODUCTION

The previous sections of this chapter concentrated on two aspects of employment choice. Section one examined the relationship between the sexes and choice of employment and concluded that there were no significant differences between male and female civil engineering students in career choice. Section two examined the relationship between the sexes in securing employment. It concluded that the actual process of securing employment did not differ significantly between the sexes. The final section of this chapter examines the factors which are important in determining the choice of first employment for male and female civil engineering students leaving higher education.

The review of the literature in chapter three discussed some of the factors which appear to be important to male and female engineers in choosing employment. Results of one survey suggested that females placed more emphasis on training and the quality of the company whereas males placed more emphasis on salary and promotion. From the literature and interviews the following sub-hypothesis and minor sub-hypotheses were derived to test whether members of one sex differed from members of the other in the factors they considered important when choosing their first employment. The results of this section will then contribute to the main hypothesis for this chapter, that of testing the differences in the

employment choices made by male and female civil engineering students.

8.3.1 THE HYPOTHESES RESTATED

The sub-hypothesis and minor sub-hypotheses for this section examining the differences between important factors in choosing first employment in the sexes were developed in chapter five. This section restates these hypotheses.

The sub-hypothesis is;

Male and female civil engineering students leaving higher education find different factors important when choosing their first employment

The minor sub-hypotheses developed in chapter five and used in this section to test the sub-hypothesis are;

(a) When choosing their first employment, the location of the organisation is more important to female than to male civil engineering students.

(b) When choosing their first employment, the opportunity to travel is more important to men than to women.

(c) When choosing their first employment, some employment benefits are more important to one sex than to the other.

(d) When choosing first employment, the level of importance placed on the type of work differs between men and women.

(e) When choosing their first employment, the level of importance of the type of organisation is different for male and female students.

The remainder of this section tests the above hypotheses.

8.3.2 DIFFERENCE IN THE IMPORTANCE TO MALE AND FEMALE STUDENTS OF THE LOCATION OF EMPLOYMENT

Hypothesis (a) above stated;

When choosing their first employment, the location of the organisation is more important to female than to male civil engineering students.

As discussed in chapter five, when the research problem for this section was originally derived, it became apparent that the importance of the location of first employment differed between men and women. The following table shows how the importance of the location of first employment near to family and to friends differed between male and female students.

TABLE 8.20 THE IMPORTANCE OF LOCATION TO MALE AND FEMALE STUDENTS

Importance of the following in choosing first employment		very important (%)	somewhat important (%)	neutral (%)	not very important (%)	not important (%)	N
location of organisation to family	female	15.7	26.5	18.7	19.3	19.9	166
	male	6.6	21.0	25.1	21.6	25.7	167
location of organisation to close friends	female	11.4	41.6	18.1	17.5	11.4	166
	male	4.8	25.7	29.9	19.8	19.8	167

Table 8.20 shows that the location of an organisation near to family is a more important factor in choosing first employment for women [42.2% (15.7% + 26.5%)] than for men [27.6% (6.6% + 21.0%)]. A Mann-Whitney test on the results showed that there was a significant difference between the sexes in stating whether location of organisation near to the family is important (M-W sig=0.0225). Women were significantly more likely to state that location of an organisation near to family was an important factor in choosing first employment.

Considering friends, it can be seen from table 8.23 that women [53 % (11.4% + 41.6%)] again are more likely to consider the location of the organisation near to close friends as more important than are men [30.5% (4.8% + 25.7%)]. Again, this result in significant, as a Mann-Whitney test revealed (M-W sig = 0.0002). Women are significantly more likely than men to consider the location of an organisation to close friends as an important factor in choosing their first employment.

The results correspond to earlier findings in the interviews in which it appeared that there was a difference between the sexes in finding location of an organisation near to family and friends important.

Concluding then, the results suggest that, when choosing their first employment, the importance of location of the organisation is different for male and female students. Women are significantly more likely than men to consider location of organisation to family and friends as an important factor in this decision.

8.3.3 THE IMPORTANCE OF TRAVEL TO MALE AND FEMALE STUDENTS

Hypothesis (b) for this section stated;

When choosing their first employment, the opportunity to travel is more important to men than to women.

As discussed in chapter five, when deriving the research problem for this section, it became apparent that the importance of travel opportunities available in the first employment was different for male and female students. In particular, the opportunity to travel, in the UK and overseas, seemed to be more important to men than women. The following table shows the difference between the sexes of the importance of the opportunity to travel.

TABLE 8.21 RELATIONSHIP BETWEEN THE SEXES OF THE OPPORTUNITY TO TRAVEL

Importance of the following in choosing first employment		very important (%)	somewhat important (%)	neutral (%)	not very important (%)	not important (%)	N
opportunity to travel in the uk	female	24.7	28.3	27.1	12.7	7.2	166
	male	14.4	26.3	35.3	13.2	10.8	167
opportunity to travel overseas	female	36.1	27.7	19.9	7.2	9.0	166
	male	28.7	26.3	28.1	9.0	7.8	167

Table 8.21 shows that the opportunity to travel in the United Kingdom is a more important factor for women [53.0% (24.7% + 28.3%)] than men [40.7% (14.4% + 26.3%)] in choosing first employment. A Mann-Whitney test on the results showed that there was a significant difference between the sexes in the importance attached to the opportunity to travel in the UK (M-W sig=0.0173). Women were significantly more likely to state that the opportunity to travel in the U.K was an important factor in choosing first employment.

Considering travel overseas, it can be seen from table 8.24 that women [63.8 % (36.1% + 27.7%)] are again more likely to consider the opportunity to travel, in this case overseas, as a more important factor than are men [55.0% (28.7% + 26.3%)]. However, the result was not significant, as a Mann-Whitney test revealed (M-W sig= 0.1487). It seems that both men and women are likely to find having the opportunity to travel overseas an equally important factor in choosing their first employment.

The results do not appear to correspond to earlier findings in the interviews, where it was tentatively concluded that men were more likely than women to consider travel as an important factor in choosing their first employment.

Concluding then, it seems that, when choosing their first employment, the importance of the opportunity to travel does differ between the sexes. Women are significantly more likely than men to consider the opportunity to travel in the UK as an important factor.

However, it seems that both men and women are equally likely to find having the opportunity to travel overseas an important factor in choosing their first employment.

8.3.4 THE IMPORTANCE OF EMPLOYMENT BENEFITS TO MALE AND FEMALE STUDENTS

Hypothesis (c) for this section stated;

When choosing their first employment, some employment benefits are more important to one sex than to the other.

As discussed in chapter five, deriving the research problem for this section, it became apparent that the importance of various employment benefits seemed to differ between the sexes. In particular, child care policies appeared to be more important to women than to men, whereas salary seemed to be more important to men than to women.

The following table shows the importance of various benefits to male and female students.

TABLE 8.22 RELATIONSHIP BETWEEN THE SEXES OF THE IMPORTANCE OF EMPLOYMENT BENEFITS

Importance of the following in choosing first employment		very important (%)	somewhat important (%)	neutral (%)	not very important (%)	not important (%)	N
salary is important	female	16.3	50.0	16.9	14.5	2.4	166
	male	20.4	57.5	14.4	4.8	3.0	167
benefits like company car	female	13.3	31.9	28.3	18.7	7.8	166
	male	9.0	22.8	40.7	15.0	12.6	167
pension plan	female	13.3	35.5	32.5	12.0	6.6	166
	male	8.4	32.3	36.5	9.6	13.2	167
child care policies and programmes	female	28.3	33.1	23.5	8.4	6.6	166
	male	2.4	10.2	36.5	20.4	30.5	167

Table 8.22 shows that salary is a more important factor in choosing first employment for men [77.9% (20.4% + 57.5%)] than women [66.3% (16.3% + 50.0%)] although these results suggest that for the majority of both sexes, salary appeared to be an important factor in choosing a first job. A Mann-Whitney test on the results showed that there was a significant difference between the sexes in stating that salary was important (M-W sig=0.0225). Men were significantly more likely to state that salary was an important factor in choosing first employment.

Considering benefits like having a company car, it can be seen from table 8.25 that women [45.2 % (13.3% + 31.9%)] were more likely to consider such benefits as a more important factor in choosing first employment than were men [31.8% (9.0% + 22.8%)]. However, the result was not significant, although they came close to it, as a Mann-Whitney test revealed (M-W sig=0.0542). It seems that both men and women are equally likely to find having benefits like a company car an important factor in choosing their first employment.

Further benefits were considered, namely pension plan and child care policies and programmes. On examining table 8.22, it can be seen that having a pension plan is important to under half of both male and female civil engineering students although it appears to be a more important factor in choosing first employment for women [48.8% (13.3% + 35.5%)] than men [40.7% (8.4% + 32.3%)]. A Mann-Whitney test on the results showed that there was no significant difference between the sexes in stating that having a pension plan was important in choosing first employment (M-W sig=0.0719).

For child-care policies and programmes, over half of women [61.4% (28.3% + 33.1%)] compared to just over a tenth of men [12.6% (2.4% + 10.2%)] stated that it was an important factor in choosing their first employment. A Mann-Whitney test on the results showed that there was a significant difference between the sexes in stating that child care

policies and programmes were important in choosing first employment (M-W sig=0.0000). It seems that women were significantly more likely to state that these policies and programmes were important considerations in choosing first employment.

The results appear to confirm earlier results in the interviews where it was seemed that women were much more likely than men to consider child care policies an important factor in choosing their first employment.

Concluding then, the results suggest that, when choosing their first employment, the importance of employment benefits varies between male and female students. Women are more likely than men to consider child-care policies and programmes an important factor in their decisions about first employment. Men, on the other hand, are more likely than women to consider salary as an important factor in choosing first employment. However, the results show that both men and women are equally likely to find benefits like a company car and pension plans as important factors in choosing their first employment.

8.3.5 THE IMPORTANCE OF THE TYPE OF WORK TO MALE AND FEMALE STUDENTS

Hypothesis (d) for this section stated;

When choosing first employment, the level of importance placed on the type of work differs between the men and women.

Both male and female civil engineering students, when asked what features of a job were important to them, mentioned aspects of the work which were particularly important. This section examines how the importance attached to these aspects differs between male and

female civil engineering students.

The following table provides the results of the questions testing the importance of the type of work to male and female students.

TABLE 8.23 IMPORTANCE OF TYPE OF WORK TO MALE AND FEMALE STUDENTS

		very important (%)	somewhat important (%)	neutral (%)	not very important (%)	not important (%)	N
opportunity to do interesting work	female	74.1	24.7	1.2	0.0	0.0	166
	male	69.5	28.1	1.8	0.6	0.0	167
opportunity to do varied work	female	65.7	30.7	1.2	1.8	0.6	166
	male	59.3	29.9	8.4	2.4	0.0	167
organisations training programme for graduates	female	74.1	20.5	4.8	0.6	0.0	166
	male	64.7	24.0	6.6	2.4	2.4	167
opportunity for quick advancement to management	female	21.1	44.6	24.1	9.6	0.6	166
	male	28.7	43.7	15.0	9.0	3.6	167
ethical considerations about the type of work	female	17.5	36.7	28.3	10.8	6.6	166
	male	7.8	25.7	44.3	10.2	12.0	167
involvement in new development	female	19.3	49.4	24.7	4.8	1.8	166
	male	11.4	47.9	32.9	3.6	4.2	167

Table 8.23 shows that the opportunity to do interesting work and the opportunity to do varied work are rated as important by both female and male civil engineering students [opportunity to do interesting work, female; 98.8% (74.1% + 24.7%), male; 97.6% (69.5 + 28.1), opportunity to do varied work, female; 96.4% (65.7% +30.7%), male; 89.2% (59.3%+ 29.9%)]. A Mann-Whitney test of these results showed that there was no significant difference between the sexes when it came to stating that the opportunity to do interesting work was important (M-W sig=0.3234), or that the opportunity to do varied work was

important (M-W sig=0.1194). The evidence from the results suggest that both men and women considered having the opportunity to do interesting and the opportunity to do varied work as important factors when choosing their first employment.

According to preliminary findings, an organisation's training policies for graduates was a feature of employment that appeared to be important. It appears that this is the same for the whole sample in the survey. 94.6% (74.1% +20.5%) of female and 88.7% (64.7% + 24.0%) of males considered the organisation's training programme for graduates as important.

Opportunities for quick advancement to a management position was also seen by both male and female students as important. The survey results showed that 65.7% (21.1% +44.6%) of females and 72.4% (28.7% + 43.7%) of males thought it was important. A Mann-Whitney test on these results showed that there was no significant difference between the sexes in stating that opportunity for quick advancement to a management position was important (M-W sig=0.1504).

Two other aspects of the work which were raised in the preliminary investigations were considered in the survey. These were ethical considerations about the type of work, and being involved in new developments.

For the first aspect, finding ethical considerations about the type of work important, it appears that more female than male civil engineering students find this important [female, 54.2% (17.5% + 36.7%) male, 33.5% (7.8% +25.7%)]. A Mann-Whitney test on these results showed that there was a significant difference between the sexes when it came to finding ethical considerations about the type of work important (M-W sig=0.0004). Women were significantly more likely to consider this important in their decision to choose their first employment.

On examining table 8.23, it can be seen that being involved in new developments is important to over half of both male and female civil engineering students [male, 59.3% (11.4% + 47.9%) female, 68.7% (19.3% +49.4%)]. It appears, though, that being involved in new developments it is significantly more important for women than men (M-W sig=0.0281). The above results appear to confirm earlier results in the interviews where it was seen that certain factors relevant to employment were important to both male and female civil engineering students leaving higher education. In particular, these factors were the opportunity to do interesting work and the opportunity to do varied work, together with an organisation's training programmes for graduates and the opportunity for quick advancement to a management position. In addition to these results it appears that women are more likely than men to rate ethical considerations about the type of work and involvement in new developments as important.

Concluding then, it seems that there exists some differences between male and female civil engineers leaving higher education in the factors considered important in choosing the type of work. However, both male and female were equally likely appear to consider four factors of the work of importance, namely, the opportunity to do varied work, the opportunity to do interesting work, the training program for graduates and the opportunity for quick advancement to a management position.

8.3.6 IMPORTANCE TO MALE AND FEMALE STUDENTS OF THE TYPE OF ORGANISATION

Hypothesis (e) for this section stated;

When choosing their first employment, the level of importance of the type of

organisation is different for male and female students.

The following table presents the results of the analysis of the questionnaire concerning the importance of various factors about the choice of organisation. Certain features of an organisation appear to be important to men and not women and vice versa. The following results, and subsequent tests on the results, examine the importance to male and female students of the importance of the type of organisation.

The table shows that the working environment is rated as important by a high percentage of both female and male civil engineering students [female; 92.2% (45.2% + 47.0%), male; 85.0% (36.5 + 48.5)]. A Mann-Whitney test on these results showed that women were significantly more likely than men to consider the working environment important (M-W sig=0.0359), although the results show that both sexes rate it as important.

TABLE 8.24 THE IMPORTANCE TO MALE AND FEMALE STUDENTS OF THE TYPE OF ORGANISATION.

		very important (%)	somewhat important (%)	neutral (%)	not very important (%)	not important (%)	N
the working environment	female	45.2	47.0	6.6	1.2	0.0	166
	male	36.5	48.5	10.8	2.4	1.6	167
size of organisation	female	9.0	50.0	23.5	11.4	6.0	166
	male	10.8	26.3	43.1	12.6	7.2	167
prestige of job title	female	13.9	21.1	36.7	15.1	13.3	166
	male	7.8	23.4	32.3	21.0	15.6	167
prestige of organisation	female	16.3	39.8	24.1	13.3	6.6	166
	male	13.2	31.7	33.5	9.0	12.6	167
percentage of women engineers in the organisation	female	2.4	15.7	32.5	23.5	25.9	166
	male	4.8	12.0	49.7	9.0	24.6	167

Examining table 8.24, it seems that the size of the organisation is more important to women than men. 59.0% (9.0% + 50.0%) of women compared to 37.1% (10.8% +26.3%) of men said it was important when choosing their first employment. A Mann-Whitney test revealed that there was a significant difference between the sexes in stating that the size of the organisation was important (M-W sig= 0.0076). Women were more likely to respond that the size of the organisation was important.

Prestige of job title and prestige of the organisation were considered important by less than half of the sample [prestige of job title, female: 35.0% (13.9% + 21.1%), male: 31.2% (7.8% + 23.4%); prestige of organisation, female: 56.1% (16.3% +39.8%), male: 44.9% (13.2%+ 31.7%)]. A Mann-Whitney test on these results showed that there was no significant difference between the sexes when it came to stating that prestige of job title was important (M-W sig=0.1325), or that prestige of the organisation was important (M-W sig = 0.0809).

Finally, the percentage of women engineers in the organisation was considered equally important by both male and female civil engineering students. A Mann-Whitney test showed no significant difference between the sexes in finding the percentage of women engineers in the organisation important (M-W sig =0.1211), although fewer than half thought that it was an important consideration in choosing first employment female; 18.1% (2.4% + 15.7%), male; 16.8% (4.8%+ 12.0%).

The above results appear to confirm earlier results in the interviews where it was apparent that some factors in the type of organisation were important to both male and female civil engineering students leaving higher education, and some appeared to be of more importance to one sex than to the other. In particular it seems that the working environment and the size of the organisation are more important to women than men. Prestige of job title and prestige

of organisation does not appear to be really important to either male or female civil engineers. This is the same for the percentage of women in the organisation, where fewer than half of male and female civil engineers stated that it was an important consideration in their decision to choose their first employment.

Concluding then, it seems that some significant differences do exist between male and female civil engineers leaving higher education in features of the type of organisation considered important. In addition, three features of the type of organisation of importance to the lowest percentage of students were the prestige of job title, prestige of organisation and the percentage of women engineers in the organisation.

8.3.7 SUMMARY OF THE FINDINGS IN RELATION TO THE SUB-HYPOTHESIS TESTED IN THIS SECTION ABOUT DIFFERENCES BETWEEN THE SEXES IN IMPORTANT FACTORS IN CHOOSING FIRST EMPLOYMENT

The sub-hypothesis for this section stated;

Male and female civil engineering students leaving higher education find different factors important when choosing their first employment.

This has certainly been shown to be the case for a number of factors to do with choosing first employment and so the hypothesis is confirmed. Women were significantly more likely than men to consider location of organisation near to family and friends as an important factor in this decision. The same result holds for opportunity to travel within the UK (although not for overseas travel), child-care policies and certain features of the organisation, such as size. Men were significantly more likely than women to consider factors such as salary as important. However, there were factors which were thought equally important by men and women. Examples of these were opportunity for overseas travel, benefits like pension plans

and company cars and the opportunity to do varied and interesting work. Similarly factors thought equally important were training programme for graduates and quick promotion. Given the significant differences outlined above, this hypothesis is confirmed. For a fuller discussion of these results in relation to this sub and the main hypothesis see chapter eleven.

SUMMARY OF THE FINDINGS IN RELATION TO THE MAIN HYPOTHESIS FOR THIS SECTION

The main hypothesis stated;

Female and male civil engineering students leaving higher education choose employment differently

This hypothesis is confirmed.

The analysis of the results in this chapter have shown some differences in how male and female civil engineering students choose employment. Although there were no significant differences in the career choices that male and female civil engineering students make and only one significant difference in the process of securing employment, many significant differences were evident when examining which factors are important to male and female students when choosing their first employment. Hence the hypothesis is confirmed. A more extensive discussion of the results in relation to the main hypothesis is covered in chapter eleven.

CHAPTER NINE

THE RELATIONSHIP BETWEEN COLLEGE EXPERIENCES AND CAREER CHOICE

9.1 INTRODUCTION

The relationship between college experiences and career choice is discussed in this chapter. During the literature search, the experiences of women on engineering and construction courses were assessed. In chapter three literature was identified which examined the college experiences of women on engineering and other courses. Part of the discussion in chapter three also focused on interviews with women civil engineering students specifically examining their college experiences and how these might affect their career choice. The evidence, from these interviews with women civil engineering students, points to the choice of career being partly dependent upon the experiences women had during higher education. This chapter examines the results of the analysis of the survey to determine whether there is a relationship between career choice and the college experiences of women leaving higher education.

9.1.1 MAIN HYPOTHESIS AND SUB HYPOTHESIS RESTATED

The main hypothesis and sub-hypotheses examining the relationship between college experiences and career choice were developed in chapter five. This section restates these hypotheses.

The main hypothesis is;

There is a relationship between the college experiences of women civil engineering

students and their career choice

In order to test the main hypothesis, a number of sub-hypotheses were developed. These sub-hypotheses were also developed in chapter five and are restated below;

(a) Women on civil engineering degree courses who enjoy the course are more likely than those who do not enjoy the course to enter civil engineering employment.

(b) Women who feel at a disadvantage throughout the course, compared with their male colleagues, are more likely to leave civil engineering than those who do not feel disadvantaged.

(c) Women who feel they have a high ability in civil engineering are more likely to enter civil engineering employment than those who feel that they have a low ability.

(d) Women who identify with their male colleagues are more likely to enter civil engineering employment than those who do not.

(e) Women who are satisfied with their lecturing staff are more likely to enter civil engineering than those who are not.

(f) Feelings attributed to minority status discourage women from entering civil engineering.

(g) Those women who feel that their role in class is determined by their sex are more likely to enter a profession other than civil engineering.

The remainder of this chapter tests the sub-hypotheses in order to draw conclusions about the main hypothesis.

9.1.2 RELATIONSHIP BETWEEN ENJOYMENT OF THE COURSE AND CAREER CHOICE

From the evidence from the interviews conducted in the earlier part of the research, it became apparent that enjoying the civil engineering course could affect career choice. It appeared that women who did not enjoy many parts of the course were more likely to seek employment in another profession. This led to the formulation of the following sub-hypothesis:

Women on civil engineering degree courses who enjoy the course are more likely to enter civil engineering employment than those who do not enjoy the course

The following table examines the relationship between career choice and college experiences, with particular focus on the relationship between enjoyment of the course and career choice. It shows the relationship between experiences at college and the decision whether or not to enter civil engineering, together with the general results for all respondents. The results show that a higher percentage of those women planning not to enter civil engineering than those planning to enter civil engineering preferred the theoretical side of the course to the practical side [are planning 12.0% (1.4% + 10.6%), are not planning 40.0% (20.0% + 20.0%)]. Generally, over half of the women on civil engineering courses tended to disagree that they preferred the theoretical side of the course to the practical side [all respondents; disagree, 59.6% (33.1% + 26.5%)]. There was a significant difference between those planning to enter civil engineering and those not as a Mann-Whitney test showed (M-W sig= 0.027). Those women not entering civil engineering are significantly more likely to prefer the theoretical side of the course to the practical side.

TABLE 9.1 RELATIONSHIP BETWEEN ENJOYMENT OF THE COURSE AND CAREER CHOICE

	planning to enter civil engineering	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I prefer the theoretical side of the course to the practical side	yes	1.4	10.6	23.4	36.9	27.7	141
	no	20.0	20.0	28.0	12.0	20.0	25
	all respondents	4.2	12.0	24.1	33.1	26.5	166
I enjoy giving presentations to a class of engineering students	yes	5.0	19.1	17.7	29.8	28.4	141
	no	8.0	24.0	20.0	16.0	32.0	25
	all respondents	5.4	19.9	18.1	27.7	28.9	166
I enjoy the practical aspects of the course	yes	56.0	29.8	7.8	4.3	2.1	141
	no	16.0	40.0	20.0	20.0	4.0	25
	all respondents	50.0	31.3	9.6	6.6	2.4	166
I enjoy laboratory classes	yes	10.6	46.1	25.5	13.5	4.3	141
	no	0.0	24.0	24.0	28.0	24.0	25
	all respondents	9.0	42.8	25.3	15.7	7.2	166
Most engineering classes are interesting	yes	12.1	49.6	19.9	14.9	3.5	141
	no	0.0	16.0	12.0	48.0	24.0	25
	all respondents	10.2	44.6	18.7	19.9	6.6	166
I prefer being taught in small groups	yes	36.2	34.0	24.1	4.3	1.4	141
	no	28.0	56.0	12.0	4.0	0.0	25
	all respondents	34.9	37.3	22.3	4.2	1.2	166
I am pleased with my decision to choose civil engineering	yes	53.2	31.9	9.9	3.5	1.4	141
	no	16.0	28.0	12.0	24.0	20.0	25
	all respondents	47.6	31.3	10.2	6.6	4.2	166
My course equipped me well for working in all sectors of the construction industry	yes	14.2	34.0	20.6	24.1	7.1	141
	no	4.2	33.3	20.8	25.0	16.7	25
	all respondents	12.7	33.7	20.5	24.1	8.4	166

The results relating the enjoyment of presentations to career choice indicated that neither group particularly enjoyed giving presentations to a class of engineering students [planning agree 24.1% (5.0% + 19.1%), not planning agree 32.0% (8.0% + 24.0%)]. This was also borne out in the general results where over half of the women did not appear to enjoy giving presentations [all respondents; disagree 56.7% (27.7% + 28.9%)]. Analysis of the results

suggested that there was no significant difference between those planning to enter civil engineering and those not, in their enjoyment of giving presentations to a class of engineering students (M-W sig=0.6021). Neither group particularly enjoyed giving presentations to a class of engineering students, but there is no relationship between this and their choice of career.

The first result, concerning enjoying the theoretical side of the course more than the practical side, showed that those who were planning to enter a profession other than civil engineering were more likely to prefer the theoretical side to the practical side. When the respondents were asked whether they enjoyed the practical aspects of the course, 85.8% (56.0% + 29.8%) of women who were planning to enter civil engineering agreed that they enjoyed the practical aspects of the course. This should be compared with only 56% (16.0% + 40.0%) of agreement from those women who were not planning to enter civil engineering. The results of a Mann-Whitney test showed that there was a significant difference between the groups and enjoyment of the practical aspects of the course (M-W sig=0.0000). On examining the results of table 9.1, the evidence suggests that those women who were entering other professions were less likely than those who were entering civil engineering to enjoy the practical aspects of the course.

A relationship between career choice and college experience was found to exist when examining the results of the question of enjoyment of laboratory classes. Women who were not entering civil engineering were less likely than women who were to say that they enjoyed laboratory classes [are planning to enter civil engineering 56.7% (10.6% + 46.1%), are not planning to enter civil engineering 24.0% (0.0% + 24.0%)]. This was a significant difference, as a Mann-Whitney test on the results showed (M-W sig=0.0001). The results suggests that there is a relationship between enjoying laboratories and choice of career, where

those women who enjoy laboratory classes are significantly more likely to enter civil engineering.

In examining the responses to the question of whether the students found most engineering classes interesting, over half of all respondents agreed that they found most engineering classes interesting [54.8% (10.2% + 44.6%)]. The results showed that a much higher percentage of women planning to enter civil engineering than of those who were not responded that they found most engineering classes interesting [are planning 61.7% (12.1% + 49.6%), are not planning 16.0% (0.0% + 16.0%)]. This was a significant difference between the two groups, as the Mann-Whitney test showed (M-W sig=0.0000). Those women not entering civil engineering were less likely than those entering civil engineering to find most engineering classes interesting. There exists a clear relationship between finding most engineering classes interesting and choice of career, as the above results show.

Most women from both groups, those entering civil engineering and those not, agreed that they preferred being taught in small groups [are planning to enter civil engineering 70.2% (36.2% + 34.0%), not planning 84.0% (28.0% + 56.0%)]. The Mann-Whitney test on these results showed that there was no significant difference between the groups in preference for being taught in small groups (M-W sig=0.8113). From these results, a conclusion that women from both groups prefer being taught in small groups is acceptable.

Unsurprisingly, those women who were planning to enter another profession were less likely than those women who were planning to enter civil engineering to agree that they were pleased with their decision to choose civil engineering [are planning 85.1% (53.2% + 31.9%), are not planning 44.0% (16.0% + 28.0%)]. There was a significant difference between these two groups in the satisfaction with their decisions to choose civil engineering, as the results of a Mann-Whitney test showed (M-W sig=0.0000). This shows that a

relationship exists between career choice and being pleased with the choice of civil engineering as a degree.

Finally, those women planning to enter civil engineering were more likely than those who were not to agree that their course equipped them well for working in all sectors of the construction industry [are planning to enter civil engineering 48.2% (14.2% + 34.0%), are not planning 37.5% (4.2% + 33.3%)]. However, a test of significance on the results showed that there was no significant difference between the groups in their responses to the statement "my course equipped me well for working in all sectors of the construction industry", (M-W sig=0.2628).

From the above results, it can be concluded that there are some relationships between enjoyment of the course and choice of career. Women who are not planning to entering civil engineering are less likely than those entering civil engineering to enjoy certain parts of the course, namely the practical aspects of the course and the laboratory classes. The results showed weak but significant correlations between the following variables; those women who tended to agree that they preferred the theoretical side of their course to the practical side were likely to disagree with the statement that they enjoyed the practical aspects of the course (Kendall correlation coefficient = -0.3423, sig= 0.000), and they were also likely to disagree with the statement that they enjoyed laboratory classes, as a Kendall correlation showed (Kendall corr. coeff. = -0.2462, sig = 0.000). In addition, those women who preferred the theoretical side of the course to the practical side were likely to disagree with the statement that they were pleased with their decision to choose civil engineering (Kendall corr. coeff. = -0.2214, sig = 0.001).

Women entering civil engineering were significantly more likely than those who were not entering civil engineering to find most engineering classes interesting. Kendall correlations

showed weak but significant associations between finding most engineering classes interesting and being pleased with their decision. Those women who found most engineering classes interesting were also likely to be pleased with their decision to choose civil engineering (Kendall corr. coeff. = 0.3975, sig = 0.000). A very weak but significant correlation existed between agreement with the statement that their course equipped them well and finding most engineering classes interesting. Those women who found most engineering classes interesting were likely to agree that the course equipped them well for working in all sectors of the construction industry (Kendall corr. coeff. = 0.1887, sig = 0.003).

Concluding, the evidence from these results suggests that those women who enjoy the course are more likely than those who do not enjoy the course to enter civil engineering employment.

9.1.3 RELATIONSHIP BETWEEN PERFORMANCE, COMPARED TO MALE CIVIL ENGINEERING STUDENTS, AND CAREER CHOICE

As was discussed in chapter three, some women who were interviewed felt that they were at a disadvantage compared with their male colleagues in that they felt, amongst other things, that they would have to work harder to get the same grades. This led to the formulation of sub-hypothesis (b) which stated;

> **Women who feel at a disadvantage throughout the course, compared with their male colleagues, are more likely to leave civil engineering than those who do not feel disadvantaged**

The following table, 9.2, displays the results of the analysis of the survey regarding the relationship between feeling disadvantaged relative to male civil engineers and career choice.

TABLE 9.2 RELATIONSHIP BETWEEN FEELING DISADVANTAGED COMPARED WITH MALE COLLEAGUES AND CAREER CHOICE.

	planning to enter civil engineering	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I feel I have to work harder than male engineering students to get comparable grades	yes	5.7	7.1	22.7	29.8	34.8	141
	no	4.0	16.0	16.0	28.0	36.0	25
	all respondents	5.4	8.4	21.7	29.5	34.9	166
I have to be more assertive than my male peers	yes	11.3	28.4	24.8	19.9	15.6	141
	no	4.0	20.0	48.0	24.0	4.0	25
	all respondents	10.2	27.1	28.3	20.5	13.9	166
At the start of the course, male students had more engineering experience than female students	yes	9.9	36.9	18.4	21.3	13.5	141
	no	12.0	40.0	32.0	12.0	4.0	25
	all respondents	10.2	37.3	20.5	19.9	12.0	166
At the beginning of the course, male students had a better understanding of computing	yes	9 9	27.0	24.1	22.7	16.3	141
	no	8 0	36.0	16.0	28.0	12.0	25
	all respondents	9.6	28.3	22.9	23.5	15.7	166

Table 9.2 shows that generally women did not feel that they had to work harder than their male colleagues to get comparable grades [all respondents, disagree 64.4% (29.5% + 34.9%)]. The findings suggested that of the two groups, those who are planning to enter civil engineering and those who are not, most women did not feel that they have to work harder than male engineering students to get comparable grades [are planning 12.8% (5.7% + 7.1%), are not planning 20.0% (4.0% + 16.0%)]. There was no significant difference between the two groups in their responses to this statement (M-W sig=0.9064). Furthermore, the results suggest that women do not feel that they have to work harder than their male peers to get comparable grades and that there is no relationship between agreeing with or rejecting this statement and career choice.

Over a third of all women felt that they had to be more assertive than their male peers [all respondents agree 37.3% (10.2% + 27.1%)]. However the results showed that there was no

significant difference between the two groups, those planning to enter civil engineering and those not, in feeling that they have to be more assertive than their male peers (M-W sig=0.7539), although the results showed that a slightly higher percentage of those planning to enter civil engineering than those not thought that they would have to be more assertive than their male peers [are planning 39.7% (11.3% + 28.4%), not planning 24.0% (4.0% + 20.0%)]. The results do suggest that there is no relationship between women civil engineers feeling they have to be more assertive than their male peers and their decisions whether or not to enter civil engineering. There was a significant, positive, weak correlation between agreement that they had to be more assertive than their male peers and agreement that they had to work harder than their male colleagues (Kendall corr. coeff. = 0.2557, sig=0.000), but this was not dependent on whether the women were planning to leave or enter civil engineering.

In examining the results concerning the relationship between women feeling disadvantaged compared to their male colleagues at the start of the course and career choice, the findings showed that many women thought that male students had more engineering experience at the start of the course and a better understanding of computing [all respondents, agree more engineering experience 47.5% (10.2% + 37.3%), all respondents, agree better understanding of computing 37.9% (9.6% + 28.3%)]. This was the same when examining the results of both groups, those planning to enter civil engineering and those not [more engineering experience; planning to enter civil engineering 46.8% (9.9% + 36.9%), not planning to enter civil engineering 52.0% (12.0% + 40.0%); better understanding of computing; those planning to enter civil engineering 36.9% (9.9% + 27.0%), not planning to enter civil engineering 44.0% (8.0% + 36.0%)]. A Mann-Whitney test on both these results showed that there was no significant differences between the groups of those entering civil

engineering and those not in their responses to the statements (more engineering experience; M-W sig= 0.2286, better understanding of computing; M-W sig= 0.7349).

A Kendall test of correlation showed that those women who agreed that at the beginning of the course male engineers had a better understanding of computing were also likely to agree that male engineers had a better knowledge of computing at the start of the course (Kendall corr. coeff.= 0.1989, sig=0.002). Although this association was significant, it was very weak. Overall, the statistical tests in this section do not suggest that there is a relationship between choosing to enter or not enter civil engineering and women feeling at a disadvantage at the start of the course compared with their male colleagues.

In conclusion, the evidence presented in the above results suggests that women who feel at a disadvantage compared with their male colleagues are no more likely than those who do not to leave civil engineering.

9.1.4 RELATIONSHIP BETWEEN PERCEIVED ABILITY AND CAREER CHOICE

In chapter three, part of the discussion focused on the effect of women's perception of their ability on their choice of career. It was indicated that those women who saw themselves as being able to achieve a good result were more likely to enter civil engineering than those who did not. This led to the formulation of the following sub-hypothesis, which stated:

> **Women who feel they have a high ability in civil engineering are more likely to enter civil engineering employment than those who feel that they have a low ability**

The following table of results shows the responses to various statements about women's perception of their ability and its relationship to career choice, either entering or not entering

civil engineering.

Generally, the results presented in table 9.3 and the subsequent statistical tests on the results suggest that differences in perception of ability are not related to career choice.

TABLE 9.3 THE RELATIONSHIP BETWEEN PERCEIVED ABILITY AND CAREER CHOICE

	planning to enter civil engineering	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
The engineering curriculum is more difficult than I expected it to be	yes	5.7	36.2	22.7	24.1	11.3	141
	no	16.0	24.0	28.0	28.0	4.0	25
	all respondents	7.2	34.3	23.5	24.7	10.2	166
The class of degree I am expecting is a first or upper second	yes	28.4	26.2	15.6	14.9	14.9	141
	no	28.0	16.0	16.0	20.0	20.0	25
	all respondents	28.3	24.7	15.7	15.7	15.7	166
I am a successful student	yes	22.0	46.1	26.2	5.7	0.0	141
	no	16.0	64.0	16.0	4.0	0.0	25
	all respondents	21.1	48.8	24.7	5.4	0.0	166
I find mathematics on the course difficult	yes	11.3	23.4	12.1	19.9	33.3	141
	no	16.0	20.0	8.0	24.0	32.0	25
	all respondents	12.0	22.9	11.4	20.5	33.1	166
I am expecting to fail my degree	yes	2.1	0.7	5.7	14.9	76.6	141
	no	0.0	0.0	4.0	12.0	84.0	25
	all respondents	1.8	0.6	5.4	14.5	77.7	166

In examining the results, in the table, of the responses to the statement about finding the engineering curriculum more difficult than expected, 41.5% (7.2% + 34.3%) of all respondents agreed. The percentages of agreement for women planning to enter civil

engineering and those not agreeing to the statement were found to be almost the same [planning to enter civil engineering 41.9% (5.7% + 36.2%), not planning to enter civil engineering 40.0% (16.0% + 24.0%)]. This meant that there were no significant differences between the groups in their responses to the statements (M-W sig=0.5381). The evidence points to many women from both groups finding the engineering curriculum more difficult than they expected it to be.

Over half of all respondents [53%,(28.3% + 24.7%)] agreed that the class of degree they were expecting was a first or upper second. A slightly lower percentage of those women planning to leave civil engineering than those planning to enter civil engineering agreed that the class of degree they were expecting was a first or upper second [planning 54.6% (28.4% + 26.2%), not planning 44.0% (28.0% + 16.0%)]. Again, a test on the results showed no significant difference between planning to enter civil engineering or planning to enter another profession in respect of women's expectations of a first or upper second degree (M-W sig=0.4490). The results suggest that there is no relationship between choice of career and expected class of degree.

A majority of women from both groups perceived themselves as successful students [planning to enter civil engineering 68.1% (22.0% + 46.1%), not planning to enter civil engineering 80.0% (16.0% + 64.0%)]. A Mann-Whitney test on the results showed that there was no difference between the those women planning to enter civil engineering and those women who have chosen not to enter civil engineering in their responses to this statement (M-W sig=0.6629). The majority of women choosing to enter civil engineering or choosing to enter another profession are likely to see themselves as successful students.

The findings suggest that over a third of women from both groups found mathematics difficult on the course [those planning to enter civil engineering 34.7% (11.3% + 23.4%),

those not planning to enter civil engineering 36.0% (16.0% + 20.0%)]. There was no significant difference between the groups in finding mathematics difficult on the course (M-W sig= 0.8779). Overall, this result shows that those women planning not to enter civil engineering did not find mathematics any more difficult than those entering civil engineering. What did emerge from the correlations was a significant but weak association between two variables. Those women who disagreed with the statement that they found mathematics on the course difficult were likely to agree that they expected a first or upper second (Kendall corr. coeff. = -0.1691, sig = 0.007). This indicates some association between finding maths on the course difficult and anticipated degree result, but as mentioned earlier, the results of a Mann-Whitney tests show that neither finding mathematics difficult nor expected degree results vary in relation to career choice. In addition, the following significant and weak correlations showed that women who tended to agree that the engineering curriculum is more difficult than they expected it to be tended to disagree with the statement that the class of degree they were expecting was a first or upper second (Kendall corr. coeff. = -0.2779 , sig= 0.000). They also tended to disagree with the statement that they were successful students (Kendall corr. coeff. = -0.2615, sig = 0.000), and agreed that they found mathematics on the course difficult (Kendall corr. coeff. = 0.2339, sig = 0.000).

Finally, the results from table 9.3 show that most women were not expecting to fail their degree (planning to enter civil engineering 2.8% (2.1% + 0.7%), planning to leave civil engineering 0.0%). Again there was no significant difference between the groups in expectation of failing their degree (M-W sig=0.3842).

Concluding then, it appears that women who are entering civil engineering are no more likely than those entering another profession to feel that they have a high ability, or a low ability, in civil engineering.

9.1.5 RELATIONSHIP BETWEEN ATTITUDES TOWARDS MEN AND CAREER CHOICE

When examining possible relationships between career choice and college experiences, the evidence from the literature in chapter three and interviews with women civil engineering students suggested that, for some women, the ability or not to relate to their male peers on a professional basis could affect their decisions to enter civil engineering or enter another profession. This led to the following sub-hypothesis;

Women who identify with their male colleagues are more likely to enter civil engineering employment than those who do not.

The following table and subsequent tests on the results examine whether there is a difference between those women who identify with their male colleagues and those who do not in their choice of career.

In examining table 9.4, it can be seen that only 15.6% (5.4% + 10.2%) of women thought that male engineering students were less mature than other male students. Most women from both groups do not feel that male engineering students are less mature than other male students [planning to enter agree 14.9% (5.0% + 9.9%), planning not to enter agree 20.0% (8.0% + 12.0%)]. There appeared to be no significant difference between the two groups in their responses to the statements (M-W sig=0.9508). Women choosing to enter another profession are no more likely than those entering civil engineering to agree that male engineering students are less mature than other male students.

TABLE 9.4 ATTITUDES TOWARDS MALE COLLEAGUES AND CAREER CHOICE

	planning to enter civil engineering	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
male engineering students are less mature than other male students	yes	5.0	9.9	43.3	25.5	16.3	141
	no	8.0	12.0	32.0	36.0	12.0	25
	all respondents	5.4	10.2	41.6	27.1	15.7	166
When I study with others, I study with men	yes	24.8	27.0	28.4	15.6	4.3	141
	no	12.0	52.0	16.0	16.0	4.0	25
	all respondents	22.9	30.7	26.5	15.7	4.2	166
I feel that male students are intimidated by me in class	yes	1.4	12.1	18.4	29.8	38.3	141
	no	0.0	4.0	12.0	48.0	36.0	25
	all respondents	1.2	10.8	17.5	32.5	38.0	166
I get unwanted attention from male students on my course	yes	5.7	9.2	22.7	28.4	34.0	141
	no	8.0	0.0	28.0	24.0	40.0	25
	all respondents	6.0	7.8	23.5	27.7	34.9	166

Many women agreed that when they study with others, they study with men, [all respondents 53.6% (22.9% + 30.7%); are planning 51.8% (24.8% + 27.0%), are not planning 64.0% (12.0% + 52.0%)]. Again, there was no significant difference between the groups in their responses to the statement (M-W sig=0.9926). Women from both groups, those entering civil engineering and those not, were likely to study with men when they studied with others. Women choosing either to enter civil engineering or not enter civil engineering did not feel that, in general, male students were intimidated by them, although a slightly higher percentage of women planning to enter civil engineering agreed with the statement [are planning, 13.4% (1.4% + 12.1%), are not planning 4.0% (0.0% + 4.0%)]. Neither did they appear to receive unwanted attention from male students on their courses [are planning

14.2% (5.7% + 9.2%), are not planning 8.0% (8.0% + 0.0%)]. The responses to these questions did not show significant differences between the groups (M-W sig=0.4418, M-W sig=0.5969, respectively). The finding suggest that there were no significant differences between those women entering civil engineering and those not in feeling that men were intimidated by them or that they received unwanted attention from male students on their course. Correlation of the results showed that those women who agreed that male engineering students were less mature than other male students tended to agree that they received unwanted attention from male students on their course (Kendall corr. coeff. = 0.2035, sig= 0.002). Although the association was significant, it was weak.

Concluding, it can be said that women who identify with their male colleagues are no more or less likely than those who do not to choose civil engineering employment.

9.1.6 RELATIONSHIP BETWEEN ATTITUDE TOWARDS LECTURING STAFF AND CAREER CHOICE

In the initial stages of the research, some indication of the effect of relationships with lecturing staff on career choice was gained. From interviews and the literature presented in chapter three, it appeared that women could be influenced in their choice of career by staff at the college. From this, the following sub-hypothesis was developed;

Women who are satisfied with their lecturing staff are more likely to enter civil engineering than those who are not

Table 9.5 shows the relationship between attitudes towards lecturing staff and choice of career for all respondents and for respondents planning to enter civil engineering or not planning to enter civil engineering. The results show that few women in both groups believe that they receive less attention than male students from male lecturers [all respondents 4.2% (0.0% + 4.2%); are planning 3.5% (0.0% + 3.5%), are not planning 8.0% (0.0% + 8.0)]. There appeared to be no significant difference between those planning to enter civil engineering and those not in their responses to the question of whether they felt that they received less attention than male students from male lecturers, as a Mann-Whitney test showed (M-W sig=0.3249). This means that women planning to enter civil engineering are no more likely than those not planning to enter civil engineering to feel that they receive less attention than male students from male lecturing staff.

The results obtained by examining the responses to the statement inquiring whether women were discouraged from entering some types of employment by college lecturers showed that over half of all respondents replied that they were not (disagree all respondents, 53.0% (31.9% + 21.1%). The results did show that a higher percentage of those not planning to enter civil engineering agreed that they were put off some types of employment by college lecturers [planning agree 12.7% (2.1% + 10.6%), not planning agree 24.0% (4.0% + 20.0%)]. The evidence from the analysis of these results shows a significant difference between those planning to enter civil engineering and those not in respect of this (M-W sig= 0.0102). Those not planning to enter civil engineering were significantly more likely than those entering civil engineering to say that they were put off some types of employment by college lecturers.

TABLE 9.5 RELATIONSHIP BETWEEN LECTURING STAFF AND CAREER CHOICE

	planning to enter civil engineering	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I receive less attention than male students from male lecturers	yes	0.0	3.5	29.1	26.2	41.1	141
	no	0.0	8.0	32.0	28.0	32.0	25
	all respondents	0.0	4.2	29.5	26.5	39.8	166
I am put off some types of employment by college lecturers	yes	2.1	10.6	29.8	22.7	34.8	141
	no	4.0	20.0	48.0	12.0	16.0	25
	all respondents	2.4	12.0	32.5	21.1	31.9	166
I am uncomfortable approaching male lecturers for help	yes	6.4	11.3	9.2	26.2	46.8	141
	no	4.0	12.0	24.0	28.0	32.0	25
	all respondents	6.0	11.4	11.4	26.5	44.6	166
The lecturers are good teachers	yes	4.3	36.9	29.8	22.7	6.4	141
	no	4.0	20.0	24.0	44.0	8.0	25
	all respondents	4.2	34.3	28.9	25.9	6.6	166
I would like more female lecturers on the faculty	yes	15.6	23.4	44.7	10.6	5.7	141
	no	8.0	36.0	36.0	12.0	8.0	25
	all respondents	14.5	25.3	43.4	10.8	6.0	166
Sexist language is never used by lecturers on the course	yes	9.9	17.0	16.3	36.9	19.9	141
	no	8.0	20.0	24.0	40.0	8.0	25
	all respondents	9.6	17.5	17.5	37.3	18.1	166
Female lecturers on the faculty show more concern for me than male lecturers	yes	1.7	5.0	35.0	28.3	30.0	60
	no	0.0	25.0	16.7	33.3	25.0	12
	all respondents	1.4	8.3	32.0	29.1	29.2	72

When the respondents were asked whether they felt uncomfortable approaching male lecturers for help, almost the same small percentages from both groups, those planning to enter civil engineering and those not, agreed that they did [planning 17.7% (6.4% + 11.3%), not planning 16.0% (4.0% + 12.0%)]. The results of a Mann-Whitney test showed that there was no significant difference between the groups in feeling uncomfortable about approaching male lecturers for help (M-W sig=0.2159). The evidence from this finding points to the conclusion that a small number of women from both groups are likely to feel uncomfortable approaching male lecturers for help.

In examining the results of table 9.5, the findings suggest that those women who were entering other industries were less likely than those who were entering civil engineering to agree that the lecturers are good teachers [are planning to enter civil engineering 41.2% (4.3% + 36.9%), are not planning to enter civil engineering 24.0% (4.0% + 20.0%)]. This was a significant difference, as a Mann-Whitney test on the results showed (M-W sig=0.0459).

In examining the responses to the statement about whether the students would like more female lecturers on the faculty, over a third of all respondents agreed with the statement [all respondents agree 39.8% (14.5% + 25.3%)]. A slightly higher percentage of those not entering civil engineering agreed than those entering it [are planning 39.0% (15.6% + 23.4%), are not planning 44.0% (8.0% + 36.0%)]. However, there was not a significant difference between the two groups, as the Mann-Whitney test showed (M-W sig=0.8675). It appears that women entering civil engineering and those not entering civil engineering are just as likely to want more female lecturers on the faculty.

Over half of all women disagreed with the statement that sexist language is never used by lecturing staff on the course [all respondents, disagree 55.4% (37.3% + 18.1%)]. A slightly

higher percentage of those planning to enter civil engineering than those not disagreed with the statement that sexist language is never used by lecturing staff on the course [are planning to enter civil engineering 56.8% (36.9% + 19.9%), not planning 48.0% (40.0% + 8.0%)]. A Mann-Whitney test on these results showed that there was no significant between the groups in their responses to the statement (M-W sig=0.3553). The results suggest that women from both groups are likely to disagree with the statement that sexist language is never used by lecturers on the course.

Turning to the responses to the statement about whether female lecturers showed more concern for the students than male lecturers, 58.3% (29.1% + 29.2%) of all respondents disagreed with this statement. The results showed that over half of the women from both groups disagreed with the statement [are planning 58.3% (28.3% + 30.0%), are not planning 58.3% (33.3% + 25.0%)]. There was no significant difference between these two groups, those entering civil engineering or entering another profession, in feeling that female lecturers on the faculty showed more concern than male lecturers (M-W sig=0.5647).

From the above results, it can be concluded that there are some differences in women's attitudes towards lecturing staff, and these differences were related to choice of career. Women who are not planning on entering the civil engineering are less likely than those entering civil engineering to agree that the lecturers are good teachers. Correlations of the results showed some very weak but significant relationships. Those women who disagree with the statement that the lecturers are good teachers are likely to disagree with the statement that sexist language is never used (Kendall corr. coeff. = 0.1528, sig=0.018) and were also likely to be uncomfortable approaching male lecturers for help (Kendall corr. coeff. = -0.1512, sig=0.021).

The results from table 9.5, and the subsequent Mann-Whitney test, showed that women not

entering civil engineering were more likely than those entering civil engineering to be put off some types of employment by lecturers. Correlations of the results showed that there was a weak but significant association between women who tended to agree that they were put off some employment by college lecturers and were also likely to agree that they received less attention from male lecturers than male students (Kendall corr. coeff. = 0.2885, sig=0.000).

However, the evidence from the results suggests that, for the most part, women from both groups, those not planning to enter civil engineering and those planning to enter civil engineering, hold similar views about most of the statements used to examine their attitudes towards lecturing staff.

Concluding, it appears that there are some differences between those women entering civil engineering and those not, in their attitudes towards lecturing staff. Women not entering civil engineering were significantly less likely to find lecturers good teachers and were significantly more likely to say they were put off civil engineering employment by lecturers.

9.1.7 RELATIONSHIP BETWEEN FEELINGS ATTRIBUTED TO MINORITY STATUS AND CAREER CHOICE

In the literature, certain feelings, such as loneliness and isolation were often attributed to women's minority status. This section examines the relationship between these feelings and career choice. It became apparent in the initial interviews that women who were not part of the social scene at college, especially within the engineering school, might be less likely to

enter civil engineering. The following sub-hypothesis is tested in this section;

Feelings attributed to minority status discourage women from entering civil engineering

The following table and subsequent statistical analysis tests this hypothesis.

TABLE 9.6 RELATIONSHIP BETWEEN SOCIAL ACTIVITIES AND CAREER CHOICE

	planning to enter civil engineering	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
I take part in a lot of social activities in the engineering school	yes	11.3	12.1	31.2	23.4	22.0	141
	no	0.0	20.0	20.0	16.0	44.0	25
	all respondents	9.6	13.3	29.5	22.3	25.3	166
I have more female friends than male friends at college	yes	5.7	7.1	18.4	19.9	48.9	141
	no	8.0	8.0	12.0	40.0	32.0	25
	all respondents	6.0	7.2	17.5	22.9	46.4	166
I feel isolated much of the time at college	yes	4.3	12.1	14.9	20.6	48.2	141
	no	0.0	16.0	20.0	20.0	44.0	25
	all respondents	3.6	12.7	15.7	20.5	47.6	166
I prefer to study alone	yes	19.1	33.3	26.2	15.6	5.7	141
	no	16.0	20.0	36.0	24.0	4.0	25
	all respondents	18.7	31.3	27.7	16.9	5.4	166
I would be more comfortable with more women students on the course	yes	1.4	7.1	48.9	24.1	18.4	141
	no	0.0	16.0	40.0	16.0	28.0	25
	all respondents	1.2	8.4	47.6	22.9	19.9	166

The results in table 9.6 suggest that there is little relationship between participation in social activities at college and career choice. In examining the results of the responses to the

statement about taking part in a lot of social activities in the engineering school, it was found that few women agreed that they took part in a lot of social activities within the engineering school [all respondents agree 22.9% (9.6% + 13.3%)]. The percentages agreeing to the statement, for women planning to enter civil engineering and those not, were almost the same [planning to enter civil engineering 23.4% (11.3% + 12.1%), not planning to enter civil engineering 20.0% (0.0% + 20.0%)]. This meant that there were no significant differences between the groups in their responses to the statement (M-W sig= 0.0703). The evidence suggests that there is no relationship between taking part in social activities in the engineering school and choice of career, that is either entering civil engineering or entering a profession other than civil engineering.

A slightly lower percentage of those women planning to leave than of those planning to enter civil engineering agreed that they had more female friends than male friends at college [planning 13.8% (5.7% + 7.1%), not planning 16.0% (8.0% + 8.0%)]. Again, a test on the results showed no significant difference between those planning to enter civil engineering and those planning to enter another profession in their responses to the statement (M-W sig=0.3208). There appears, from these results, to be no relationship between having more female friends than male friends and choice of staying or leaving civil engineering. However, a Kendall correlation showed a very weak but significant correlation. Those women who tended to agree that they took part in a lot of social activities in the engineering school tended to disagree with the statement that they had more female friends than male friends at college (Kendall corr. coeff. = -0.1925 , sig= 0.003). In addition, a weak and significant correlation existed between agreement that they had more female friends than male friends and feeling isolated at college. Those women who tended to agree that they had more female friends than male friends at college tended to agree that they felt isolated at college (Kendall

corr. coeff. = 0.2358, sig= 0.000).

However, those feeling isolated at college were a minority [all respondents agree 16.3% (12.7% + 3.6%)]. The results showed that a majority of women from both groups disagreed with the statement that they felt isolated most of the time at college [planning to enter civil engineering 68.8% (20.6% + 48.2%), not planning to enter civil engineering 64.0% (20.0% + 44.0%)]. Again a Mann-Whitney test on the results showed that there was no significant difference between those women planning to enter civil engineering and those women who have chosen to enter another profession, in their responses to this statement (M-W sig= 0.7450). Correlation of the results showed that there was a weak but significant association between women feeling isolated and taking part in social activities. Those women who tended to disagree with the statement that they felt isolated much of the time at college tended to agree with the statement that they took part in a lot of social activities in the engineering school (Kendall corr. coeff. = -0.2712, sig = 0.000). However, most women from both groups do not feel isolated most of the time at college.

More women who were planning to enter civil engineering than those not planning to enter civil engineering agreed that they preferred to study alone [those planning to enter civil engineering 52.4% (19.1% + 33.3%), those not planning to enter civil engineering 36.0% (16.0% + 20.0%)]. However, there was no significant difference between the groups in their preferences to study alone (M-W sig= 0.2521).

Finally, a small percentage of women from both groups agreed that they would be more comfortable with more women students on the course, although a higher percentage of those not planning to enter civil agreed with this statement [planning to enter civil engineering 8.5% (1.4% + 7.1%), planning to leave civil engineering 16.0 (0.0% + 16.0)]. Again, there was no significant difference between the groups in their responses to the statement (M-

W sig=0.9287). A Kendall correlation showed that women who tended to agree that they had more female friends than male friends were likely to agree that they would be more comfortable with more women students on the course (Kendall corr. coeff. = 0.2748, sig = 0.000). Although this association was significant, it was weak.

Concluding, few women appear to have experienced problems associated with being in a minority on their civil engineering course and the analysis of the results suggest that feelings attributed to minority status do not discourage entry into civil engineering.

9.1.8 RELATIONSHIP BETWEEN ROLE IN CLASS AND CAREER CHOICE

In observing women on civil engineering courses, it became apparent that women enter into various roles during the course. The results presented in this section show to what extent the roles women think they have in the class is related to their career choice. Sub-hypothesis (g) stated;

> **Those women who feel that their role in class is determined by their sex are more likely to enter a profession other than civil engineering.**

The following results and subsequent statistical analysis tests this hypothesis.

TABLE 9.7 RELATIONSHIP BETWEEN ROLE IN CLASS AND CAREER CHOICE

	planning to enter civil engineering	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	N
In the laboratory groups I am generally the one to record the data	yes	9.9	18.4	25.5	27.7	18.4	141
	no	4.0	28.0	16.0	28.0	24.0	25
	all respondents	9.0	19.9	24.1	27.7	19.3	166
I am usually the organiser in group projects	yes	17.0	27.7	33.3	17.0	5.0	141
	no	8.0	32.0	28.0	24.0	8.0	25
	all respondents	15.7	28.3	32.5	18.1	5.4	166
I am reluctant to ask questions in class	yes	11.3	29.1	16.3	22.7	20.6	141
	no	20.0	32.0	28.0	4.0	16.0	25
	all respondents	12.7	29.5	18.1	19.9	19.9	166
Female engineering students are perceived as less feminine than other female students	yes	16.3	36.2	14.2	17.7	15.6	141
	no	4.0	44.0	16.0	20.0	16.0	25
	all respondents	14.5	37.3	14.5	18.1	15.7	166
I am chosen by staff to represent the course to external bodies	yes	14.2	22.7	24.1	11.3	27.7	141
	no	4.0	20.0	20.0	16.0	40.0	25
	all respondents	12.7	22.3	23.5	12.0	29.5	166

In examining the table 9.7, it can be seen that for all respondents, 28.9% (9.0% + 19.9%) agreed that in laboratory classes they are usually the ones to record the data. Nearly the same percentage of women from both groups agree that in the laboratory groups they are generally the one to record the data [planning to enter 28.3% (9.9% + 18.4%), planning not to enter 32.0% (4.0% + 28.0%)]. There appeared to be no significant difference between the two groups in their responses to the statements (M-W sig=0.6364). Being the student who

generally records the data in laboratory classes did not appear to vary with career choice. Many women agreed that they were the organisers in group projects [all respondents 44.0% (28.3% + 15.7%)]. The results of both groups also showed over a third of women agreeing with the statement [are planning 44.7% (17.0% + 27.7%), are not planning 40.0% (8.0% + 32.0%)]. Again, there was no significant difference between the groups and their responses to the question (M-W sig=0.2994). Many women from both groups, those choosing to enter civil engineering and those not, are likely to agree that they are the organisers in group projects. Correlation of the results showed a very weak but significant relationship between those women who tended to agree that in the laboratory groups they were usually the ones to record the data and those who tended to agree that they were usually the organisers in the group (Kendall corr. coeff. = 0.1960, sig= 0.002).

Many women appeared to be reluctant to ask questions in class [all respondents 42.2% (12.7% + 29.5%)]. However, a higher percentage of women choosing not to enter civil engineering than those choosing to enter civil engineering, agreed that they were reluctant to ask questions in class [are planning, 40.4% (11.3% + 29.1%), are not planning 52.0% (20.0% + 32.0%)]. But, these results did not establish a statistically significant difference between the groups (M-W sig=0.5969). Many women from both groups were reluctant to ask questions in class.

Around half of the women from both groups agreed that female engineering students are perceived as less feminine than other female students [are planning 52.5% (16.3% + 36.2%), are not planning 48.0% (4.0% + 44.0%)]. The responses to these questions showed no significant differences between the groups (M-W sig=0.4239). Women leaving civil engineering are no more likely than those not to believe that female engineering students are perceived as less feminine that other female students.

Finally, a higher percentage of those women planning to enter civil engineering thought that they were chosen by staff to represent the course to external bodies [are planning 36.9% (14.2% + 22.7%), are not planning 24.0% (4.0% + 20.0%)]. Although close to the 0.05% significance level, there results showed no statistically significant difference between the groups in their responses to the question (M-W sig= 0.0916). Members of both groups were equally likely to be chosen to represent the course to external bodies. Correlation of the results showed the following very weak but significant correlation: women who tended to agree that they were chosen by staff to represent the course to external bodies also tended to agree with the statement that they were the organisers in the group (Kendall corr. coeff. = 0.1922, sig = 0.003).

Concluding then, it appears from these results that no identifiable relationships exist between the roles women adopt in class and choice of career.

9.2 GENERAL CONCLUSION TO THE CHAPTER

The main hypothesis stated:

There is a relationship between the college experiences of women civil engineering students and their career choice

This hypothesis is neither confirmed or disconfirmed

From the analysis in this section of the results of the questionnaire, it appears that there are some significant relationships between the experiences that women have on civil engineering degree courses and their decisions either to enter civil engineering or enter another profession.

The results suggest that women who enjoy the course and are satisfied with their lecturers are more likely to enter civil engineering employment. On the other hand, there are no

relationships between some important aspects of college experience and career choice. The results suggest that women who feel at a disadvantage compared with their male colleagues are no more likely to leave civil engineering. There is a similar lack of relationship between ability, identification with male colleagues, feelings attributed to minority status and role in class on the one hand, and career choice on the other. Hence the hypothesis is neither confirmed or disconfirmed. For a more detailed discussion of these results in relation to the main hypothesis, see chapter eleven.

CHAPTER TEN

CAREER EXPECTATIONS OF WOMEN CIVIL ENGINEERING STUDENTS

10.1 INTRODUCTION

Chapter four discussed the role of women in the labour market in general and the role of women in engineering, construction and civil engineering in particular. The chapter identified a number of important issues which concern women in the labour market. In chapter four the results of interviews and discussions which expanded and refined some of the points in the literature, as well as supplying further ideas and views on the role of women in civil engineering were examined. Based upon a detailed examination from these two groups of sources, chapter five formulated a main hypothesis and five sub-hypotheses about the career expectations of final year women civil engineers leaving higher education. This chapter produces results from the national questionnaire to final year women civil engineering degree students conducted for this research to test these sub-hypotheses, in order to draw conclusions about the main hypothesis.

First the main and sub-hypotheses are restated. The testing of the sub-hypotheses follows this restatement.

10.1.1 MAIN HYPOTHESIS AND SUB-HYPOTHESES RESTATED

The main hypothesis and sub-hypotheses examining the relationship between the expectations that women have of civil engineering and their career intentions were developed in chapter five. This section restates these hypotheses.

The main hypothesis is;

There is a relationship between the career expectations of women civil engineering students and the sector of civil engineering they choose

The sub-hypotheses developed in chapter five and used in this chapter to test the main hypothesis are;

(a) There is a relationship between the beliefs about various sectors of civil engineering held by women civil engineering students and their choice of sector of civil engineering.

(b) There is a relationship between the expected enjoyment by women civil engineering students of some features of civil engineering work and their choice of sector of civil engineering.

(c) There is a relationship between the impressions women have of the availability of child-care facilities and their choice of sector of civil engineering.

(d) There is a relationship between opportunities women expect from a civil engineering career and their choice of sector of civil engineering.

(e) There is a relationship between the degree of opposition women civil engineering students leaving higher education expect to receive and their choice of sector of civil engineering.

The remainder of this chapter tests the sub-hypotheses in order to draw conclusions about the main hypothesis.

10.1.2 RELATIONSHIP BETWEEN IMPRESSIONS OF VARIOUS SECTORS AND CHOSEN CAREER.

Sub-hypothesis (a) stated:

> **There is a relationship between the beliefs about various sectors of civil engineering held by women civil engineering students and their choice of sector of civil engineering.**

As discussed in chapter five, in deriving the research problem for this section, it became apparent that there could be a relationship between the impressions women had of sectors of the construction industry and their choices of future career. There appeared to be a difference between their opinions of certain sectors of the construction industry and this was related to the choice of the sector of industry women were entering. The following tables, 10.1 and 10.2 in this section, and the subsequent statistical tests examine this difference. They show crosstabulations of the choice of sector of industry in civil engineering against the responses to various questions testing women's impressions of some of the sectors of the construction industry.

Table 10.1 shows the different responses to the statement about the treatment of women in two sectors, consultancy and contracting. It shows that over half the women [52.0% (32.0 + 20.0)] who preferred local authority and utility sectors agreed that consultancies treat women better than contractors do. However, for most of the other sectors, the responses fell into the neutral category, thus implying that those women had no opinion of whether consultancies treat women any better, or worse, than contractors, or possibly indicating that, in their view, the treatment of women by consultancies is the same as that of contractors (percentages of responses in the neutral category are; consultancy 45.6%, higher education and research 58.3%, contractors, large and small 60.6%, others 66.7%).

In general, a majority of respondents replied in the neutral category (51.2%) although over a third [38.5% (10.2% + 28.3%)] agreed that consultancies treat women engineers better than contractors do.

TABLE 10.1 COMPARISON BETWEEN IMPRESSIONS OF TWO SECTORS AND PREFERRED SECTOR.

	consultancies treat women engineers better than contractors do					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	20.0	32.0	36.0	8.0	4.0	25
consultancy	8.8	33.8	45.6	10.3	1.5	68
higher education and research organisations	16.7	25.0	58.3	0.0	0.0	12
contractors, small and large	6.1	27.3	60.6	0.0	6.1	33
other	16.7	16.7	66.7	0.0	0.0	6
all respondents	10.2	28.3	51.2	7.8	2.4	166

Note: column "all respondents" covers all those who answered the question, which is more than those specifying a particular sector. This is the same for all tables in this section.

A Kruskall-Wallis test on the results of the sectors chosen in table 10.1 showed that there was no significant difference across sectors and therefore no relationship between women's choice of sector and stating that consultancies treat women better than contractors do (K-W chi^2 sig= 0.7637).

Table 10.2 reports the results of a second statement aimed to test the relationship between choice of sector and impressions of the construction industry.

TABLE 10.2 COMPARISON BETWEEN LOCAL AUTHORITIES AND CONSULTANCIES AGAINST PREFERRED SECTOR

	My impression is that local authorities have more favourable employment policies than consultancies for women					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	24.0	36.0	28.0	4.0	8.0	25
consultancy	19.1	14.7	44.1	19.1	2.9	68
higher education and research organisations	25.0	8.3	50.0	16.7	0.0	12
contractors, small and large	9.1	6.1	78.8	3.0	3.0	33
other	0.0	0.0	83.3	16.7	0.0	6
all respondents	16.3	14.5	55.4	10.8	3.0	166

From table 10.2, it can be seen that 60% of the women (24.0% + 36.0%) who preferred local authority and utility sectors agreed with the statement "my impression is that local authorities have more favourable employment policies than consultancies for women" However, for most of the other sectors, the responses again fell into the neutral category, thus implying that those women had no opinion of whether the employment policies of local authorities for women were any better, or worse, than those of consultancies, or that the employment policies of local authorities were as good as those of consultancies (neutral category: consultancy 44.1%, higher education and research 50.0%, contractors, large and small 78.8%, others 83.3%).

In general, a majority of respondents replied in the neutral category (55.4%) although nearly a third [30.8% (16.3% + 14.5%)] agreed that their impression was that local authorities have more favourable employment policies for women than do consultancies.

A Kruskall-Wallis test on the results of the sectors chosen showed that there was no significant difference between women who had chosen different sectors and their responses to the statement about the employment policies for women of local authorities and consultancies (K-W chi^2 sig= 0.1479).

The results do not correspond to earlier findings where there appeared to be a difference in opinion about some sectors of the construction industry between those women who preferred a career in one sector and their impressions of other sectors. The results of this questionnaire survey in this section show that the beliefs held by respondents choosing any of the sectors were much the same.

Concluding then, from the evidence presented in these results, it appears that the impressions of various sectors of the construction industry held by women civil engineers is not related to their career choice.

10.1.3 RELATIONSHIP BETWEEN EXPECTED ENJOYMENT OF SECTORS OF CIVIL ENGINEERING AND CHOICE OF SECTOR

Sub-hypothesis (b) stated:

> **There is a relationship between the expected enjoyment by women civil engineering students of some features of civil engineering work and their choice of sector of civil engineering.**

As discussed in chapter five, in deriving the research problem for this section, it appeared that there was a relationship between expected enjoyment of various features of the work involved in civil engineering and career choice.

The following tables, 10.3 and 10.4, show crosstabulations of features of the work against chosen sectors of the civil engineering industry.

TABLE 10.3 THE RELATIONSHIP BETWEEN TEAM WORK AND CHOICE OF SECTOR

	I find working in a team satisfying					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	20.0	64.0	12.0	4.0	0.0	25
consultancy	25.0	64.7	8.8	1.5	0.0	68
higher education and research organisations	41.7	50.0	0.0	0.0	8.3	12
contractors, small and large	27.3	60.6	9.1	3.0	0.0	33
other	33.3	66.7	0.0	0.0	0.0	6
all respondents	25.9	63.9	7.8	1.8	0.6	166

Table 10.3 shows that women in all sectors tended to agree with the statement that team work is satisfying [local authority and utilities 84.0% (20.0 + 64.0), consultancy 89.7% (25.0% + 64.7%), higher education and research organisations 91.7% (41.7% + 50.0%), contractors, large and small 87.9% (27.3% + 60.6%), others 100% (33.3% + 66.7%)]. There appears to be general agreement from the respondents that working in a team is satisfying [all respondents 89.8% (25.9% + 63.9%)].

Unsurprisingly then, a Kruskall-Wallis test on the results of choice of sector showed that there was no significant difference between those women who had chosen to enter any of the above sectors of industry as a career in agreeing that they found team work satisfying (K-W chi^2 sig = 0.6576).

The following table, 10.4, shows the responses to a statement about site work and choice of sector.

TABLE 10.4 RELATIONSHIP BETWEEN WORK ON SITE AND CHOICE OF SECTOR

	I will enjoy working on site					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	20.0	32.0	36.0	8.0	4.0	25
consultancy	8.8	33.8	45.6	10.3	1.5	68
higher education and research organisations	16.7	25.0	58.3	0.0	0.0	12
contractors, small and large	6.1	27.3	60.6	0.0	6.1	33
other	16.7	16.7	66.7	0.0	0.0	6
all respondents	25.3	42.2	18.1	10.8	3.6	166

From table 10.4, it can be seen that 52.0% of the women (20.0% + 32.0%) who preferred local authority and utility sectors agreed with the statement that working on site is enjoyable. However, under half of all the respondents in the other sectors agreed with the statement about enjoying site work [consultancy 42.6% (8.8 + 33.8), higher education and research 41.7% (16.7 + 25.0), contractors, large and small 33.4% (6.1 +27.3), others 33.4% (16.7 + 16.7)]. The majority of responses in three of the categories fell into the neutral category [higher education and research 58.3%, contractors, large and small 60.6%, others 66.7%]. In two categories, local authorities and utilities and consultancies, about a fifth of the respondents disagreed that they would enjoy working on site [local authorities and utilities 12.0% (8.0% + 4.0%), consultancies 11.8% (10.3% + 1.5%)]. In general, the majority of respondents agreed that they would enjoy working on site [all respondents 67.5% (25.3% + 42.2%)].

A Kruskall-Wallis test of significance on the results of the choice of sectors showed that there

was a significant difference between women who had chosen various sectors in their responses to the statement about enjoying work on site (K-W chi^2 sig =0.0047). It appeared that there is a difference in the responses to the statement about working on site, which vary with the type of sector chosen. Further investigation of this result considered the difference between those planning to enter civil engineering and those not. The following table presents the results of the responses to the question of enjoyment of site work and the decision to enter or not enter civil engineering.

TABLE 10.5 RELATIONSHIP BETWEEN WORKING ON SITE AND LEAVING THE INDUSTRY

planning to enter civil engineering	I will enjoy working on site					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
yes	29.8	42.6	17.7	8.5	1.4	141
no	0.0	40.0	20.0	24.0	16.0	25
all respondents	25.3	42.2	18.1	10.8	3.6	166

In examining table 10.5, it can be seen that the reaction to the statement relating to site work is different for the two groups. Women who were planning to enter civil engineering were more likely than those who were not to state that they would enjoy working on site [are planning to enter civil engineering 72.4% (29.8% + 42.6%), are not planning to enter civil engineering 40.0% (0.0% + 40.0%)]. A Mann-Whitney test on the results showed that there was a significant difference between the two groups, those entering the industry and those not, in agreeing that they would enjoy site work (M-W sig=0.0000). In examining the table, it seems that women who plan to enter civil engineering are significantly more likely to agree

that they would enjoy site work.

Concluding: it appears that there is a significant difference in the expected enjoyment of site work and type of sector chosen. However, it seems that there is no significant difference between the level of satisfaction with team work and choice of sector of industry.

10.1.4 RELATIONSHIP BETWEEN CAREER CHOICE AND CHILD-CARE

Sub-hypothesis (c) stated:

> **There is a relationship between the impressions women have of the availability of child-care facilities and their choice of sector of civil engineering.**

In chapter four, it was seen that child-care facilities are important to many women, and in particular chapter four showed that child-care was an issue for women in civil engineering. In 8.3.4, the results of the questionnaire survey showed that over half of women responding (61.4%) agreed that child-care policies and programmes were an important factor in choosing their first employment. This section examines further the expectations women have of child-care provisions in civil engineering to discover whether there is a relationship between expectations and chosen sector.

The following tables, 10.6, 10.7, 10.8, show crosstabulations of the responses to questions connected with child-care.

TABLE 10.6 RELATIONSHIP BETWEEN IMPRESSIONS ABOUT CHILD-CARE AND CAREER CHOICE

	If I had children a career in civil engineering would be impossible					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	0.0	20.0	8.0	52.0	20.0	25
consultancy	2.9	7.4	13.2	35.3	41.2	68
higher education and research organisations	8.3	33.3	8.3	8.3	41.7	12
contractors, small and large	6.1	12.1	6.1	48.5	27.3	33
other	0.0	0.0	16.7	33.3	50.0	6
all respondents	3.0	15.1	10.8	39.8	31.3	166

From the above table, it can be seen that the highest agreement with the statement about having children and finding a career in civil engineering impossible came from those women entering higher education and research organisations [41.6% (8.3% + 33.3%)]. Most of the women in the survey disagreed with the statement [local authority and utilities 72.0% (52.0% + 20.0%), consultancy 76.5% (35.3 + 41.2), higher education and research 50.0% (8.3 + 41.7), contractors, large and small 75.8% (48.5 + 27.3), others 83.3% (33.3 + 50.0)], implying that most women did not think they would find a career in civil engineering incompatible with having children. The general responses supported this where 71.1% (39.8% + 31.3%) disagreed with the statement that if they had children a career in civil engineering would be impossible.

A Kruskall-Wallis test of significance on the results showed that there was no significant difference across sectors and therefore no relationship between women's choice of various

sectors and responses to the statement about the compatibility of a career and children (K-W chi^2 sig =0.2318).

TABLE 10.7 RELATIONSHIP BETWEEN CHILD-CARE PROVISIONS AND CAREER CHOICE

	If I had children, I believe employers would provide adequate support for me					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	4.0	16.0	36.0	24.0	20.0	25
consultancy	8.8	16.2	27.9	27.9	19.1	68
higher education and research organisations	16.7	16.7	16.7	33.3	16.7	12
contractors, small and large	0.0	9.1	39.4	27.3	24.2	33
other	0.0	16.7	33.3	50.0	0.0	6
all respondents	5.4	15.1	30.7	28.9	19.9	166

Table 10.7 shows that about half of the women from all of the sectors disagree with the statement that employers would provide adequate support for them if they were to have children [local authority and utilities 44.0% (24.0% + 20.0%), consultancy 47.0% (27.9 + 19.1), higher education and research 50.0% (33.3 + 16.7), contractors, large and small 51.5% (27.3 + 24.2), others 50.0% (50.0 + 0.0)], implying that around half of the women would not expect to be provided with child-care support from employers. This was the case for all respondents where nearly half of all women answering the survey did not expect employers to provide adequate support for them if they had children [48.8% (28.9% + 19.9%)].

A Kruskall-Wallis test of significance showed that there was no significant difference among the responses of women who had chosen different sectors in agreeing with the statement

about being provided with support from employers (K-W chi^2 sig =0.2318). It seems that the impression of most women choosing any sectors is that they are not likely to receive support for children from employers.

TABLE 10.8 RELATIONSHIP BETWEEN QUESTIONS RELATING TO CHILDREN AND CAREER CHOICE.

	At interviews I anticipate being asked questions about marriage and children					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	16.0	44.0	20.0	16.0	4.0	25
consultancy	13.2	33.8	16.2	17.6	19.1	68
higher education and research organisations	41.7	33.3	25.0	0.0	0.0	12
contractors, small and large	27.3	33.3	12.1	18.2	9.1	33
other	16.7	16.7	0.0	33.3	33.3	6
all respondents	19.9	33.7	16.9	15.1	14.5	166

Examination of the results of the responses to a statement about the expectation of being asked about marriage and children at interviews, showed that over half of the women from three of the sectors, local authorities and utilities [60% (16.0% + 44.0%)], higher education and research [75.0 (41.7% + 33.3%)], contractors, large and small [60.6% (27.3% + 33.3%)] agreed that they expected to be asked questions about marriage and children at interviews. In the remaining sectors, consultancies and others, less than half of the respondents in each sector agreed that they anticipated being asked questions about marriage and children at interviews [47.0% (13.2% + 33.8%) consultancies, 33.4% (16.7% + 16.7%) others]. However, in general over half of all women in the survey expected to be

asked questions about marriage and children at interviews [53.6% (19.9% + 33.7%)].

A Kruskall Wallis test on these results showed that there was no significant difference across sectors and therefore no relationship between women's choice of sector and anticipation of being asked questions about marriage and children at interview (K-W chi^2 sig = 0.1429). The results suggest that women civil engineers, in general, expect to be asked such questions.

Concluding: the above results about the impressions women have of combining a career in civil engineering with having children indicate that the impressions that women have of the availability of child-care facilities do not vary with sector chosen. The results also show that the impression of women choosing any sectors is that they are not likely to receive support for children from employers.

10.1.5 RELATIONSHIP BETWEEN EXPECTED OPPORTUNITIES AND SECTOR CHOSEN IN CIVIL ENGINEERING

Sub-hypothesis (d) stated;

> **There is a relationship between opportunities women expect from a civil engineering career and their choice of sector of civil engineering.**

In the initial stages of the research, it appeared that women had differing views of opportunities which influenced their choice of sector in civil engineering. The following results are presented to give an indication of the opportunities that women expect of a career in civil engineering and how expectations might vary with choice of sector. Tables 10.9 to 10.13 examine the responses to various statements and their relationship to choices between the five sectors of industry.

TABLE 10.9 RELATIONSHIP BETWEEN EASE OF FINDING A JOB BY SECTOR

	I feel that it will be easier for me to get a job in engineering because I am a woman					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	0.0	12.0	32.0	36.0	20.0	25
consultancy	4.4	26.5	25.0	26.5	17.6	68
higher education and research organisations	8.3	50.0	8.3	16.7	16.7	12
contractors, small and large	3.0	27.3	30.3	21.2	18.2	33
other	0.0	16.7	33.3	16.7	33.3	6
all respondents	3.6	25.9	28.9	25.3	16.3	166

Considering the opinions of women tabulated above on the question of whether they think it would be easier for them to get a job in engineering because they are female, a majority of respondents from only one sector, higher education and research organisations [58.3% (8.3% + 50.0%)] agreed with the statement. Over a third of respondents in the remaining sectors disagreed, and did not think it would be easier for them to get jobs because they were women [local authority and utilities 56.0% (36.0% + 20.0%), consultancy 44.1% (26.5 + 17.6), contractors, large and small 39.4% (21.2 + 18.2), others 50.0% (33.3 + 16.7)]. Overall, more women disagreed [41.6% (25.3% + 16.3%)] than agreed [29.5% (3.6% + 25.9%)] with the statement that it would be easier for them to get a job because they were female. This appears to complement the responses of the questionnaire as presented in 8.2.2 where the results of the survey showed that women make, on average, two more job applications per job offers than men, suggesting that it is harder for women than men to

secure jobs. The results in this section suggest that many women do not believe that it is easier for women than men to get jobs.

A Kruskall-Wallis test on the results of the choice of sectors showed that there was no significant difference between the responses of women choosing any of the five sectors in agreeing with the statement that it would be easier for them to get a job because they were female (K-W chi^2 sig = 0.2915).

The next table, 10.10, examines the relationship among the responses to a question referring to employment in a recession, tabulated by sector of industry which the women were proposing to enter. Table 10.10 sets out the responses to the statement that in a recession women expect that civil engineering companies will employ men before them.

From table 10.10, it can be seen that 50% or more of the women in higher education and research (58.3%) and the "other" category (50%) agreed that they expected that in a recession civil engineering companies preferred to employ men before women. However, for two sectors, consultancies and contractors, large and small, just under half of the respondents disagreed [consultancies 44.1% (26.5% + 17.6%), contractors small and large 48.5% (27.3% + 21.2%)] with the statement that in a recession they expect civil engineering employers to employ men before women. Generally, over a third of all respondents disagreed with the statement that in a recession civil engineering companies prefer to employ men before women [38% (22.3% + 15.7%)].

TABLE 10.10 RELATIONSHIP BETWEEN EMPLOYMENT AND SECTOR

	In a recession, I expect that civil engineering companies prefer to employ men before women					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	8.0	32.0	32.0	16.0	12.0	25
consultancy	10.3	13.2	32.4	26.5	17.6	68
higher education and research organisations	0.0	58.3	25.0	0.0	16.7	12
contractors, small and large	9.1	18.2	24.2	27.3	21.2	33
other	0.0	50.0	33.3	16.7	0.0	6
all respondents	9.0	23.5	29.5	22.3	15.7	166

A Kruskall-Wallis test on the results in table 10.10 showed that there was no significant difference between the five sectors in women's responses to the statement (K-W chi^2 sig =0.1921).

Additional responses to statements testing the relationship between expected opportunities and choice of sector in civil engineering can be found in the following tables, 10.11, 10.12 and 10.13.

Table 10.11 shows the results of responses to the question about expected management position and how these responses vary with sector of civil engineering chosen.

TABLE 10.11 RELATIONSHIP BETWEEN EXPECTED MANAGEMENT POSITION AND CHOSEN SECTOR OF INDUSTRY

	I expect to gain a management position within five years of graduation					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	12.0	16.0	44.0	12.0	16.0	25
consultancy	14.7	29.4	35.3	13.2	7.4	68
higher education and research organisations	33.3	16.7	25.0	16.7	8.3	12
contractors, small and large	15.2	39.4	36.4	9.1	0.0	33
other	16.7	0.0	66.7	0.0	16.7	6
all respondents	15.7	25.9	37.3	13.3	7.8	166

When examining the results of the responses to table 10.11, it can be seen that 50% or more of women who have chosen the sectors higher education and research [50.0% (33.3% + 16.7%)] and contractors, large and small [54.6% (15.2% + 39.4%)] agreed that they expected a management position within five years of graduation. In none of the categories did more than 30% disagree with expecting a management position within five years of graduation [local authorities and utilities 28.0% (12.0% + 16.0%), consultancies 20.6% (13.2% + 7.4%), higher education and research 25.0% (16.7% + 8.3%), contractors small and large 9.1% (9.1% + 0.0%), others 16.7% (0.0% + 16.7%)]. These results indicate that many women do expect to gain a management position within five years of graduation. Of all respondents, 41.6% (15.7% + 25.9%) agreed that they expected to gain a management position within five years of graduation.

A Kruskall-Wallis test showed that there was no significant difference in responses across sectors and therefore no relationship between women's choice of sector and expecting a

management position within five years of graduation (K-W chi^2 sig = 0.2582).

The following table presents the results of the analysis of the responses to the statement concerning the respondents' wishes to manage their own companies.

TABLE 10.12 RELATIONSHIP BETWEEN MANAGING OWN COMPANY AND CHOSEN SECTORS OF INDUSTRY

	I would like to manage my own company					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	12.0	12.0	20.0	28.0	28.0	25
consultancy	30.9	23.5	17.6	13.2	14.7	68
higher education and research organisations	25.0	16.7	25.0	25.0	8.3	12
contractors, small and large	18.2	24.2	21.2	24.2	12.1	33
other	16.7	16.7	0.0	66.7	0.0	6
all respondents	22.3	22.3	18.7	21.1	15.7	166

From table 10.12, it seems that women who choose to work for consultancies are more likely than women who choose to work for other sectors to agree that they would like to manage their own companies [consultancies 54.4% (30.9% + 23.5%), local authorities 24.0% (12.0% + 12.0%), higher education and research organisations 41.7% (25.0% + 16.7%), contractors large and small 42.4% (18.2% + 24.2%) and other 33.4% (16.7% + 16.7%)]. Women who are least likely to want to manage their own companies are women who prefer to work for local authorities and utilities [56.0% (28.0% + 28.0%)] and women who choose to work for other sectors [66.7% (67.0% + 0.0%)]. Of all the respondents, 44.6% (22.3% + 22.3%) thought that they would like to manage their own company.

However, a Kruskall-Wallis test on the results showed no significant differences across

sectors and therefore no relationship between women's choice of sector and their wishes to manage their own companies (K-W chi^2 sig =0.0878).

The next table examines the responses of final year women civil engineering students and the relationship between chosen sector and expected promotional opportunities.

TABLE 1 13 RELATIONSHIP BETWEEN CHOICE OF SECTOR AND EXPECTED PROMOTIONAL OPPORTUNITIES

	I think that I will have the same promotional opportunities as men in construction					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	0.0	24.0	40.0	28.0	8.0	25
consultancy	16.2	29.4	23.5	25.0	5.9	68
higher education and research organisations	25 0	41.7	0.0	25.0	8.3	12
contractors, small and large	3.0	51.5	15.2	27.3	3.0	33
other	16.7	50.0	33.3	0.0	0.0	6
all respondents	10.2	33.1	25.9	25.9	4.8	166

By referring to table 10.13, it can be seen that over half of the women from three sectors: higher education and research organisations, 66.7% (25.0% + 41.7 %), contractors large and small 54.5% (3.0% + 51.5%), and others 66.7% (16.7% + 50.0%) agreed that they thought that they would have the same promotional opportunities as men in construction. Of the remaining two sectors, local authorities and utilities and consultancies, those who preferred to work for local authorities and utilities were the least likely to agree that they would have the same promotional opportunities in construction as men [24.0% (0.0% + 24.0%)], and were the most likely to disagree with the statement [36.0% (28.0% + 8.0%)]. Generally,

43.3% (10.2% + 33.1%) agreed that they thought that they would have the same promotional opportunities as men.

A Kruskall-Wallis test on the results of choice of sector showed that there was no significant difference between the groups in their feelings that they would have the same promotional opportunities as men (K-W chi^2 sig = 0.1545).

Expecting to gain a management position within five years of graduation was found to correlate weakly but significantly with wanting to manage their own company (Kendall corr. coeff=0.2473, sig=0.000).

From the above results, testing sub-hypothesis (d), it appears that there are no significant differences among the women choosing different sectors in their expected opportunities. However, what is clear from the results is that many women expect that the construction industry will provide them with the same opportunities as men.

Concluding then, it seems that from the results presented above, that there is little evidence to suggest that women's perceptions of opportunities varies with type of sector in which they choose to work.

10.1.6 RELATIONSHIP BETWEEN EXPECTED DEGREE OF OPPOSITION AND CAREER CHOICE

Sub-hypothesis (e) stated;

> **There is a relationship between the degree of opposition women civil engineering students leaving higher education expect to receive and their choice of sector of civil engineering.**

Part of the discussion in chapter four focused on the expectations some women have of receiving a certain amount of opposition when working in the construction industry.

Interviews with women civil engineering students led to the idea that this expected degree of opposition could affect which sector in which they chose to work. This section tests the relationship between expected opposition and career choice.

TABLE 10.14 RELATIONSHIP BETWEEN PROVING COMPETENCE AND CHOICE OF SECTOR

	It will be easy to prove myself as a competent engineer					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	8.0	12.0	32.0	40.0	8.0	25
consultancy	11.8	27.9	26.5	23.5	10.3	68
higher education and research organisations	0.0	16.7	16.7	66.7	0.0	12
contractors, small and large	12.1	27.3	30.3	27.3	3.0	33
other	0.0	50.0	16.7	33.3	0.0	6
all respondents	8.4	23.5	28.9	30.7	8.4	166

In referring to table 10.14, it can be seen that there are a range of responses relating to the above statement about women civil engineers being able to prove that they are competent engineers. Under half of the respondents in four sectors agreed that it would be easy to prove themselves as competent engineers. These sectors were local authorities, 20% (8.0% + 12.0%), consultancies 39.7% (11.8% + 27.9%), higher education 16.7% (0.0% + 16.7%) and contractors large and small 39.4% (12.1% + 27.3%). In the category "other", 50% (0.0% + 50.0 %) agreed that it would be easy to prove themselves as competent engineers. For all respondents, more women disagreed 39.3% (30.7% + 8.4%) than agreed 31.9% (8.4% + 23.5%) with the statement that it would be easy to prove themselves as competent engineers.

However, a Kruskall-Wallis test on the results showed that there was no significant difference across sectors and therefore no relationship between women's choice of sector and being able to prove themselves as competent engineers (K-W chi^2 sig =0.2017).

For the next statement in this section, the following table 10.15 presents the results of a crosstabulation of the responses of women who have chosen different sectors of industry and their concerns about their relationships with male engineers.

TABLE 10.15 RELATIONSHIP WITH MALE ENGINEERS BY SECTOR

	I worry about how male engineers will interact with me at work					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	4.0	16.0	20.0	40.0	20.0	25
consultancy	5.9	19.1	19.1	29.4	26.5	68
higher education and research organisations	0.0	25.0	8.3	33.3	33.3	12
contractors, small and large	0.0	24.2	27.3	24.2	24.2	33
other	0.0	50.0	0.0	16.7	33.3	6
all respondents	3.0	21.1	20.5	30.1	25.3	166

The table shows that women in most sectors are not very concerned about how male engineers will interact with them at work. For most sectors, the results showed that the majority of respondents disagreed with the statement that they were worried about how male engineers would interact with them at work [local authorities and utilities 60.0% (40.0% + 20.0%), consultancies 55.9% (29.4% + 26.5%), higher education and research organisations 66.6% (33.3% + 33.3%), contractors small and large 48.4% (24.2% + 24.2%) and other 50% (16.7% + 33.3%)]. Generally women were not worried about how men would interact

with them at work; the results of all respondents showed 55.4% (30.1% + 25.3%) disagreed with the statement and 20.5% were neutral. A Kruskall-Wallis test on the results showed that there was no significant difference between the groups in the concern for relationships with male engineers (K-W chi^2 sig =0.9569).

The following table, 10.16, examines the responses to the statement about whether women civil engineering students feel that manual workers prefer being supervised by men by preferred sector.

The table shows that over 50% of women in all categories believe that manual workers prefer being supervised by men [local authorities and utilities 56.0% (8.0% + 48.0%), consultancy 57.3% (27.9% + 29.4%), higher education and research organisations 75% (25.0% + 50.0%), contractors small and large 54.5% (30.3% + 24.2%) and other 66.7% (16.7% + 50.0%)]. For all respondents, over half agreed that manual workers prefer being supervised by men [60.8% (34.9% + 25.9%)].

TABLE 10.16 RELATIONSHIP BETWEEN SUPERVISING MANUAL WORKERS AND SECTOR CHOSEN

	manual workers prefer being supervised by men					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	8.0	48.0	24.0	16.0	4.0	25
consultancy	27.9	29.4	25.0	13.2	4.4	68
higher education and research organisations	25.0	50.0	16.7	8.3	0.0	12
contractors, small and large	30.3	24.2	21.2	12.1	12.1	33
other	16.7	50.0	16.7	16.7	0.0	6
all respondents	25.9	34.9	21.1	13.3	4.8	166

Again a Kruskall-Wallis test on the results showed that there was no significant difference between the groups in belief that manual workers prefer being supervised by men (K-W chi^2 sig =0.7460).

Thus it is established from table 10.16 that the majority of women in all categories believe that manual workers prefer being supervised by men. The following table examines the opinion of women in relation to their worries about supervising manual labour.

TABLE 10.17 RELATIONSHIP BETWEEN SUPERVISING AND SECTORS

	I do not worry about how men will react when I have to supervise them					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	20.0	28.0	24.0	24.0	4.0	25
consultancy	22.1	33.8	13.2	23.5	7.4	68
higher education and research organisations	25.0	33.3	8.3	33.3	0.0	12
contractors, small and large	30.3	30.3	15.2	24.2	0.0	33
other	33.3	16.7	50.0	0.0	0.0	6
all respondents	21.1	33.1	16.3	25.9	3.6	166

Table 10.17 shows that about half all women in each category do not worry about supervising men [local authorities and utilities 48.0% (20.0% + 28.0%), consultancy 55.9% (22.1% + 33.8%), higher education and research organisations 58.3% (25.0% + 33.3%), contractors small and large 60.6% (30.3% + 30.3%) and other 50.0% (33.3% + 16.7%)]. Generally, over half of the women respondents agree that they do not worry about how men will react when they have to supervise them [54.2% (21.1% + 33.1%) disagreed, 16.3% were neutral]. There appears to be no significant difference between the women preferring different sectors in their responses to the statement about supervision of men as a Kruskall-

Wallis test shows (K-W chi^2 sig = 0.7982).

The next table examines the responses of women civil engineering students to a statement about their feelings of working in civil engineering and whether they will be accepted in their job.

TABLE 10.18 THE RELATIONSHIP BETWEEN FEELING AN OUTSIDER AND PREFERRED SECTOR.

	I worry about being made to feel an outsider in my job because I am female					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	0.0	20.0	16.0	48.0	16.0	25
consultancy	2.9	20.6	17.6	27.9	30.9	68
higher education and research organisations	0.0	25.0	25.0	33.3	16.7	12
contractors, small and large	0.0	24.2	15.2	30.3	30.3	33
other	0.0	16.7	66.7	0.0	16.7	6
all respondents	1.8	21.7	19.9	31.3	25.3	166

Table 10.18 shows that the over half of respondents do not worry about being made to feel an outsider in their jobs because they are female [all respondents disagree; 56.6% (31.3% + 25.3%)]. A statistical test on the results showed that there was no significant difference between the groups in their responses to the statement (K-W chi^2 sig= 0.9284). The results suggest that most women do not expect difficulties in being accepted in their work as a civil engineer.

The following table presents the results of the analysis of the questionnaire concerning women's expectations that there will be harassment problems in the construction industry. Some women in the initial stages of the research mentioned that they were concerned about

there being harassment in the industry. Table 10.19 and subsequent tests on the results examines these expectations by preferred sector.

TABLE 10.19 RELATIONSHIP BETWEEN HARASSMENT AND SECTOR

	Sexual harassment is a problem in the construction industry					N
	strongly agree (%)	somewhat agree (%)	neutral (%)	somewhat disagree (%)	strongly disagree (%)	
local authority and utilities	8.0	20.0	48.0	24.0	0.0	25
consultancy	10.3	25.0	26.5	35.3	2.9	68
higher education and research organisations	16.7	33.3	8.3	33.3	8.3	12
contractors, small and large	9.1	48.5	30.3	0.0	12.1	33
other	0.0	33.3	66.7	0.0	0.0	6
all respondents	9.6	31.3	32.5	22.3	4.2	166

The above table shows that around 50% or more of women in two categories believed that sexual harassment is a problem in the construction industry. These results show that agreement with the statement was: for women entering higher education and research organisations 49.9% (16.7% + 33.3%), and women entering contractors large and small 57.6% (9.1% + 48.5%). Of the other categories, more women agreed than disagreed with the statement, and overall this was the same for all respondents [agree; 40.9% (9.6% + 31.3%), disagree 26.5% (22.3% + 4.2%)].

A Kruskall-Wallis test on the results showed that there was no significant difference between the groups and believing sexual harassment to be a problem (K-W chi^2 sig = 0.3105).

Feeling that sexual harassment was a problem in the construction industry was weakly but significantly correlated with being made to feel an outsider in their job (Kendall corr. coeff. = 0.2333, sig=0.000). Further correlations showed significant but weak correlations

between the following variables: women who agreed that they were worried about being made to feel an outsider in their jobs were likely to disagree that they thought it would be easy to prove themselves as competent engineers (Kendall corr. coeff.= -0.2918, sig=0.000), they also tended to agree that manual workers preferred being supervised by men (Kendall corr. coeff.= 0.2640, sig=0.000) and tended to disagree that they were not worried about how men would react when supervised by them (Kendall corr. coeff.= -0.3542, sig=0.000).

Concluding: it appears that from these results that for women entering civil engineering, the degree to which they expect opposition does not vary significantly with choice of sector. What is clear from these results is that some women do have concerns about being a woman in the civil engineering profession.

10.2 GENERAL CONCLUSION TO THE CHAPTER

The main hypothesis stated;

There is a relationship between the career expectations of women civil engineering students and the sector of civil engineering they choose

This hypothesis is disconfirmed

A variety of expectations were assessed to test this hypothesis. From the results there is no relationship between expectations and choice of sector, with the sole exception of expected enjoyment of site work. Impressions of the various sectors, of the possibility of combining a career with children, of availability of child-care, opportunities and expected opposition were all not related to choice of sector. This evidence therefore disconfirms the hypothesis. For a more detailed discussion of these results in relation to the main hypothesis see chapter eleven.

CHAPTER ELEVEN

DISCUSSION

11.1 INTRODUCTION

The purpose of this chapter is to discuss the main findings of the thesis in relation to the four main hypotheses set out in chapter one and tested in chapters seven, eight, nine and ten of this thesis. The discussions in this chapter show to what extent these hypotheses are confirmed or disconfirmed (see section 6.13.1 for a discussion on the use of these terms). The limitations of these findings are also discussed together with their significance.

11.2 DISCUSSION: HYPOTHESIS ONE

Main Hypothesis one:

There are general patterns in the initial career choices of women on civil engineering degree courses

This hypothesis is confirmed.

The results showed that the initial reasons for women choosing civil engineering were varied and complex. However, some general patterns were evident when examining the reasons of the larger sample in the national survey questionnaire. Evidence that this main hypothesis is confirmed can be found when analyzing the results of the questionnaire survey testing the influence of parents, brothers, science and mathematics teachers and careers advisors, together with other factors which may have influenced women's decisions to choose civil engineering as a career as tested in chapter seven. These results and their relationship to the

main hypothesis are discussed in this section.

11.2.1 DISCUSSION: SUB-HYPOTHESIS ONE

Families are important in encouraging women to choose civil engineering

This hypothesis is neither confirmed or disconfirmed.

The literature presented in chapter two suggested that there was a degree of parental influence on the decision of women to choose civil engineering, and that, in particular, fathers could play an important part in the decision. The results established by this research confirmed this relationship for some women answering the questionnaire survey. Sections 7.3.2 and 7.3.3 indicated that 25.9% of fathers and 16.7% of brothers provided encouragement in the career choice of women civil engineers. The results showed that in particular, fathers and brothers who were engineers, or in professions related to building, were significantly more likely to provide encouragement to women in their choice of civil engineering as a career than women without brothers or fathers in these professions. On the other hand, the results did indicate that 34.5% of women answering the survey disagreed that there was encouragement from fathers and 52.8% of women answering the survey disagreed that there was encouragement from brothers. Therefore it would appear that although some women are encouraged in their choice, other women are not.

In addition to testing the encouragement from these members of the family, the results of the questionnaire survey presented in section 7.3.4 of this study, suggested that the majority of women (67.4%) were not being discouraged in their decision to choose civil engineering by

their mothers. However, it is a limitation of the results of the survey in this thesis that it could not say how many women are actively encouraged by their mothers in their career choice. When drawing conclusions about this sub-hypothesis, consideration must be given to the fact that not all family members could be tested and this makes it hard to conclude definitively whether families are important in encouraging women to choose civil engineering. Thus the hypothesis is neither confirmed or disconfirmed as it is not true that families are always important, nor that they are always unimportant but the significant point to make is that women with fathers and brothers in engineering or building related professions are likely to receive the most encouragement from these two members of their families.

11.2.3 DISCUSSION: SUB-HYPOTHESIS TWO

Careers advice is inadequate for women choosing civil engineering

This hypothesis is confirmed.

Chapter two examined the work of researchers on the impact of careers advice on women's decisions to choose careers like civil engineering. It concluded that there appeared to be no general pattern in the type of careers advice that women choosing engineering might receive. The results of the questionnaire survey as presented in section 7.4 in this research provided quite detailed information on the influence of careers services on women's decisions to choose civil engineering so that conclusions about the careers advice received by women civil engineers could be made. The results analyzed in section 7.4.2 suggested that almost half of

all women (48.8%) answering the survey did find the careers advice at school unhelpful. In addition, an analysis of the results in section 7.4.4 suggested that over half of the women (54.8%) sought careers advice outside school. Both these results suggest that there could often be inadequate careers advice at school.

That an inadequate careers service often exists can also be partially confirmed by the results of the questionnaire survey as analyzed in section 7.4.6 which suggested that just under half of the respondents to the questionnaire survey (47.0%) felt that they chose civil engineering with little knowledge of what work civil engineers actually did. This result highlights the inadequacy of the advice some women are receiving. There may be an exception to the widespread inadequacy of careers advice - short courses for women . Although only 32.6% of the women in the survey found that these influenced their careers decision, it should not be concluded that they are less helpful than other elements of careers services. How significant the 32.6% is depends on how widespread the short courses are. Almost every school has a careers service and that about half find it inadequate is bad. But if only a few schools have short courses, that only 32.6% of the total number of respondents found them helpful may mean that all those who attended these courses benefited. It is a limitation of these results that a judgement on this cannot be made, given that it is not known how many women replying to the survey attended these courses.

However, an analysis of the results did suggest that the majority of women (69.3%) were not being actively discouraged from choosing civil engineering, although a minority (12.0%) were advised not to choose civil engineering by careers advisors at school. A limitation on the result of the survey is that it cannot give any indication why careers advisors would discourage women from choosing civil engineering.

Further useful findings can be found in the analysis of the results in section 7.4.2 which

suggested that there was no relationship between women civil engineering degree students finding careers advice unhelpful, and the type of school they attended. This is a significant finding because in the initial investigations for this research, it was suggested, from a small sample, that there was a difference, but on this larger sample this does not appear to be the case. Overall, the results suggested that an inadequate careers advice exists for many women and lends confirmation to the hypothesis that women choosing civil engineering as a degree find careers advice inadequate.

11.2.4 DISCUSSION: SUB-HYPOTHESIS THREE

Science and mathematics teachers play an important role in the career choice of women civil engineers

This hypothesis is disconfirmed.

The results of the questionnaire survey conducted for this research, and presented in 7.5.3, showed that for only a minority of women (22.9%) on civil engineering courses was some influence from science teachers in their initial career decisions detected. The results presented in section 7.5.4 in this research also suggested that for only a small percentage of women (12.0%) on civil engineering courses was there any influence on their career choice from mathematics teachers. Hence the hypothesis must be disconfirmed.

Initial investigations, from the literature and interviews had suggested that teachers could be strong role models but this does not appear to be generally the case when examining the influence of teachers on a larger sample. What was also an important finding from these

results was the type of school attended, either single or mixed sex, appeared to make no difference to the influence of science or mathematics teachers.

Overall, the evidence from the results lead to a disconfirmation of the hypothesis that science and mathematics teachers play an important role in the career choice of women civil engineers and would appear to confirm that there exists of a general pattern of no influence from these teachers.

11.2.5 DISCUSSION: SUB-HYPOTHESIS FOUR

There is a relationship between women's choice of civil engineering as a degree and their ability in certain subjects.

This hypothesis is confirmed.

The results presented in section 7.6.2 indicated that generally the majority of women (60.1%) who choose civil engineering as a career did not find mathematics at school difficult. In addition, the results presented in 7.6.6 suggested strong support from the majority of respondents (73.5%) that they chose civil engineering because it gave them the opportunity to use their mathematics and science background without specialising in either. These results provide support for the hypothesis that women choose civil engineering because they are good at certain subjects and confirm the findings of the initial investigation, of literature and interviews, that one reason why women chose civil engineering was because they were competent at mathematics and physics subjects at school.

However, the analysis of the results of the questionnaire survey, as discussed in section 7.6.3

in this research, indicated that there was little evidence to suggest that women who chose civil engineering were likely to rate physics as their strongest subject at school, even though 77.1% of women who entered civil engineering courses did achieve advanced level qualifications in physics. Unfortunately the results of the survey do not indicate to what extent women felt they were competent at physics and therefore the extent to which women thought that they were good at physics and its relationship to career choice remains unknown. However, the results analyzed and discussed in section 7.6.4 suggested that almost a quarter (24.7%) of the women answering the survey felt that they were not good at arts subjects at school and for these women there may have been a tendency towards science subjects. However, the results also suggested that few women had technical hobbies and therefore it can be assumed that there is no link here between the career choice of civil engineering for women and hobbies as a child. Given that the some of the results discussed above provided evidence to suggest a relationship between ability in certain subjects and career choice, this hypothesis is confirmed.

11.2.6 DISCUSSION: SUB-HYPOTHESIS FIVE

The same features of civil engineering are found attractive by women choosing it.

This hypothesis is confirmed.

The findings from this questionnaire survey showed that for many women there were common reasons for choosing civil engineering. Section 7.7.2 assessed the importance of these other reasons and concluded that some of the main reasons for choosing civil engineering were opportunity to do interesting work (92.2% agreed) and the challenge of

problem solving (79.5% agreed). These were two commonly mentioned features in interviews and were discussed in chapter two. Seeing civil engineering as a transferable profession was also identified in interviews as a reason for choosing civil engineering and this reason was again confirmed as a reason for choosing civil engineering by over seventy percent of the respondents (71.0% agreed) to the questionnaire survey as the results in table 7.38 showed. In addition to these reasons, other reasons for choosing civil engineering as indicated in interviews were confirmed by the results presented in section 7.7.2. For example, over half of the women (57.2%) answering the questionnaire stated that they choose civil engineering because they wanted to work outside most of the time and over a third of women (36.7%) in the survey agreed that succeeding in a male dominated world was also a reason for choosing civil engineering. Two other reasons, given in the interviews as reasons for choosing civil engineering, were not generally widely held reasons for choosing civil engineering. These reasons were having a high salary (only 10.8% agreed) and not dealing with the general public (only 7.2% agreed) where the results presented in table 7.38 showed little support for these reasons. Overall, some common reasons for women choosing civil engineering appear to be widely held, hence the hypothesis is confirmed.

11.3 CONCLUSIONS: MAIN HYPOTHESIS ONE

That general patterns in the career choices of women civil engineering exist can be found in the results discussed in this section. Summing up these general patterns, it appears that there is support for the hypothesis that generally many women find careers advice inadequate, that science and mathematics teachers do not influence career choice of women civil engineers, some patterns exist in the ability of women civil engineering in certain subjects and that there are some general patterns in the reasons women give for choosing civil engineering. Hence

the hypothesis that there are general patterns in the career choice of women civil engineers is confirmed. Even the sub-hypothesis relating to families, which was neither confirmed or disconfirmed, provides evidence of a general pattern. Families tend not to encourage women unless they are made up of fathers or brothers in engineering or building related professions. Overall the conclusion of the results in relation to the main hypothesis in that there are general patterns in the initial reasons for women choosing civil engineering is confirmed.

11.4 DISCUSSION: HYPOTHESIS TWO

Main hypothesis two

Female and male civil engineering students leaving higher education choose employment differently

This hypothesis is confirmed.

The results showed that there were some differences in the ways male and female civil engineering students choose employment. Evidence from the three areas of career choice examined in this section of the thesis, that of what they were choosing, how they were choosing it and what determined those choices showed some significant differences but many similarities which will be discussed in this section.

11.4.1 DISCUSSION: SUB-HYPOTHESIS ONE

Male and female civil engineering students make different career choices

This hypothesis is disconfirmed.

In the results presented in sections 8.1.2 and 8.1.3, referring to the choice of sector of industry and choice of specialisation, no significant differences between the choices that male and female civil engineering students made were apparent. The results of the questionnaire survey, as analyzed in section 8.1.2, showed that for sector of industry there were no significant differences in the preferences of male and female civil engineering graduates. However, there were some observational differences in the results in preferences for working with contracting or specialist research organisations. The results presented in table 8.2 showed that men were more likely than women to prefer to work for contractors (34.0% men, 22.9% women) and women were more likely than men to choose specialist research organisations (6.9% women, 2.7% men). In other sectors such as consultancy, utilities and local authorities some differences were also apparent when observing the data. However, statistical tests suggested that these differences were not significant. Women were slightly more likely than men to choose to work for consultancies (47.2% female, 43.3% male), but again these differences were observational rather than significant and therefore the conclusion that there are differences in these cases would be inaccurate. In analyzing the results presented in 8.1.3 showing specialisation preferences, there were overall no significant differences; however again some observational differences are worth commenting on which were small differences in four sub-categories. These were structural engineering (19.6% female, 24.7% male), construction management (17.5% male, 11.0% female), geotechnical

engineering (11.7% female, 9.0% male) and environmental engineering (11.0% female, 4.2% male). The results of this questionnaire survey, as analyzed in section 8.1.4, suggested that most male (85.6%) and female (84.9%) civil engineering students leaving higher education intended to find work in the civil engineering industry and were not planning to enter another industry. Statistical tests on these results revealed no significant differences between male and female civil engineering students in this respect. Additional findings from this research, as examined in section 8.1.5, suggested that over a quarter of students of both sexes (32.3% male, 25.3% female) were planning to take further qualifications and that the differences between them in this respect were not significant. The results in section 8.1.6 showed that a high percentage of both male and female civil engineering students (59.6% female, 62.3% male) were likely to take "time off" after their degrees, the most common length of time being three months or less, the most usual activity, travelling. Overall the analysis of the findings do not support the hypothesis that male and female civil engineering students make different career choices, instead suggesting that there are no statistically significant differences, and hence the hypothesis is disconfirmed.

11.4.2 DISCUSSION: SUB-HYPOTHESIS TWO

The process of securing employment differs between men and women

This hypothesis is disconfirmed.

The results, presented in section 8.2, showed that, with one exception, there were no significant differences between male and female civil engineering students in the way they secured employment. The only significant difference in the results between male and female

civil engineering students leaving higher education was in the number of job applications that male and female civil engineering students made per job offer. The findings analyzed in 8.2.2 suggested a significant difference in this respect where it appeared that women made on average two more job applications per job offer than men. (The mean number of job applications per job offer for those respondents who had received job offers was 7.67 female and 5.64 male.)

There appeared to be no previously conducted research which examined what resources both male and female civil engineering students used when trying to find employment. It was suggested from the interviews conducted in the early stages of the research that there could be differences between male and female civil engineers in this respect. The questionnaire survey examined this topic and gives a clear indication of the resources used by these students and whether there are differences between male and female students. The findings of the questionnaire survey in this study, as discussed in section 8.2, showed that no significant differences existed between the sexes in their use of resources to find employment and therefore lends support to the conclusion that the hypothesis is disconfirmed. In the case of use of careers services, table 8.13 showed that both male and female civil engineering students leaving higher education made use of careers services in high, and almost equal, percentages (female 76.5%, male 71.1%). The results analyzed in 8.2.6 showed that engineering journals were also a common source for finding information about employment opportunities for both male and female civil engineering students (female 50.6%, male 44.9%). An analysis of the results in 8.2 showed that engineering journals were used by more female and male students for finding out about employment opportunities than using other sources such as family, friends and other sources. Examining the use of family, friends

and other sources for finding employment, the results suggested that there were no significant differences between male and female students in their use of these resources. In general, the findings of this research, as examined in section 8.2, suggested that the process of securing employment does not vary significantly between male and female civil engineering students leaving higher education and there is therefore no evidence from these findings that the process of securing employment differs between men and women, and hence the hypothesis that there is a difference is disconfirmed.

11.4.3 DISCUSSION: SUB-HYPOTHESIS THREE

Male and female civil engineering students leaving higher education find different factors important when choosing their first employment

This hypothesis is confirmed.

The results of the research as analyzed and discussed in section 8.3 of this study tend to confirm the existence of differences, showing that male and female civil engineering students leaving higher education find different factors important when choosing their first employment. The results presented in 8.3.2 suggested that, when choosing their first employment, the importance of location of the first employment was different for men and women. Women were significantly more likely than men to consider the location of organisation to family and close friends as an important factor in this decision. Similarly it appears, from the analysis of the results presented in 8.3.3, that when choosing their first employment, the importance of the opportunity to travel does vary between the sexes.

Women were significantly more likely than men to consider the opportunity to travel in the UK as an important factor. However, the results suggest that men and women were equally likely to find having the opportunity to travel overseas important in choosing their first employment. The importance of employment benefits was discussed in section 8.3.4. This section showed that when choosing their first employment, the importance of some employment benefits appeared to be different for male and female civil engineering students. Women were significantly more likely than men to consider child-care policies and programmes an important factor in their decisions about first employment. Men, on the other hand, were significantly more likely than women to consider salary as an important factor in choosing first employment. However, the results showed no significant differences between men and women in finding benefits like company car and pension plans important factors in choosing their first employment. Further results, as analyzed and presented in section 8.3.5, showed some significant differences and some similarities between male and female civil engineers leaving higher education in the factors which they considered important in choosing work. There were no significant differences between male and female respondents to the survey in considering four related factors of equal importance, namely, the opportunity to do varied work, the opportunity to do interesting work, the training programme for graduates and the opportunity for quick advancement to a management position. However, an analysis of the results in 8.3.5 showed that women were significantly more likely than men to consider two factors important in choosing their first employment; being involved in new developments and ethical considerations about the type of work involved. The results of the questionnaire survey carried out for this study, as presented in 8.3.6, also suggested that most male and female respondents appeared to consider three factors of relatively little importance and that there were no significant differences between

them in their consideration of these factors. These were the prestige of job title, prestige of organisation and the percentage of women engineers in the organisation. The results in this section also showed that women were significantly more likely than men to consider the working environment important. Similarly the results showed a significant difference in the responses of male and female civil engineering students to the importance of the size of the organization, and again women were significantly more likely than men to rate it important. Evidence presented above provides support for the hypothesis that male and female civil engineering students leaving higher education find different factors important when choosing their first employment and hence the hypothesis is confirmed.

11.5 CONCLUSION: MAIN HYPOTHESIS TWO

Female and male civil engineering students leaving higher education choose employment differently

The evidence presented above shows that in some ways the choices male and female civil engineering students make is different and in some ways it is not. Although there were no significant differences in the career choices male and female civil engineering students were making, and only one significant difference between male and female civil engineering students in the process of securing employment, given the important and significant differences found in the analysis of the results in the third hypothesis, that of factors important for choosing first employment, it can be concluded that this hypothesis is confirmed.

11.6 DISCUSSION: MAIN HYPOTHESIS THREE

There is a relationship between the college experiences of women civil engineering students and their career choice

This hypothesis is neither confirmed nor disconfirmed.

Analysis of the results suggests that there is some evidence which confirms, and some evidence which disconfirms, the hypothesis that the college experiences of women influence their career choice. The following discussion draws together the findings of the questionnaire survey in relation to the sub-hypotheses and allows conclusions about the main hypothesis to be made.

11.6.1 DISCUSSION: SUB-HYPOTHESIS ONE

Women on civil engineering degree courses who enjoy the course are more likely than those who do not enjoy the course to enter civil engineering employment

This hypothesis is confirmed.

The results of the questionnaire survey in this research, as presented in 9.1.2, suggest that there is a significant difference in career choice between those women who enjoy the civil engineering course and those who do not. Those who enjoy the course were significantly more likely than those who do not enjoy it to enter civil engineering employment. The findings analyzed in 9.1.2 suggested that women not entering civil engineering were

significantly less likely than those entering the industry to enjoy laboratory classes and the practical aspects of the course. These results help confirm the hypothesis. The findings, analyzed in 9.1.2, also suggested that women not planning a civil engineering career were significantly less likely than those planning a civil engineering career to find engineering classes interesting and were significantly less likely to be pleased with their decisions to choose civil engineering. Given these results, overall the hypothesis is confirmed.

11.6.2 DISCUSSION: SUB-HYPOTHESIS TWO

Women who feel at a disadvantage throughout the course, compared with their male colleagues, are more likely to leave civil engineering than those who do not feel disadvantaged

This hypothesis is disconfirmed.

It appears, from the results of the questionnaire survey presented in 9.1.3, that women who feel at a disadvantage compared to their male colleagues, were no more likely than those who did not, to leave civil engineering. That some women felt at a disadvantage, however, did support some of the results of the literature surveys reviewed in chapter three, which suggested that women felt at an initial disadvantage on the course compared with their male colleagues. The results of the questionnaire survey in this research, as presented in 9.1.3, confirmed that some women on civil engineering courses appeared to feel that at the start of the course male students had more engineering experience (47.5% agreed) and a better understanding of computing than themselves (37.9% agreed), 13.8% of the respondents felt that they had to work harder than their male colleagues to get comparable grades and 37.3%

believed that they have to be more assertive than their male colleagues. However, there were no differences in any of these respects between those entering and those leaving civil engineering. Hence the hypothesis that there is a difference is disconfirmed.

11.6.3 DISCUSSION: SUB-HYPOTHESIS THREE

Women who feel they have a high ability in civil engineering are more likely to enter civil engineering employment than those who feel that they have a low ability

This hypothesis is disconfirmed.

The results of the questionnaire survey conducted for this research, as analyzed in 9.1.4, suggest that women civil engineering students who were entering civil engineering were no more likely than those not entering civil engineering to feel that they have a high ability, or a low ability, in civil engineering. In general, the results analyzed in 9.1.4 suggested that both women entering and leaving civil engineering felt that they were successful students. Despite this, a third of all respondents (33.9%) found mathematics on the course difficult and 41.5% thought that the engineering curriculum was more difficult than they expected but the analysis for both of these results suggested that those leaving the industry were no more likely than those not to agree, or disagree with these questions. Thus, this hypothesis that there is a difference is disconfirmed.

11.6.4 DISCUSSION: SUB-HYPOTHESIS FOUR

Women who identify with their male colleagues are more likely to enter civil engineering employment than those who do not

This hypothesis is disconfirmed.

The results discussed in 9.1.5 suggested that women who identified with their male colleagues were no more or less likely than those who did not to choose civil engineering employment. The survey of the literature in chapter three showed that some research implied that women on engineering courses felt that there were problems about being taken seriously by their male colleagues, and that women engineering students found their male colleagues immature, amongst other things. The results from the questionnaire survey, as presented in section 9.1.5, do not confirm this; over half of the women civil engineering students included in this questionnaire survey did not appear to have problems with their male colleagues. Specifically, the results presented in 9.1.5 suggested that only 15.6% of respondents found their male colleagues less mature than other male students and only 12.0% felt that they intimidated their male colleagues. The analysis suggested that few women (13.8%) felt they got unwanted attention from the male students on their course. In all these results, there were no significant differences between those women entering civil engineering and those women not. Therefore the hypothesis that there is a difference is disconfirmed.

11.6.5 DISCUSSION: SUB-HYPOTHESIS FIVE

Women who are satisfied with their lecturing staff are more likely to enter civil engineering than those who are not

This hypothesis is confirmed.

Overall the findings of the questionnaire survey in this research, as discussed in 9.1.6,

showed that women on civil engineering courses tend to view lecturing staff favourably. The findings in 9.1.6 indicated that 39.8% of the women respondents would like more female lecturers on the faculty, but only 9.7% of the respondents felt that female lecturers actually showed more concern for them. The findings also showed that most women (71.1%) were not uncomfortable in approaching lecturing staff for help although the results presented in 9.1.6 did suggest that over half (55.4%) of the women taking part in the survey disagreed that sexist language was never used by lecturing staff. There were also some significant differences between those women entering civil engineering and those not in their attitudes towards lecturing staff. The results in 9.1.6 showed that women who were not entering civil engineering were significantly more likely than those entering civil engineering to state that they were put off some types of employment by lecturing staff, although overall only 14.4% stated they were actually put off. They were also significantly less likely than those entering civil engineering to state that the lecturing staff were good teachers. Overall the hypothesis is confirmed given the evidence presented above.

11.6.6 DISCUSSION: SUB-HYPOTHESIS SIX

Feelings attributed to minority status discourage women from entering civil engineering

This hypothesis is disconfirmed.

The results in 9.1.7 suggested that women who were sociable and participated in social activities were no more likely than those who were not to enter civil engineering. Contrary to the literature analyzed in chapter three, there was little evidence from the questionnaire

survey conducted for this research as analyzed in section 9.1.7 that women felt isolated at college (16.3% agreed), or that they would be any more comfortable if more women students were on the course (only 9.6% of respondents agreed). However, women who felt this way were no less likely to enter civil engineering than those who did not have these feelings. Thus the hypothesis that there is a difference is disconfirmed.

11.6.7 DISCUSSION: SUB-HYPOTHESIS SEVEN

Those women who feel their role in class is determined by their sex are more likely to enter a profession other than civil engineering

This hypothesis is disconfirmed.

When examining the results in 9.1.8 it became apparent that there was no identifiable difference between a woman's perceived role in class, either feeling that she was the organiser in group projects or the student likely to record the data in laboratories, and her choice of career. The findings presented in section 9.1.8 nethertheless did suggest that there were difficulties for some women on civil engineering courses. Almost a third of women (28.9%) agreed that in laboratory groups they are generally the one to record the data, and 44.0% of the respondents agreed that they were usually the organiser in group projects. In addition to this, the results in this section showed that over a third of women (42.2%) were reluctant to ask questions in class. Other findings in 9.1.8 suggested that over half of women responding (51.8%) thought that they were perceived as less feminine than other female students. However, in neither of these results were there significant differences between women not entering civil engineering and those entering civil engineering. Given that there

are no differences between those entering and those not, this hypothesis is disconfirmed.

11.7 CONCLUSION: MAIN HYPOTHESIS THREE

Some aspects of the college experiences of women civil engineering students are related to their career choice, namely enjoyment of the course and satisfaction with lecturing staff. But the findings from this research show that there is little evidence to suggest that other aspects of college experiences were related to the career choices of women civil engineering students. Therefore overall the hypothesis is neither confirmed nor disconfirmed. The results do tend to confirm the suggestions made in the literature that some women face problems on engineering courses and, more importantly, the results give a fairly comprehensive view of impressions of their experiences by women civil engineering students.

11.8 MAIN HYPOTHESIS FOUR

There is a relationship between the career expectations of women civil engineering students and the sector of civil engineering they choose

This hypothesis is disconfirmed.

Generally the evidence from the results of the questionnaire survey suggest that the career expectations that women have do not influence the choice of sector

11.8.1 DISCUSSION: SUB-HYPOTHESIS ONE

There is a relationship between the beliefs about various sectors of civil engineering held by

women civil engineering students and their choice of sector of civil engineering.

This hypothesis is disconfirmed.

The findings in this research suggest that there is no difference in the sectors women choose and their beliefs about various sectors. There was no identified significant relationship between the choice of sectors and women's beliefs that consultancies treat women engineers better than contractors do, nor were there any significant relationships between the choice of sectors and the beliefs of women that local authorities have more favourable employment policies than consultancies. Given that there is no relationship, identified from the findings of this research, between the choice of various sectors and women's beliefs, the hypothesis that the beliefs about various sectors of civil engineering held by women civil engineers is related to their choice of sector of civil engineering is disconfirmed.

11.8.2 DISCUSSION: SUB-HYPOTHESIS TWO

There is a relationship between the expected enjoyment by women civil engineering students of some features of civil engineering work and their choice of sector of civil engineering.

This hypothesis is confirmed.

On analyzing the results of the questionnaire in 10.1.2, it became apparent that the impression of various sectors of industry held by women civil engineers could influence their choice of sector of civil engineering. The results presented in section 10.1.2 suggested that there was a significant relationship between the expected enjoyment of site work and choice

of sector of industry. In addition, those women planning on entering civil engineering were significantly more likely than those not to agree that they would enjoy working on site. However, another result in 10.1.2 also suggested that there was no difference in the level of satisfaction with team work experienced by women who chose different sectors of industry. The results suggested that most women found team work satisfying. Obviously, there are many other features of civil engineering which could have been tested. It is a limitation of this thesis that this could not happen. However, given that the evidence suggested a significant difference between choice of sector and enjoyment of site work, this hypothesis is supported as far as the feature of site work is concerned and the hypothesis in this instance is confirmed.

11.8.3 DISCUSSION: SUB-HYPOTHESIS THREE

There is a relationship between the impressions women have of the availability of child-care facilities and their choice of sector of civil engineering.

This hypothesis is disconfirmed.

On examining the findings in the questionnaire survey, presented in 10.1.4, about the impressions women have of combining a career in civil engineering with having children, it appears that over half of the women (48.8%) do not believe that adequate support would be provided for them by employers if they had children. The findings from the questionnaire survey as analyzed in 10.1.4 also showed that most women (71.1%) responding to the survey believed that if they had children, a career in civil engineering would not be impossible.

Furthermore, the results in 10.1.4 showed that over half the women (53.6%) also expected to be asked questions about marriage and career at interviews. However, the responses to these questions did not differ significantly given the sector of employment chosen. Therefore the hypothesis is not supported and the conclusion from these findings is that the impressions that women have of the availability of child-care facilities is not related to the sector of civil engineering chosen and hence the hypothesis is disconfirmed.

11.8.4 DISCUSSION: SUB-HYPOTHESIS FOUR

There is a relationship between opportunities women expect from a civil engineering career and their choice of sector of civil engineering.

This hypothesis is disconfirmed.

It appears from the analysis of the results, presented in 10.1.5, that there is little evidence to suggest that the expected opportunities that women perceive as available to them affects the choice of sector in which they chose to work. The findings analyzed in 10.1.5 did give an indication of the impressions that women had of expected opportunities in civil engineering. In general, the results analyzed in 10.1.5 suggested that more women disagreed (41.6%) than agreed (29.5%) with the statement that it would be easier for them to get a job because they were female. Further results showed that over a third of all respondents (38.0%) disagreed with the statement that in a recession employers prefer to employ men before women, and almost half of all women (43.3%) answering the questionnaire survey agreed that they thought that they would have the same promotional opportunities as men. Furthermore, the results presented in 10.1.5 suggested that over a third of women (41.6%)

expected a management position within five years of graduating. The analysis of the results suggested that there was no significant relationship between those women entering the different sectors and the expected opposition. Therefore the hypothesis that for women entering civil engineering, the degree of expected opposition is related to their choice of sector of civil engineering is disconfirmed on the evidence from these results.

11.8.5 DISCUSSION: SUB-HYPOTHESIS FIVE

There is a relationship between the degree of opposition women civil engineering students leaving higher education expect to receive and their choice of sectors of civil engineering.

This hypothesis is disconfirmed.

Generally the results presented in 10.1.6 showed that over half of all women (55.4%) answering the questionnaire survey for this research did not appear to be worried about how men would interact with them at work. Nor did most women (54.2%) appear to worry about how men would react when they have to supervise them. However, the results presented in 10.1.6 did suggest that over half of the women (60.8%) answering in the questionnaire survey thought that manual workers preferred being supervised by men and 40.9% of the women answering the survey believed that sexual harassment was a problem in the construction industry. The results, although showing no evidence to suggest that the career expectations women have of a career in civil engineering are related to their choice of sector of civil engineering, are significant in that they indicate that some women do expect opposition in their civil engineering career. However, given the discussion of the findings in this section, it can be concluded that the hypothesis is disconfirmed.

11.9 CONCLUSION: MAIN HYPOTHESIS FOUR

Given the discussion in this section, overall the hypothesis that there is a relationship between the beliefs about various sectors of civil engineering held by women civil engineering students and their choice of sector of civil engineering is not supported from the results of this thesis and therefore the hypothesis is disconfirmed.

11.10 OVERALL CONCLUSIONS

The discussions in this chapter have shown to what extent the four main hypotheses are confirmed or disconfirmed. On the evidence presented in this chapter and the subsequent discussions, main hypothesis one, which stated that there are general patterns in the initial career choices of women on civil engineering degree courses, was confirmed; main hypothesis two, which stated that female and male civil engineering students leaving higher education choose employment differently, was confirmed; main hypothesis three which stated that there is a relationship between the college experiences of women civil engineering students and their career choice, was neither confirmed nor disconfirmed and main hypothesis four which stated that there is a relationship between the career expectations of women civil engineering students and the sector of civil engineering they choose was disconfirmed. The next chapter draws together the final conclusions of this research.

CHAPTER TWELVE

CONCLUSIONS

12.1 INTRODUCTION

The aim of this chapter is to draw together the conclusions of this thesis in relation to the aims and objectives as set out in chapter one. The conclusions in this chapter show to what extent these aims and objectives have been achieved and take into account the total work carried out during all the stages in this thesis including the analysis of the literature review, the outcomes from interviews and discussions conducted and the national survey questionnaire. The relationship of these results to the wider environment is assessed and conclusions about the work in the thesis made. Throughout this chapter the results are compared as far as possible with the literature and the exploratory interviews. Chapters two, three and four reported the conclusions and the evidence for those conclusions of many who have worked in the area of this thesis. Those conclusions are reassessed in the light of the results from this thesis in order to see how far they have been either confirmed or disconfirmed. As will be seen, there is often a discrepancy between the results of the large survey carried out in this thesis and the arguments and conclusions to be found in small surveys discussed in the literature.

12.2 CONCLUSIONS: RESEARCH OBJECTIVE ONE

Objective one:

To investigate the initial reasons for women choosing a career in civil engineering

This objective has been achieved in so far as the initial reasons for women choosing civil engineering were identified in the literature, interviews and discussions and then tested with the results from the national survey questionnaire. From an assessment of the total work carried out in this thesis, the initial reasons for women choosing civil engineering have been investigated and certain patterns in these choices found. Attempts to isolate these reasons were made in the early stages of the thesis where chapter two discussed reasons for the choice of civil engineering amongst women as analyzed in the literature and the interviews. Hypotheses about these reasons were formulated and in chapter six results were analyzed from the national survey questionnaire which examined the initial reasons for women choosing civil engineering in relation to these hypotheses. Chapter eleven drew these results together in relation to the sub and main hypotheses. The results demonstrated that the initial reasons for women choosing civil engineering were varied and complex. However, some general patterns were evident when examining the reasons of the larger sample in the national survey questionnaire. These patterns were discussed in association with the hypotheses in chapter eleven.

12.2.1 INITIAL REASON IDENTIFIED: FAMILIES

Investigation of objective one led to research in this thesis examining the importance of families in the initial career choice of women civil engineers. These conclusions relate to this investigation. Many of those writing in the field claim that familial influence is significant in career choice. The questionnaire survey in this research produced evidence that women civil engineering students were significantly more likely than their male counterparts to have fathers who were engineers (see table 7.7 and subsequent discussion). Furthermore, those women with engineering fathers were significantly more likely to have been encouraged to

enter the industry than those women with fathers who were not engineers (See section 7.3.2). On the basis of these results, one might conclude that fathers who are engineers are more likely to encourage their daughters to enter the industry and that encouragement does indeed influence their daughters' behaviour. This is indirectly confirmed by another result (section 7.4.4), where women with fathers in engineering or building related professions were significantly more likely to have looked for careers guidance outside schools.

In chapter two, several writers suggested that engineering fathers made a difference to the likelihood of women entering the industry (eg; Newton 1987, Carter and Kirkup, 1989). These results confirm that this is likely to be so. Women who enter civil engineering go against the trend of their sex, and an important explanation for why a proportion of them do is that they are subject to some special influence. Here, that special influence appears to be paternal. However, it may not be purely paternal influence; it is also the case, as the results in section 7.3.3 suggest, that some women with brothers in engineering or building related professions were significantly more likely to receive encouragement to enter the industry from them than were women from their non-engineering brothers.

Hence the suggestion from the results in this thesis is that having a close relative in the industry is an important part of the explanation of why many women enter the industry and therefore helps to provide conclusions relating to objective one of this thesis, that of investigating the initial reasons for women choosing civil engineering.

These results confirm earlier suggestions made in this thesis that fathers and brothers in engineering and building professions provide information and set examples which are able to overcome the stereotypes many writers have thought significant in putting women off civil engineering. (See e.g. Chives 1991, Newton 1987 and section 2.5.3.2 generally.)

Some researchers, whose work was discussed in chapter two, have suggested that engineering

fathers have their influence not as engineers specifically, but as members of a professional class. Thus Ryrie et al suggested concerning subject choice in schools that '...the higher the occupational level of the father, the more the parents were involved' (Ryrie et al 1979 p63). The research of both Carter and Kirkup and Newton, discussed in section 2.5.1, suggested that, with respect to choice of engineering in particular, professional fathers were more likely to support their daughters' choice of that subject. However, one result in this thesis suggested that, engineering aside, encouragement did not vary significantly with fathers' occupational band, either professional, managerial or skilled (see section 7.3.2). **This further illuminates the other results by helping to show that it is the engineering or building related background of the fathers that is significant in encouraging women's choices and not the professional status of their occupation.** The result does not directly conflict with the reports of other writers since Ryrie was concerned with school subject choice and Carter and Kirkup talked of support rather than encouragement. But it suggests that we cannot extrapolate from what they say to the conclusion that it is the mere professional status of parents that makes a difference to their daughters' choices of engineering. **Concluding then, one of the initial reasons for some women choosing civil engineering is the presence of a father or a brother in engineering or building related profession.**

12.2.2 INITIAL REASON IDENTIFIED: CAREERS SERVICES AND TEACHERS' INFLUENCE

In the early stages of this research careers services and teachers were identified as possibly assisting the initial career choices of some women civil engineering students. The theory was investigated in this research. As far as careers services are concerned, the discussion of the results of the questionnaire survey suggested that they were often found to be unhelpful (see

section 7.4.2 and section 11.2.3). This provides the basis for a firmer conclusion about the significance of careers services than previously available. Carter and Kirkup, for example, reported that the influence varied from place to place (see section 2.6.1) and the exploratory interviews for this thesis, whose results were discussed in section 2.8, tended to confirm this. The questionnaire data for this thesis provided a more detailed understanding of the role careers advisors do play. Furthermore, the questionnaire survey conducted for this thesis found that the type of school attended did not make much difference to the helpfulness of the careers advice, a significant result given that previous research (eg; Redpath and Harvey, 1987; Marland, 1983) had suggested that differences between school types did occur.

Newton, whose work was discussed in chapter two, claimed that careers services had deterred some women from applying for engineering courses (Newton, 1981, p.140). However, the results from this larger survey suggested that there was little evidence that women were actively discouraged by their careers advice from entering engineering (see section 7.4.3). This result of the survey does not refute Newton's claim since, first of all, she only claimed that some women were deterred by their careers advice and, secondly, the questionnaire survey in this thesis was only of those who had entered engineering and not those who had not. If any women had been successfully deterred by their careers advice, this would not show up in the survey. **Nonetheless, the results in this thesis do suggest that the women in this survey were not actively discouraged by careers counsellors in their choice of civil engineering.**

Chapter two reported a disagreement in the literature about the nature and significance of the influence of mathematics and science teachers. Spear claimed that teachers did not actively encourage girls to opt for technology and sometimes actively discouraged them while Newton, for the UK and Fitzpatric and Silverman, for the US, reported that women found

teachers a strong influence on their decisions to enter science or engineering. The results from interviews in this thesis as discussed in chapter two suggested more support for Spear's claim. The influence of teachers on women's decisions to choose civil engineering was identified as an area where research was needed to clarify the situation. The extensive survey in this thesis can resolve this issue, at least with respect to women's decisions to enter civil engineering. (The literature just mentioned was not primarily concerned with civil engineering.) The survey found that science teachers only influenced a minority of women to choose civil engineering and the same result held for mathematics teachers. (See the discussion of the results in chapter eleven, section 11.2.4)

Furthermore, the extent of influence did not vary across single-sex or mixed schools. This result compares with one concerning careers advice which also did not vary across single-sex or mixed schools. These results suggest that there is no difference in the influence of teachers working in either single-sex or mixed schools on the career choice of women civil engineers. **On the evidence presented in this thesis, the reasons for women choosing civil engineering should not generally be attributed to the careers advice they receive or the influence of their science and mathematics teachers.**

12.2.3 INITIAL REASONS IDENTIFIED: HOBBIES

In 2.5.2, the analysis of the literature suggested that several researchers had reported that hobbies and play might be important factors in children's later choices of engineering careers. However, those who claimed this disagreed on why those hobbies were significant. Some said that mechanical hobbies had independent causal significance due to the superior effect of the development of spatial skills needed in engineering while others thought that the significance lay in the association of mechanical hobbies with boys. That disagreement cannot

be resolved in a survey of the type carried out in this thesis. The interviews conducted for this thesis found no evidence to suggest that hobbies were important. The investigation of the initial reasons for women choosing civil engineering as tested in the national survey suggested that these interviews were correct in that technical hobbies were unlikely to have been a major influence on the decisions of the women in this survey to enter engineering because most women did not have hobbies and interests of a technical nature (see section 7.6.5 for results of the questionnaire relating to hobbies). **The investigation in this thesis lends support to the theory that hobbies are unlikely to be of major significance in explaining women's decisions to choose civil engineering.**

12.2.4 INITIAL REASONS IDENTIFIED: ABILITY IN SUBJECTS

The investigation of the initial reasons for women choosing civil engineering examined the suggestion from previous research that ability in certain subjects is important in choosing a career and that ability in science and mathematics is important for women choosing civil engineering. The results presented in 7.6.6 suggested support from the majority of respondents (73.5%) that they chose civil engineering because it gave them the opportunity to use their mathematics and science background without specialising in either. As suggested in chapter eleven, these results provide support for the hypothesis that women choose civil engineering because they are good at certain subjects and confirm the findings of the initial investigation, of literature and interviews, that **one reason why women chose civil engineering was because they were competent at mathematics and physics subjects at school.**

12.2.5 INITIAL REASONS IDENTIFIED: COMMON FEATURES

Some initial reasons for women choosing civil engineering as found in the literature and exploratory interviews were tested on the larger sample. These suggested that most women choose civil engineering for some similar reasons. The findings from this questionnaire survey (see section 7.7.2 and discussion in 11.2) assessed the importance of these other reasons and concluded that some of the main reasons for women choosing civil engineering were opportunity to do interesting work and problem solving, seeing civil engineering as a transferable profession and wanting to work outside most of the time. These reasons provide results and contribute to the investigation of the initial reasons for women choosing civil engineering.

12.3 OVERALL CONCLUSION: RESEARCH OBJECTIVE ONE

The above conclusion show to what extent the investigation of the initial reasons for women choosing civil engineering has been achieved. The reasons for women choosing civil engineering as identified in the literature and interview stage of this thesis have been tested in a national sample of final year women civil engineering students. Some of these reasons have been upheld as general reasons for women choosing civil engineering, some have not. However, overall this objective has been achieved given the evidence presented in this thesis.

12.4 CONCLUSION: RESEARCH OBJECTIVE TWO

Objective two:

To investigate whether there are differences in the employment choices made by male and female civil engineering students leaving higher education

This objective has been achieved. Overall conclusions about the hypothesis tested in chapter eleven confirmed that male and female civil engineering students choose employment differently. Three sub-hypotheses were tested. Two of these tests, those testing the career choices and the process of employment, suggested that there were few and usually insignificant differences between men and women. The third test suggested significant differences in factors men and women consider important when choosing their first employment. Conclusions from the results in this section from the questionnaire survey and exploratory interviews will be compared with other literature as discussed in chapter three of this thesis.

12.4.1 DIFFERENCES: CAREER CHOICES

Initial investigations in the literature on the career choices of male and female civil engineering students suggested that some differences in these choices existed. The First Destination survey revealed a greater shortfall (relative to men) in the numbers of women entering the industry suggesting that there were differences in the career choices of male and female civil engineering students after graduation. The results of the questionnaire in this thesis diverge from the results of that survey. This is the most interesting result of the national survey in the area of career choice. These conclusions describes the importance of this divergence and offers some explanations of why it exists. In 11.4.1, the discussion of the hypotheses suggested that there was little evidence from this research of differences in the career choice of male and female civil engineering students.

Where the First Destination Survey results found that the proportion of women entering the construction industry on completion of their degrees was some way lower than the proportion of men, results from this survey found that almost the same percentage of male and female

civil engineering students intended to enter the civil engineering industry. Thus in the First Destination Survey Results in 1986, the proportion for men was 59.5% whereas for women it was only 48.7%, and in 1990, these numbers were 76.8% and 64.6% respectively,(see table 3.5), while the results for the survey in this thesis of intentions suggested that 84.9% of female and 85.6% of male intended to enter civil engineering (see table 8.4 and subsequent statistical tests for more details). Thus, although no significant differences were identified in the intentions of civil engineering male and female students leaving higher education, there appears to be differences in the careers six months after graduation. A possible explanation for why these results vary is that employers may prefer to employ men. A limitation of this research is that it cannot conclude whether employers prefer, other things being equal, to hire male employees. As a preliminary, the examination of the First Destination Survey results provide figures which suggest evidence of such a preference. It is notable that the relative shortfall increased in size from 1988 onwards. (The gap was 5.3% in 1988, 5.6% in 1989 and had more than doubled to 12.2% in 1990). This increase coincided with the onset of recession in the British construction industry. In such a recession, there is a surplus of labour - more people want jobs than can get them. Employers are more able to pick whom they want. That proportionately more men than women were hired also might suggest a preference for men.

Further evidence of this preference can be found in the experience of women and men in applying for jobs. The graduating female students reported that, on average, they had to make two more job applications for each offer than their male counterparts. (See section 8.2.2 for statistical tests on these results). Thus the results of this questionnaire survey confirm that it appears to be harder for women engineers to be offered posts than it is for men. However, the evidence that it is the recruitment policies of employers which explains

the shortfall is not conclusive and further work needs to be done.

Overall conclusions suggest that there are no statistically significant differences in intended career choice of male and female civil engineering students.

12.4.2 DIFFERENCES: PROCESS

The discussion relating to the hypothesis also found that the process of securing employment, as examined in this thesis did not vary significantly between male and female students and hence the hypothesis that there were differences was disconfirmed. Impressions from the exploratory interviews had suggested that there were possible differences between male and female civil engineering students in the process of securing employment which warranted more detailed investigation. For instance the analysis of the interview results as discussed in chapter three (section 3.5) suggested that more women used families than men and that overall women appeared to be making more of an effort to secure employment than men and were using a greater variety of methods. The results, presented in section 8.2, showed that there were some statistically insignificant differences between male and female civil engineering students in the way they secured employment. Generally male and female civil engineering students make use, in almost equal percentages, of careers services, engineering journals, families, friends and other sources to find information about job opportunities (see section 8.2 for details of these results and the statistical analysis carried out).

There was only one significant difference in the process of securing employment of male and female civil engineering students, as mentioned in the last section. That was the results of the questionnaire which confirmed that women were making more applications per job offered than men, something that was implied in the analysis of the interviews in chapter three. The results of the questionnaire suggested that women made on average two more job

applications per job offer than men. Despite this, analysis of the questionnaire data as discussed in section 8.2 showed no other significant differences in the process of securing employment between male and female civil engineering students leaving higher education. **Therefore, from this research, it can be concluded that there are no significant differences between male and female civil engineering students in their use of the following resources; careers services, engineering journals, family and friends.**

12.4.3 DIFFERENCES: IMPORTANT FACTORS

Where significant differences between male and female civil engineering students did occur was in the factors they considered important when they were choosing their first employment. The hypothesis that there were differences was confirmed and chapter eleven discussed the evidence to support these differences.

The results partly confirmed the results of the IVL survey to engineering graduates discussed in chapter three which suggested that when selecting employers, females place slightly more emphasis on training and the quality of the company while males place more emphasis on salary and promotion (IVL, 1989, p13). The results from the questionnaire survey in this thesis confirmed that men were significantly more likely than women to rate salary as important in their decisions. However, there were no significant differences from the survey in this research between male and female civil engineers when examining the importance of training programmes for graduates. The results of the survey in this thesis did suggest that women were significantly more likely than men to consider the working environment and the size of an organisation as important in choosing their first employment, although the results did not indicate which size of organisation women, or men, prefer. Further results of the IVL survey discussed in chapter three suggested that for all engineering graduates, male and

female, that "... of lesser importance, come factors such as organisation and philosophy of the company" (IVL, 1989, p31). However, the results in this survey suggest that ethical considerations about the type of work are significantly more important to women civil engineering graduates that to male civil engineering graduates and confirm that they are considered important by over half of the women in the survey and a third of men. Other researchers, whose work was discussed in chapter three, suggested differences in the importance of factors between male and female engineers, some of which have been confirmed when examining the importance of factors to civil engineers specifically. Weinreich-Haste and Newton's work discussed in chapter three found that of pupils just entering engineering, young women intending to enter engineering appeared to be relatively less concerned with pay and status than young men with similar career plans (Weinreich-Haste and Newton, 1983, p50). As previously mentioned, male civil engineering students were significantly more likely to rate salary as important. However the results in this survey found no significant differences between male and female civil engineering graduates in the importance of their attraction to status (either prestige of job title or prestige of the organisation) as tested in this thesis. Further differences between male and females not previously examined in the literature consulted but identified in the discussion of the results of the interviews conducted for this research and discussed in section 3.5, suggested that women were significantly more likely than men to consider the location of organisation to family and close friends as an important factor in their decision to choose their first job. The national questionnaire survey confirmed this difference. However, women were significantly more likely than men to consider the opportunity to travel in the UK, which conflicted with the evidence from an analysis of the results of the interviews conducted for this research as discussed in chapter three where it was suggested that men were more likely to consider

travel important. The results of the questionnaire survey in this thesis are likely to be more reliable than the exploratory interviews since they are based on a much larger sample. As expected from the analysis of the literature and the interviews, women were more likely than men to consider child-care policies important. In addition to this, the results revealed that women were significantly more likely than men to consider being involved in new developments as important factors in their employment decisions.

The usefulness of these differences can be found in the importance to the recruitment policies of employers. An awareness of the differences could allow employers who would like to employ more women civil engineers to target women civil engineering students more effectively.

In conclusion, the results have suggested significant differences in the importance of factors for male and female civil engineering students when choosing their first employment.

12.5 OVERALL CONCLUSIONS: RESEARCH OBJECTIVE TWO

The above conclusions show to what extent the investigation of the differences in the employment choices of male and female civil engineering students has been achieved. The differences in these choices as identified in the literature and interview stage of this thesis have been tested by a national sample of final year male and female civil engineering students. Some of the differences previously identified have been upheld and others have been suggested. Overall this objective has been achieved given the evidence presented in this thesis.

12.6 CONCLUSIONS: RESEARCH OBJECTIVE THREE

Objective three:

To investigate whether there is a relationship between the college experiences of women civil engineering students and their career choice.

This objective has been achieved. **The main conclusion is that, on the basis of the results, there is a relationship between only some aspects of college experiences and the career choice of women civil engineering students.** The discussion of the results of the questionnaire survey testing the hypotheses about the relationship between aspects of college experience and career choice could neither overall confirm nor disconfirm this relationship (see section 11.6 for details). However, the research has highlighted some of the experiences women have on higher education civil engineering courses and tested these experiences against intended career choice to see if a relationship exists.

This section discusses the role played by the course content, any sense of prejudice or disadvantage, and any feelings of isolation or identification from and with male colleagues. Thus the conclusions from the survey which are concerned with college experiences and their relationship to career choice are presented here. Throughout there is a comparison with the relevant literature.

Two relationships which were found in this research between college experiences and career choice were that of enjoyment of the course and that of satisfaction with lecturing staff. The hypothesis that women on civil engineering courses who enjoy the course are more likely than those who do not enjoy the course to enter civil engineering was confirmed by the evidence from the questionnaire survey, as was the hypothesis that women who were satisfied with their lecturing staff were more likely to enter civil engineering than those who were not

(refer to section 11.6 for more details).

Carter and Kirkup had suggested that a major cause of anxiety among women was a fear of the practical aspects of the work (see section 3.4). Some questions in the survey were asked about the theoretical and practical content of the course. It was found that of the practical aspects and laboratory work, those women planning on entering the industry were significantly more likely to enjoy this than were those not planning to enter (see section 9.1.2). This result appears to reflect a greater distaste for aspects of the course of those not entering civil engineering than those entering civil engineering. However, overall the results did suggest that generally the practical aspects of the course were popular and enjoyed (see the results in section 9.1.2 where the majority, 81.3%, of the respondents, agreed that they enjoyed the practical aspects of the course and half of the respondents, 51.2%, agreed that they enjoyed laboratory classes).

There is some evidence to suggest that those who preferred the theoretical side of the course were less likely to be pleased with their decisions to choose engineering (as discussed in 9.1.2). This partly conflicts with an observation that might be drawn from the work of Usher and Ward (as discussed in section 3.4). They suggested that courses ought to be made more practical. But the evidence is that this will not tempt those otherwise leaving into remaining within the industry, since they appear to prefer theory. Those who are probably staying in the industry may prefer practice but, insofar as the intention is to attract others into staying, there is no reason to make courses more practical.

In chapter three, it was noted that there was some disagreement in the literature about women's attitudes towards their male counterparts, their feelings of loneliness and isolation and so forth. Thus, from the discussion in section 3.4, Tizzard and Chiosso claimed that a sense of loneliness was the biggest problem facing women on male-dominated courses, while

Bakos reported that few women felt isolated. The research in this thesis suggested that only a small minority felt isolated at college (16.3%), see section 9.1.7, and, furthermore, suggested that there was no significant link between a sense of isolation and a decision to enter the industry. There was also no significant relationship between participating in social activities and entering, or not entering, the civil engineering industry. The research by Newton, as discussed in section 3.4, stated that the female students she questioned thought of their male classmates as dull and immature. This result was not borne out by the survey. Most did not think of their classmates as immature. Furthermore, those who did were no more likely to leave engineering than those who did not (see section 9.1.5 for more details on this result).

Some of those writing on women in engineering held that women were at a disadvantage in various ways, such as an initial lack of technical knowledge. It was asked, in the literature chapter, whether this could explain an apparent reluctance of some women to remain within the industry. The answer is that it probably does not. The survey suggested that while some women felt at a disadvantage in their initial lack of technical knowledge they were no more likely to leave civil engineering. This result is not conclusive, however, given that the survey in the thesis questioned only final year students. It is possible that those most put off by their initial lack of knowledge had already dropped out of the course. It is a limitation of this result of the survey that it cannot tell whether that is so.

There are other possible sources of disadvantage that women might face. They may be treated worse by lecturers, most of whom are male, as suggested by Greed whose work was discussed in 3.4; they may be expected to act in subordinate roles in group tasks as some of the research also discussed in 3.4 suggested; they may be expected to work harder to succeed, as the discussion in section 3.4 of the work by Greed suggested, and as was

partially confirmed by the interviews conducted for this research whose details were discussed in section 3.6; or they may feel uncomfortable about asking male lecturers for help as the research by Thomas had suggested (see section 3.4 for more details). The questionnaire survey in this research suggested, however, that generally most women did not feel disadvantaged in these ways. Those who did were usually no more likely to leave the industry than those who did not. One counter example is with one of the results reported in section 9.1.6 and discussed in 11.6.5; women who disagreed that the lecturers were good teachers were significantly more likely than those who did not to leave civil engineering. In addition, women leaving civil engineering were significantly more likely than those not to state that they were put off some types of employment by lecturers.

Finally, only just over a third of women (39.8%) responding to the survey wanted more female lecturers. And, again, those who expressed this wish were no more likely to leave the industry than those who did not. This partly conflicts with the claims of Srivastava, whose research was discussed in section 3.4, since it does not appear that women's perception of their course would be more 'positive' if there were more female lecturers. Additionally, this result could cast doubt on the significance of certain role model arguments which hold that the presence of more female lecturers is likely to increase the number of females studying for, or entering, non-traditional careers. There is no evidence from this research of a relationship between the desire for more female lecturers and women's decisions to enter civil engineering.

There is a more general conclusion that can be drawn from this research. That is that what is reported in much of the literature constitutes an inaccurate description of the experiences of women students where they are in a minority on courses in the UK, since, as noted in 3.4, studies prior to this research tended to rely on small samples. When viewing the experiences

of women through a national questionnaire, those difficulties experienced by women on courses as reported in much of the literature appear to become the difficulties of only a minority of the women students. However, there is still some cause for concern since the evidence in this research does suggest that a minority of women on civil engineering courses feel they are experiencing difficulties. For instance, 12.8% of respondents felt that they got unwanted attention from male students on the course (see section 9.1.5); 17.4% of the respondents felt uncomfortable approaching male lecturers for help (see section 9.1.3); evidence from the results in section 9.1.3 also suggest that sexist language is used by lecturers (55.4% disagreed with the statement that it is never used); 16.3% of the respondents feel isolated much of the time at college (see section 9.1.7) and 42.2% of the respondents felt reluctant to ask questions in class (see section 9.1.8). All these results should provide some concern for higher education establishments were civil engineering courses are taught.

However, overall, the evidence from the research in this thesis regarding the college experiences of women civil engineers, is that only a few relationships between the college experiences of women civil engineering students and their career choices exist.

It is important to note that the majority of women do not report that they suffer from the problems mentioned in the literature and that, when they do, this generally appears not to affect their career choice.

12.7 CONCLUSIONS: RESEARCH OBJECTIVE FOUR

Objective four:

To investigate whether there is a relationship between the career expectations women hold of civil engineering and the sector of civil engineering industry they choose

From the results of the questionnaire survey in this thesis, the overall conclusion relating to objective four is that there is no relationship between the career expectations and the sector chosen. The results have also suggested that generally the beliefs women have of a career in civil engineering do not appear to be related to their choice of the sector of civil engineering.

The conclusions in this section illuminate these results in relation to the total work carried out in the thesis. Chapter ten described the expectations that women engineering students had of their careers and chapter eleven discussed the results in relation to the hypotheses. It is worth emphasizing some aspects of this discussion, both because there is little in the literature concerned with this topic and because what little there is often contradicted by the results in this thesis.

The ICE survey was reported in section 4.5. This was a survey of women members, which described the expectations of its female students and the experiences of its female graduates. As was mentioned there, the survey is now nine years old. In this thesis some of the results from that survey were tested again to see if its conclusions were still valid and additional results were gathered.

The ICE survey of its student members found that they believed themselves to be at a disadvantage relative to men because, among other things, they were less likely to be promoted, or employers thought them to be too weak to do the work, or that they would not remain long in the industry. There is evidence in this thesis to suggest that some women regard themselves at a disadvantage. 32.5% think that companies prefer to employ men in a recession (see the results in section 10.1.5). 40.9% think that sexual harassment is a problem in the industry (and 26.5 % disagree, see section 10.1.6). But 43.3% thought they had the same promotional opportunities as men (30.7% disagreed, see section 10.1.5). And

54.2% said that they did not worry about how men would react when they were supervised by them (see section 10.1.6). The implication is that while some students believe that they will be at a disadvantage, many - the majority - do not. This research in itself is important because it shows to what extent women believe they are at a disadvantage. However, in relation to the objective, the overall conclusion based on the results in the thesis is that there little relationship between these beliefs and career choice.

The questionnaire survey revealed further relevant information. 41.6% expected a management position within five years (see section 10.1.5). 39.3% thought that it would not be easy to prove themselves as engineers (see section 10.1.6). More than half (56.6%) did not think that they would be made to feel outsiders (see section 10.1.6). All these results contribute to our knowledge of women's expectations.

The ICE survey discussed in chapter four found that its female chartered members thought that there was a difference in the way that different sectors of the industry treated women, with contractors being the worst, consultancies second, and local authorities and utilities the best (ICE, 1984). However, the students' beliefs, in the survey in this thesis, about the opportunities available to them does not appear to vary depending on the type of sector chosen. That is, the same proportions believe the same things about their opportunities regardless of which sector in which they intend to enter. That does not conflict with the ICE survey, since that was a survey of those with work experience already. Results in the survey suggested that women did think that different sectors sometimes treat women differently. However, in relation to the objective, what is striking is that the perception of how well different sectors treat women does not relate to career choice (see section 10.1.2). In other words, women do not apparently make their decisions of which sector to enter on the basis of their beliefs about disadvantage relative to men, the available opportunities or the degree

of expected opposition. This is perhaps, in retrospect, not entirely surprising. What perhaps counts for women is their perceptions of their opportunities, not what those opportunities are like compared with other people's. An explanation of this result is that women may believe that they are treated much more equally by local authorities than by contractors, yet believe that the opportunities in contracting are still better for women than the opportunities in local authorities. The survey in this thesis did not show whether or not this is what women think, but it is plausible that they have some beliefs like this to offset their convictions about the instances of bias in the industry. Otherwise it is hard to see why a third of women (38.5%, see section 10.1.2) should think, for instance, that consultancies treat women better than contractors, and yet for this not to be related to career choice. This may similarly be applied to the results about the issue of child-care where women believed that there would be inadequate support for them having children but this was not related to career choice (see section 10.1.3). On the subject of child-care, the results suggested that generally almost half of the women (48.8% see 10.1.3) did not believe that employers would provide support for them but they generally did not believe that a combining a career in civil engineering with having children would be impossible (71.1%, see section 10.1.3). However, for none of the results of the questionnaire about child-care was there a relationship between the beliefs of the women and choice of sector of civil engineering.

From the work conducted in this thesis it can be said that research objective four has been achieved. The overall conclusion from the investigation of this objective is that there is no relationship between the career expectations of students and their choice of sector of civil engineering.

12.8 CONCLUSIONS: AIM ONE

Aim one:

The aim of this research was to identify the factors affecting the career choice of women civil engineering students leaving higher education

There are two main ways in which the results of this thesis have contributed to this aim. The first is in the identification and testing of the factors affecting the initial career choices of women civil engineering students. The second way is in the identification of the career choices that women civil engineering students are making when they are leaving higher education.

In the first section factors affecting initial career choice, such as families, careers advisors and teachers, amongst others were identified and tested with the national survey. Chapter eleven discussed these factors in relation to the main hypothesis drawing on the significance of the findings. In section 12.2 above conclusions about these factors were related to those factors previously identified in the literature and in interviews discussed in chapter two.

In the second research area the factors affecting the career choices of women civil engineers once they had completed their degrees were identified and compared with male engineers. Furthermore, additional factors were identified which contribute to career choice of women civil engineers as determined by the detailed analysis of the relationship between college experiences and career choice and career expectations and career choice. The conclusions of these were discussed in the two previous sections, 12.6 and 12.7.

12.9 CONCLUSIONS: AIM TWO

Aim two:

To broaden the knowledge base of available information about women in civil engineering.

This aim has been achieved. Prior to the research in this thesis there was very little available information on women civil engineers specifically. Any available information tended to be based on small samples or from allied areas such as other engineering or building occupations. This thesis has provided extensive, original and empirical data which contributes to the discussion of women in civil engineering specifically. Hence the knowledge base of available information has been broadened. In addition to this, the research in this thesis contributes to the wider topic areas of women in engineering and women in construction. In both of these areas the existence of large scale empirical data was lacking and the reliance on small samples extensive. The data from the national questionnaire has changed this. Extensive empirical data is now available which has broadened the understanding of the role of women in civil engineering and has contributed much to the existing debates of women in engineering and women in construction.

12.10 CONCLUSIONS: AIM THREE

Aim three:

To test some of the statements made by some of those who have researched into the role of women in engineering and construction to see if they are applicable to women in civil engineering.

The testing of previous research has formed a large part of this thesis. Throughout the discussion chapter and when drawing conclusions in relation to the four objectives the research in this thesis has been compared to previous research. For instance, in section 12.2, this research tested whether the professional father made a difference, something which researchers had previously identified as so. This research suggested that for women civil engineers it was the engineering and not the professional occupational band which appears to make the difference. Other examples of this testing can be found in 12.4.3 where research on the factors important to engineers when choosing employment were shown to be inaccurate for civil engineers specifically. Other researchers' work has been confirmed by this research, for instance the claim that child-care is an issue for many women civil engineers (see the discussion in 12.7), and that claim that women are disadvantaged at college (see the discussion in 12,6). The thesis has made an important contribution in showing to what extent assumptions about the career choice and experience of women civil engineers are correct when tested on a large sample. In chapter three some of the discussion focused on the experiences of women on science, engineering and technology courses. The point was made that most of the evidence which the surveys were based upon relied on interviewing small samples and the absence of large scale data was noted (see section 3.4). The research in this thesis has tested whether the problems noted in that section are in existence across all civil engineering courses in the country. Thus, for instance, Usher and Ward stated that "Anecdotal evidence suggests that sexist language, gender-biased comments and examples are commonplace in the classroom and that sexual harassment is not unknown" (Usher and Ward, 1989, p4). The results in this thesis suggest that it is indeed the case that sexist language is used in classrooms (see section 9.1.6 where 55.4% of the respondents disagreed with the statement that sexist language is never used). This finding is significant

and should cause some concern to civil engineering faculties, other examples of this have been discussed in section 12.7. Further examples where research which relied on interviews, or small samples, has been confirmed or disconfirmed can be found in the discussions in the previous sections. In all the four research areas the results of the main findings of the questionnaire survey analyzed and discussed in the previous sections have in some way contributed to the fulfilment of this aim.

12.11 WIDER IMPLICATIONS OF THE RESEARCH

The conclusions from this research could be of importance to many sections of the communities, through both practical use and academic use. The following section details some of the main benefits of this research.

For schools:

The analysis of the extensive profile data of male and female civil engineering students gives a better understanding of the parents, schooling and qualifications, amongst other things, of the likely students on civil engineering courses. The information could be of use to careers services and teachers, for whom a greater understanding of students entering civil engineering degree courses might be beneficial when they advise students about choosing careers. The data about background reasons for women choosing civil engineering could be valuable for teachers, careers advisors and parents because the results could provide them with a greater awareness of what some of the main influences are on women's career choices, an understanding of what are seen as the deficiencies of the services careers advisors provide, and the potential part that teachers could play in encouraging women students. Results such as women starting civil engineering with little knowledge of their intended career (see section 7.4.2), and other such results in chapter seven should cause some concern

to careers services. Details of the experiences of women on courses could be useful for careers services so that they have more information with which to advise female students.

For Universities and Colleges:

The comparative analysis of the career choices of male and female civil engineers at the final stages of their degree could be useful for lecturers and careers services at universities and colleges, because it would supplement their understanding of what are the usual resources students used when looking for employment and what are the factors of importance to them. Career choice aside, an awareness by lecturers of some of the difficulties, outlined in this research, which are faced by women on civil engineering courses could assist in their examining ways of making the experience less problematic. In particular, some of the problems highlighted, for instance the use of sexist langauge, some women's reluctance to ask questions in class, and others discussed in 12.6 provide some cause for concern and need to be addressed. Similarly, awareness that women often feel at a disadvantage in the early stages of the courses, could, perhaps, lead some institutions to find ways of making the educational experience of women on civil engineering courses more comfortable and less problematic.

For employers:

The factors that are important to male and female civil engineers in choosing their first employment, and where differences in the importance attached to the factors occur, could be important for employers of graduate civil engineers, especially in marketing their company when looking for recruits.

The research findings about the career expectations of women civil engineering students could be important to employers of civil engineering graduates where an appreciation of women's beliefs and fears about working in the industry could be addressed by companies.

In particular knowledge of the apprehensions and beliefs that women have about the available opportunities and opposition as discussed in this thesis (see section 10.1.5 and 10.1.6 together with other results in chapter ten) could be of use to employers.

For researchers:

The discussions in this thesis could contribute to the debate between qualitative and quantitative research. The quantitative research, in the form of the questionnaire has provided much large scale, empirical data about the four research objectives. The research gives examples of discrepancies between conclusions from qualitative research (eg interviews and in-depth studies on small samples) and quantitative research (as conducted in the main body of this thesis). (See section 12.10 for examples.) The research in this thesis has also provided suggestions for further research projects. In addition, research methodology issues have been discussed and addressed (see chapter six).

Overall, the results and analysis of this research can assist a number of people working in schools, universities and colleges and employers of civil engineering graduates and researchers. One of the important contributions this research has made, as mentioned above, is that it has laid much of the groundwork for future studies on this topic, the details of which are given in the next section.

12.12 FURTHER RESEARCH

The results and analysis presented in this research have laid much of the groundwork for future studies on the career choices of women in civil engineering, and dispelled some of the assumptions and ambiguities about these career choices. For each of the four research problems investigated in this research, further and more detailed analysis could be carried out. For instance, even though this research has provided a fairly comprehensive analysis of

the background reasons for women choosing civil engineering as a degree, detailed comparative studies of the reasons for women choosing other construction courses could be undertaken. In addition to this, more research on ways of increasing the numbers of women in civil engineering could be carried out. There is potential for more research on the different choices male and female civil engineering students make, with particular emphasis on the employer as a possible cause of some of the differences. There is also scope for a longitudinal study, tracking women students through their careers, and comparing their expectations on leaving college with those which they have after, say, one, two or more years. Similarly, there is also scope for international comparisons between women in the United Kingdom and women in other countries.

The possibility for research to build on the groundwork presented in this research is extensive. Further studies would provide wider and more detailed knowledge of the topic of women in civil engineering and contribute to a greater understanding of the role of some women in construction and in engineering. This will be helpful if women are to be encouraged into civil engineering in greater numbers. The research in this study has attempted to establish much needed empirical data for use by careers advisors, teachers in schools and in higher education, researchers and employers in the construction industry. Only in this way can new policies and practices be formulated to encourage and improve the role of women in civil engineering.

LIST OF APPENDICES

APPENDIX A

Copy of interview guide

BACKGROUND (WOMEN ONLY)

1. What were your reasons for choosing civil engineering?
2. What type of school did you attend?
3. Did anyone encourage you to choose civil engineering?

   If so who?

   If family members, were any engineers/in building?
4. Did anyone discourage your choice?

   If so who?

   If family members, were any engineers/in building?
5. What was careers advice at your school like?
6. How did you get information about civil engineering?
7. When did you decide to choose civil engineering?
8. What were your best/worst subjects at school?
9. What hobbies did you have as a child?

CAREER CHOICE (MEN AND WOMEN)

1 What do you intend doing when you have completed your degree?

2. Are you entering civil engineering?

   If so why, if not why not?

3. What sector of industry are you considering/ would you prefer to enter?
4. What sector would you least prefer?

5. Would you like to specialise in any particular aspect of civil engineering,

   If so what?

6. How do you find out about employment opportunities?

7. What do you look for in a job? (eg types of benefits)

8. Are you considering further studies?

   If so what subject area/ course

COLLEGE EXPERIENCES (WOMEN ONLY)

1. Tell me about your experiences at college

2. Did you enjoy your course?

   If yes/no, why?

3. Were there any particular aspects you did not enjoy

   If so, what?

4. Do you think your college experiences influences your career choice?

   If so how?

5. What is your impression of

   (a) male peers (b) lecturers

6. Are there any changes you would like to see on your course?

7. Do you get involved in the social activities

   (a) at college (b) in your department/school

CAREER EXPECTATIONS (WOMEN ONLY)

1. What are your impressions of the construction industry?

2. What are your impressions of womens' role in the construction industry?

3. What are your beliefs about the role of women in

(a) contracting (b) local authorities (c) consultancies

4. Would you expect to combine a career in civil engineering with having children?

If so would you expect any help from employers (ie career breaks etc)

If not, why not?

APPENDIX B

Copies of the questionnaires

(i) Questionnaire to final year women civil engineering students

(ii) Questionnaire to final year male civil engineering students

FOR OFFICE USE			

SURVEY OF WOMEN UNDERGRADUATES IN THE FINAL YEAR OF A CIVIL ENGINEERING DEGREE

A NATIONAL SURVEY 1992

SCHOOL OF CONSTRUCTION AND EARTH SCIENCES,
OXFORD POLYTECHNIC,
GIPSY LANE
HEADINGTON,
OXFORD,
OX3 OBP

TO THE STUDENT

The attached questionnaire forms the basis of a national survey for a PhD research project being undertaken at Oxford Polytechnic by me, Suzanne Wilkinson. The research aims to establish details about the career choice amongst male and female civil engineering students who are in the final year of their degrees. In addition, the research will examine the experience of women on civil engineering courses and their career expectations. I should appreciate it if you would complete the questionnaire as your help in this survey will be extremely valuable. The questionnaire should take no more than ten minutes to complete. The questionnaire is interested in your general impressions so please do not take too much time over each question. After completing the questionnaire, could you please return it in the envelope provided.

ALL RESPONSES WILL BE TREATED IN **STRICT CONFIDENCE** AND ONLY STATISTICAL TOTALS OR ANONYMOUS COMMENTS WILL BE PUBLISHED

If you have any queries regarding the questionnaire please contact:

SUZANNE WILKINSON on 0865-819360

THANK YOU FOR YOUR COOPERATION

PLEASE RETURN THE COMPLETED QUESTIONNAIRE AS SOON AS POSSIBLE IN THE PREPAID ENVELOPE AND AT THE LATEST BY 31st MAY 1992

PLEASE COULD YOU ANSWER THE FOLLOWING QUESTIONS RELATING TO YOUR BACKGROUND

1. Your age
18 - 21 ( ) 22 - 25 ( ) 26 - 30 ( ) over 30 (*please state*) _____

2. Your marital status (*please tick*)
Married ( ) Separated/Divorced ( ) Single ( ) Widowed ( )

3. Are you a citizen of the United Kingdom ? Yes ( ) No ( )

If no, of which country are you a citizen ? _____

4. Please list the occupation and age of the members of your family
(If any member of your family is not working outside the home at present, not living at home or is deceased please give the title of the job they trained for)

	Age	Occupation
Mother		
Father		
brother (1)		
brother (2)		
sister (1)		
sister (2)		

5. What type of secondary school did you attend? *Please tick appropriate box*
State (single sexed) ( ) Private (single sexed) ( ) State (mixed) ( ) Private (mixed) ( )

Other (*please specify*)_____

6. Did you change school after GCSE/O Levels Yes ( ) No ( )
If yes, please specify type of establishment (*eg sixth form college, college of further education*)

_____

7. What entry qualifications did you have for your degree
(please state A level, BTEC, ONC or similar and grade if known)

qualification	grade

8. Title of course on which you are a final year student.
(*eg Beng (Hons) Civil Engineering*) _____

Is this a (*please tick*) Four year thick sandwich ( ) Four year thin sandwich ( ) Four year full time ( )
Three year full time ( ) Other (*please specify*)_____

9. Did you consider any other degree courses Yes ( ) No ( )

If yes please give title(s) of course(s) _____

10. Are you sponsored or have you held a bursery during your degree course Yes ( ) No ( )
If so please state company _____

11. Are you a member of any technical societies such as Institution of Civil Engineers Yes ( ) No ( )

If yes, please specify _____

12. Have you had any civil engineering work experience relevant to your degree course? Yes ( ) No ( )
If yes, please list type of work (*eg on site with a contractor*) and duration (*in weeks*)

Type of Work Experience	Duration (in weeks)

13. Did this/these experience(s) make you more likely to choose a civil engineering career? Yes ( ) No ( )

14. What is/will be your three preferred areas of specialization in employment? *Choose three and rank in order of preference*

1. Structural	( )	6. Hydraulics and Hydrology	( )
2. Materials Technology	( )	7. Geotechnical Engineering	( )
3. Construction Management	( )	8. Computer Technology	( )
4. Transportation Engineering	( )	9. Environmental Engineering	( )
5. Public Health Engineering	( )	10. Other (*please specify*) _____	

15. If you are planning to take a course to obtain further qualifications please state type of course.

_____

16. If you are planning to enter another industry (*eg banking, commerce etc*) please state industry and likely employment

_____

17. If you are planning to enter the civil engineering industry, which three sectors of this industry would you like to work in? *Choose three and rank in order of preference.*

1. Local Authority	( )	5. Small Contractor (less than 50 employees)	( )
2. Consultancy	( )	6. Large Contractor	( )
3. Utilities ie gas, water	( )	7. Specialist Research Organisation	( )
4. Higher Education	( )	8. Other(*please specify*)_____	

18. How many applications for employment have you made this academic year?_____

19. How many job offers have you received this academic year? _____

20. Where do you find information about employment opportunities?
Careers service at college ( ) Friends ( ) Family ( ) Journals (*list titles*) ( ) _____

Other (*please state*) ( ) _____

21. Do you intend to take time off after your degree? (*eg for travelling or voluntary work*) Yes ( ) No ( )

If yes, please state likely activity and planned duration. _____

BACKGROUND DECISIONS TO CHOOSE CIVIL ENGINEERING

23. How much do you agree or disagree with the following statements about your decision to choose engineering

Please circle one number where 1 = strongly agree to 5 = strongly disagree

explanation of codes:	1 strongly agree	2 somewhat agree	3 neutral	4 somewhat disagree	5 strongly disagree

I was attracted to engineering because of the high salary	1	2	3	4	5
I was not good at arts subjects at school	1	2	3	4	5
My mother did not want me to choose civil engineering as a career	1	2	3	4	5
Engineering provided an opportunity to do interesting work	1	2	3	4	5
I wanted a career where I did not have to deal with the general public	1	2	3	4	5
I was influenced by my mathematics teacher who suggested engineering as a career	1	2	3	4	5
I wanted the challenge of solving problems	1	2	3	4	5
I wanted to work outside most of the time	1	2	3	4	5
I found careers advice at school unhelpful	1	2	3	4	5
I decided to study civil engineering after the age of sixteen	1	2	3	4	5
I wanted to use my science and/or maths background without specialising in either	1	2	3	4	5
My science teacher influenced my decision to choose civil engineering	1	2	3	4	5
I was advised by a careers counsellor at school not to choose civil engineering	1	2	3	4	5
I chose civil engineering with little knowledge of what civil engineers actually did	1	2	3	4	5
My father encouraged me to study civil engineering	1	2	3	4	5
I sought careers advice on engineering from outside school	1	2	3	4	5
Physics was my strongest subject at school	1	2	3	4	5
I wanted a profession that is transferable throughout the world	1	2	3	4	5
I found mathematics difficult at school	1	2	3	4	5
I wanted to succeed in a male dominated field	1	2	3	4	5
I was influenced by a short course which gave girls an insight into engineering (eg women in engineering,insight or other such courses)	1	2	3	4	5
My hobbies and interests were of a technical nature	1	2	3	4	5
My brother provided encouragement in my choice of an engineering career *(if no brother leave blank)*	1	2	3	4	5

EXPERIENCES AT COLLEGE

24. Do you agree, disagree or are you neutral about the following statements

Please circle one number where 1 = strongly agree to 5 = strongly disagree

explanation of codes:	1 strongly agree	2 somewhat agree	3 neutral	4 somewhat disagree	5 strongly disagree

I prefer the theoretical side of my course to the practical side	1	2	3	4	5
I enjoy giving presentations to a class of engineering students	1	2	3	4	5
I feel I have to work harder than male engineering students to get comparable grades	1	2	3	4	5
The engineering curriculum is more difficult than I expected it to be	1	2	3	4	5
I enjoy the practical aspects of the course such as field courses and site visits	1	2	3	4	5
I receive less attention from male lecturers than the male students on my course	1	2	3	4	5
In the laboratory groups I am generally the one to record the data	1	2	3	4	5
I am put off some types of employment by college lecturers	1	2	3	4	5
I am usually the organiser in group projects	1	2	3	4	5
The class of degree I am expecting is a first or upper second	1	2	3	4	5
I take part in a lot of the social activities in the engineering school	1	2	3	4	5
I enjoy laboratory classes	1	2	3	4	5
I am uncomfortable approaching male lecturers for help	1	2	3	4	5
At the start of the course I lacked knowledge of technical drawing	1	2	3	4	5
I have to be more assertive than my male peers	1	2	3	4	5
I am a successful student	1	2	3	4	5
Male engineering students are less mature than other male students	1	2	3	4	5
Female lecturers on the faculty show more concern for me than male lecturers (*if no female lecturers please leave blank*)	1	2	3	4	5

Please continue on the next page

Please circle one number where 1 = strongly agree to 5 = strongly disagree

explanation of codes:	1 strongly agree	2 somewhat agree	3 neutral	4 somewhat disagree	5 strongly disagree

At the start of the course, male students had more engineering experience than female students	1	2	3	4	5
I am reluctant to ask questions in class	1	2	3	4	5
I have more female friends than male friends at college	1	2	3	4	5
When I study with others, I study with men	1	2	3	4	5
I find mathematics on the course difficult	1	2	3	4	5
I am expecting to fail my degree	1	2	3	4	5
I prefer to study alone	1	2	3	4	5
Most engineering classes are interesting	1	2	3	4	5
The lecturers are good teachers	1	2	3	4	5
I feel that male students are intimidated by me in class	1	2	3	4	5
I would like more female lecturers on the faculty	1	2	3	4	5
I prefer being taught in small groups	1	2	3	4	5
I feel isolated much of the time at college	1	2	3	4	5
Female engineering students are perceived as less feminine than other female students	1	2	3	4	5
I am pleased with my decision to choose civil engineering	1	2	3	4	5
I get unwanted attention from male students on my course	1	2	3	4	5
Sexist language is never used by lecturers on the course	1	2	3	4	5
I am chosen by staff to represent the course to external bodies	1	2	3	4	5
I would be more comfortable with more women students on the course	1	2	3	4	5
At the beginning of the course the male students had a better understanding of computing	1	2	3	4	5
My course equipped me well for working in all sectors of the constuction industry	1	2	3	4	5

Please continue on the next page

CAREER EXPECTATIONS

25. Please circle one number where 1 = strongly agree to 5 = strongly disagree

explanation of codes:	1 strongly agree	2 somewhat agree	3 neutral	4 somewhat disagree	5 strongly disagree

I feel that it will be easier for me to get a job in engineering because I am a woman	1	2	3	4	5
I find working in a team satisfying	1	2	3	4	5
At interviews I anticipate being asked questions about marriage and children	1	2	3	4	5
I worry about how male engineers will interact with me at work	1	2	3	4	5
In a recession I expect that civil engineering companies prefer to employ men before women	1	2	3	4	5
I expect to gain a management position within five years of graduation	1	2	3	4	5
If I had children, a career in civil engineering would be impossible	1	2	3	4	5
I do not worry about how men will react when I have to supervise them	1	2	3	4	5
Manual workers prefer being supervised by men	1	2	3	4	5
I worry about being made to feel like an outsider in my job because I am female	1	2	3	4	5
It will be easy to prove myself as a competent engineer	1	2	3	4	5
I will enjoy working on site	1	2	3	4	5
Consultancies treat women engineers better than contractors do	1	2	3	4	5
Sexual harassment is a problem in the construction industry	1	2	3	4	5
I would like to manage my own company	1	2	3	4	5
M impression is that local authorities have more favourable employment policies than consultancies for women	1	2	3	4	5
If I had children, I believe employers would provide adequate support for me	1	2	3	4	5
I think that I will have the same promotional opportunities as men in civil engineering	1	2	3	4	5

26. How important do you think the following factors will be when making a decision to accept your first job?

Please circle one number where 1 = very important to 5 = not important

explanation of codes:	1 very important	2 somewhat important	3 neutral	4 not very important	5 not important
Salary	1	2	3	4	5
Location of organisation to family	1	2	3	4	5
Location of organisation to close friends	1	2	3	4	5
The working environment	1	2	3	4	5
Size of organisation	1	2	3	4	5
The people you work with	1	2	3	4	5
Opportunity to do interesting work	1	2	3	4	5
Opportunity to do varied work	1	2	3	4	5
Opportunity to travel in the UK	1	2	3	4	5
Opportunity to travel overseas	1	2	3	4	5
Benefits like a company car	1	2	3	4	5
Pension Plan	1	2	3	4	5
Child-care policies and programs	1	2	3	4	5
Prestige of your job title	1	2	3	4	5
Prestige of organization	1	2	3	4	5
Organization's training program for graduates	1	2	3	4	5
Perceived opportunities for quick advancement to a management position	1	2	3	4	5
Percentage of women engineers in the organization	1	2	3	4	5
Ethical considerations about the type of work	1	2	3	4	5
Involvement in new developments	1	2	3	4	5
Other (specify) _____	1	2	3	4	5

27. Please add any additional comments you think may be relevant to the survey

FOR OFFICE USE			

SURVEY OF UNDERGRADUATES IN THE FINAL YEAR OF A CIVIL ENGINEERING DEGREE

A NATIONAL SURVEY 1992

SCHOOL OF CONSTRUCTION AND EARTH SCIENCES,
OXFORD POLYTECHNIC,
GIPSY LANE
HEADINGTON,
OXFORD,
OX3 OBP

TO THE STUDENT

The attached questionnaire forms the basis of a national survey for a PhD research project being undertaken at Oxford Polytechnic by me, Suzanne Wilkinson. The research aims to establish details about the career choice amongst male and female civil engineering students who are in the final year of their degrees. I should appreciate it if you would complete the questionnaire as your help in this survey will be extremely valuable. The questionnaire should take no more that ten minutes to complete. After completing the questionnaire, could you please return it in the envelope provided.

ALL RESPONSES WILL BE TREATED IN **STRICT CONFIDENCE** AND ONLY STATISTICAL TOTALS OR ANONYMOUS COMMENTS WILL BE PUBLISHED

If you have any queries regarding the questionnaire please contact:

SUZANNE WILKINSON on 0865-819360

THANK YOU FOR YOUR COOPERATION

PLEASE RETURN THE COMPLETED QUESTIONNAIRE AS SOON AS POSSIBLE IN THE PREPAID ENVELOPE AND AT THE LATEST BY 31st MAY 1992

PLEASE COULD YOU ANSWER THE FOLLOWING QUESTIONS RELATING TO YOUR BACKGROUND

1. Your age
18 - 21 ( ) 22 - 25 ( ) 26 - 30 ( ) over 30 (*please state*) _____

2. Your marital status (*please tick*)
Married ( ) Separated/Divorced ( ) Single ( ) Widowed ( )

3. Are you a citizen of the United Kingdom ? Yes ( ) No ( )

If no, of which country are you a citizen ? _____

4. Please list the occupation and age of the members of your family
(If any member of your family is not working outside the home at present, not living at home or is deceased please give the title of the job they trained for)

	Age	Occupation
Mother		
Father		
brother (1)		
brother (2)		
sister (1)		
sister (2)		

5. What type of secondary school did you attend? *Please tick appropriate box*
State (single sexed) ( ) Private (single sexed) ( ) State (mixed) ( ) Private (mixed) ( )

Other (*please specify*)_____

6. Did you change school after GCSE/O Levels Yes ( ) No ( )
If yes, please specify type of establishment (*eg sixth form college, college of further education*)

_____

7. What entry qualifications did you have for your degree
(please state A level, BTEC, ONC or similar and grade if known)

qualification	grade

8. Title of course on which you are a final year student.
(*eg Beng (Hons) Civil Engineering*) _____

Is this a (*please tick*) Four year thick sandwich ( ) Four year thin sandwich ( ) Four year full time ( )
Three year full time ( ) Other (*please specify*)_____

9. Did you consider any other degree courses Yes ( ) No ( )

If yes please give title(s) of course(s) _____

10. Are you sponsored or have you held a bursery during your degree course Yes ( ) No ( )
If so please state company _____

11. Are you a member of any technical societies such as Institution of Civil Engineers Yes ( ) No ( )

If yes, please specify _____

12. Have you had any civil engineering work experience relevant to your degree course? Yes ( ) No ( )
If yes, please list type of work (*eg on site with a contractor*) and duration (*in weeks*)

Type of Work Experience	Duration (in weeks)

13. Did this/these experience(s) make you more likely to choose a civil engineering career? Yes ( ) No ( )

14. What is/will be your three preferred areas of specialization in employment? *Choose three and rank in order of preference*

1. Structural	( )	6. Hydraulics and Hydrology .	( )
2. Materials Technology	( )	7. Geotechnical Engineering	( )
3. Construction Management	( )	8. Computer Technology	( )
4. Transportation Engineering	( )	9. Environmental Engineering	( )
5. Public Health Engineering	( )	10. Other (*please specify*) _____	

15. If you are planning to take a course to obtain further qualifications please state type of course.

_____

16. If you are planning to enter another industry (*eg banking, commerce etc*) please state industry and likely employment

_____

17. If you are planning to enter the civil engineering industry, which three sectors of this industry would you like to work in? *Choose three and rank in order of preference.*

1. Local Authority	( )	5. Small Contractor (less than 50 employees)	( )
2. Consultancy	( )	6. Large Contractor	( )
3. Utilities ie gas, water	( )	7. Specialist Research Organisation	( )
4. Higher Education	( )	8. Other(*please specify*)_____	

18. How many applications for employment have you made this academic year?_____

19. How many job offers have you received this academic year? _____

20. Where do you find information about employment opportunities?

Careers service at college ( ) Friends ( ) Family ( ) Journals (*list titles*) ( ) _____
Other (*please state*) ( ) _____

21. Do you intend to take time off after your degree? (*eg for travelling or voluntary work*) Yes ( ) No ( )
If yes, please state likely activity and planned duration. _____

22. How many final year women civil engineering students are on your course? _____

22. How important do you think the following factors will be when making a decision to accept your first job?

Please circle one number where 1 = very important to 5 = not important

explanation of codes:	1 very important	2 somewhat important	3 neutral	4 not very important	5 not important

Salary	1	2	3	4	5
Location of organisation to family	1	2	3	4	5
Location of organisation to close friends	1	2	3	4	5
The working environment	1	2	3	4	5
Size of organisation	1	2	3	4	5
The people you work with	1	2	3	4	5
Opportunity to do interesting work	1	2	3	4	5
Opportunity to do varied work	1	2	3	4	5
Opportunity to travel in the UK	1	2	3	4	5
Opportunity to travel overseas	1	2	3	4	5
Benefits like a company car	1	2	3	4	5
Pension Plan	1	2	3	4	5
Child-care policies and programs	1	2	3	4	5
Prestige of your job title	1	2	3	4	5
Prestige of organization	1	2	3	4	5
Organization's training program for graduates	1	2	3	4	5
Perceived opportunities for quick advancement to a management position	1	2	3	4	5
Percentage of women engineers in the organization	1	2	3	4	5
Ethical considerations about the type of work	1	2	3	4	5
Involvement in new developments	1	2	3	4	5
Other (specify) _____	1	2	3	4	5

23. Please add any additional comments you think may be relevant to the survey

APPENDIX C

Copy of timetable for distributing the questionnaires

The chart below lists the main activities each month for administering the questionnaire.

Date	Proposed activity
February 1992	- complete questionnaire design - questionnaire pilot study prepared
March 1992	- first pilot study and amendments - second pilot study and amendments - third pilot study and amendments - main sampling decisions made - contact with all departments in the survey completed
April 1992	- some questionnaires sent out - bulk of questionnaires sent out
May 1992	- first follow-up - subsequent follow-ups
June 1992	- closing date for returned questionnaires
July 1992	- coding
August-December 1992	- data input - beginning of analysis

APPENDIX D

Points raised in second pilot study

1. A query was raised concerning the possibility of either of the parents being deceased. It was decided that something should be added to make it clear that previous occupations should be added to this question. This should be worded as "if any member of your family not living at home, deceased or....."
2. There should be some reference to duration of work and not just type of work. Therefore it would be better to include a chart with "type of work" and "duration" as the columns.
3. There should be a choice of only three specialisations since by having to answer and rank nine specialisations was too complex and time consuming. The term "Choose three and rank in order of preference" should be inserted. Also there should be provision made for a "none of the above" answer this should possibly be included as "other or none please specify".
4. The term "multinational" caused some confusion. It was recommended that this should be removed as the other terms were specific. However, it was suggested that "specialist research organisation" should be added to account for organisations like the buildings research establishment amongst others.
5. There should be a duration incorporated into the question of taking time off, so that it read "if yes please state type of activity and duration"
6. Type of course should be more specific to include an "eg BEng civil engineering sandwich course"and should be title and type of course.
7. Choose was used instead of chose on two occasions
8. The question about insight courses or other residential courses which were designed

to encourage girls into engineering should be more specific, to include an example

9. The question about female lecturers could not be answered because there were none on the faculty therefore it should answered by only those who had female lecturers on their faculty.

10. The statement "engineering classes are very difficult" was not specific enough and that it should possibly be changed to say "on balance...."

11. The question about being chosen to represent the course was queried as it was unclear to one student as to whether it included showing people around especially new students.

12. The question about practical aspects was unclear as one student thought that this would mean the same as laboratory work. It was recommended that practical aspects such as field courses or site visits should be included.

13. It was felt that some male students are intimidated but on the whole this was rare and that the question should account for this by including "some..."

14. The question about "basic knowledge of the course " should be removed since it repeated the question 22 "little knowledge of what civil engineers actually did"

15. The statement "Engineering classes are interesting" should have "most or not many or some other term" included

16. The statement "expect to be asked questions about marriage and children" many students were unsure how to answer this because they were aware that employers were not supposed to ask these questions and expected employers not to ask them, but in reality many employers did ask questions of this nature.

17. The questions relating to knowledge were difficult to answer these were "consultancies treat women better..." " local authorities have....", " the construction industry provides adequate support..." and "in a recession...". many of these require some opinion and

knowledge and therefore having a "don't know" or "unsure" column included with the neutral may be a way of solving this. alternatively, these questions should be changed to include a statement "My impression is....." (or removed).

8. The question "how important do you think the following will be in the acceptance of your first job" this was unclear whether it meant after you have been offered a job or when you are applying for a job. This should be changed to "in accepting" since this would include post application stage and possibly after a visit had been made to the company.

9. The statement "the people you work with" it was pointed out that you would not be in a position to judge this before you accepted the job. Therefore this should be changed to "perceived atmosphere of work environment on preacceptance visit" or something of this nature.

0. The term "opportunity to travel" should include in brackets " including overseas"

1 The questions relating to father and mother should be changed so that father is positive influence and the mother is a negative influence since this would make it more realistic.

2. A question relating to whether the student was studying at a university or polytechnic should be added as it was felt that this could be used to see the different attitudes from these two sectors of higher education.

APPENDIX E

Copy of the letter sent with the questionnaire

Gipsy Lane Headington Oxford OX3 0BP
Telex 83147 VIA Facsimile 0865-819387
Telephone 0865-819340

14 April 1992

Address

oxford polytechnic

CIVIL ENGINEERING & BUILDING DIVISION
School of Construction & Earth Sciences
Head: C G Topley BSc
Tel: 0865-819360

Dear *Name*

I am undertaking a PhD research project in Construction Management. The research aims to assess the differences in career choice between male and female final year civil engineering degree students. In order to do this, data are being collected on the employment preferences of students; the enclosed questionnaires are an essential part of this research. The questionnaires are being distributed nationally to all final year women civil engineering degree students and an equal number of final year male civil engineering degree students in all university and polytechnic civil engineering departments in the UK.

Some time ago, I contacted your department and you kindly agreed to distribute the questionnaires to your students. I was informed that you have * final year women civil engineering students in your department. Therefore, I have included * green questionnaires for women and * yellow questionnaires for men.

I should be very grateful if you would distribute the green questionnaires to each of your final year women civil engineering students from the UK or overseas. The yellow questionnaires are for an equal number of final year male civil engineering students and I would appreciate it if you would distribute these to any male final year civil engineering students from the UK or from overseas who would be willing to answer the questionnaire. Please would you remind the students to return the questionnaires to me in the self addressed envelopes provided.

You may notice that the questionnaires are slightly different in that the green questionnaire to women has more pages than the yellow questionnaire to men. This is because the secondary aim of the questionnaire is to assess the experiences of women on civil engineering courses.

If you have any problems with distributing the questionnaire then please contact me at the above address.

Thank you for your assistance.

Yours sincerely

Suzanne Wilkinson
Post Graduate Teaching Assistant

Encs

APPENDIX F

Coding instructions

(i) Instructions for positions of codes

instructions for coding row one (men and women)

COLUMN NUMBER	VARIABLE
1,2,3	subject number
4	sex
5	type of institution
6,7	institution number
8	age
9	marital status
10	country of citizenship
11	blank
12,13	age of mother
14	socio economic status of mother engineering/building mother
15	age of father
16,17	socio economic status of father
18	engineering/building father number of brothers
19	engineering/building brothers
20	number of sisters
21	engineering/building sisters
22	blank
23	secondary education
24	school change
25	qualification
26	maths at entry
27	physics at entry
28	number of other passes
29	blank
30	type of engineering course
31	other courses considered
32	sponsorship
33	societies
34	blank to end of line
35	
36	

Instructions for coding second row, (men and women)

1,2,3	subject number
4	work experience
5	type of work experience
6	duration in weeks
7	experience
8	enter another industry
9	further qualifications
10	blank
11	preferred area
12	preferred area (2)
13	preferred area (3)
14	other preference
15	blank
16,17	sector preference
18,19	sector preference (2)
20,21	sector preference (3)
22	other preference
23	blank
24,25	number of job applications
26	number of job offers
27	careers service at college
28	careers information: friends
30	careers information: family
31	careers information: journals
32	careers information: others
33	time off
34	duration of time off
35,36	number of women on the course

instructions for coding row three (men and women)

1,2,3	subject number
4-24	factors (both sexes)
25	others

instructions for coding row four (women only)

1,2,3	subject number
4-25	background
26	brother encouragement
27	blank
28-45	career expectations

instructions for coding row five (women only)

1,2,3	subject number
4-41	experiences at college
42	female lectures

(ii) Codes Used

(unspecified codes=0 unless stated)

1. subject number 001, 002 etc
2. female=1, male=2
3. type of institution 1=university, 2=polytechnic/college
4. age 18-21=1, 23-25=2, 26-30=3, over 30=4
5. marital status married=1, separated/divorced=2, single=3, widowed=4
6. country of citizenship 1=United Kingdom, 2=Hong Kong, Singapore, Malaysia, etc ,3= Nigeria, Sudan, Zimbabwe, etc 4=South America, 5=Europe (France, Germany, Norway etc.),6= Iran, Iraq, Middle East, 8=West Indies, 9=New Zealand, Australia.
7. mothers age as given, 00 if none/deceased
8. ses of mother 1=unemployed, 2=professional (eg accountant, doctor, chemist, engineer, lawyer), 3=managerial (eg nurse, farmer, teacher, manager), 4= housewife/husband, 5= skilled occupation (eg clerical worker, bank clerk, miner, sales rep, bricklayer,carpenter, draftsperson), 6= partly skilled (eg telephonist, gardener, waiter, bus conductor), 7= unskilled (eg cleaner, labourer, messenger, porter)
9. engineering mother 1=yes, 2=no/unknown, 3=building related
10. age of father, 00 if none/deceased
11. ses of father (as mother)
12. engineering father 1=yes, 2=no/unknown, 3=building related
13. number of brothers (as given)
14. brothers in engineering/building related fields 1=yes, 2=no/unknown, 3=building related
15. number of sisters (as given)
16. sisters in engineering/building related fields 1=yes, 2=no/unknown, 3=building related
17. secondary education; 1= state single, 2=private single, 3=state mixed, 4=private mixed, 5=others (frequent changed, european)
18. school change; 0=no change/unspecified, 1-4 as above, 5=college of further education, 6=sixth form college
19. qualification; 1=Alevels or Scottish Highers, 2=BTEC Higher National Diploma, Higher National certificate in civil engineering, building studies, engineering etc 3= other qualifications such as international or unspecified
20. Maths at entry; 0=none/unspecified, 1=A grade, 2=Bgrade, 3=C grade, 4=D grade, 5=E grade, 6=F grade
21. physics at entry; 0=none/unspecified, 1=A grade, 2=Bgrade, 3=C grade, 4=D grade, 5=E grade, 6=F grade
22. number of other passes (as given)
23. type of engineering course 1=four year thick sandwich, 2=four year thin sandwich, 3=four year full time, 4= three year full time, 5=part time 6=others
24. other courses considered 0=no other courses considered or courses unspecified 1=only other engineering courses considered 2=building related courses considered excluding architecture 3=only architecture considered 4=only pure maths or pure science considered 5=arts subjects such as law history and geography consider 6=only maths related courses considered 7=combination of building, engineering, science, or technology considered 8=other combinations considered
25. sponsorship; 0=none/unspecified, 1=contractor 2=consultants, 3=local authority/city council, 4=army, 5=overseas government, 6=engineering company, 7=utilities/British Rail

26. societies, 0=no membership/unspecified, 1=Institution of civil engineers, 2=Institution of Structural Engineers, 3= both, 4=others (eg, Chartered Institute of Builders, Geological Society)
27. work experience; 1=yes, 2=no
28. type of work experience; 0=none/unspecified, 1=local authority/city council 2=contractor, 3=utilities/British Rail, 4=technician/civil engineering office work (unspecified sector), 5=consultancy, 6=site work (unspecified sector), 6= others eg voluntary work, marketing, research, sales.
29. duration in weeks; 0=none/unspecified, 1=twelve weeks or less, 2=13-24 weeks, 3=25-36 weeks, 4=37-48 weeks, 5= 49-52 weeks, 6=1-2 years, 7= over 2 years.
30. experience 1=yes, 2=no
40. planning to enter another industry 1=yes, 2=no, 3=teaching, 4=management consultancy, 5=H M Forces, 6= yes but unsure what to change to, 7=banking/marketing/investment, 8=accountancy/actuarial, 9=others (eg information technology, broadcasting, entertainment, aviation)
41. further qualifications; 1=no, 2=Msc related to civil engineering, 3=other masters, 4= PGCE (teaching). 5=yes but unsure, 6=Msc architecture, 7= Information technology, 8=MBA business, accountancy, 9=PhD
42. preferred specialisation; 1= structural, 2=materials technology, 3=construction management, 4=transportation, 5= public health, 6=hydrology and hydraulics, 7=geotechnical engineering, 8=computer technology, 9=environmental engineering, 10=other preference
43. other preference 1= health and safety/ fire engineering, 2=surveying, 3=petroleum engineering, 4=third world engineering, 5= aviation planning, 6=interior decoration, 7=tunnelling
44. sector preference; 1=local authority, 2=consultancy, 3=utilities, 4=higher education, 5=small contractor, 6=large contractor, 7=specialist research organisation, 8=other
45. other preference; 1=voluntary organisation, 2= army/ forces, 3=oil industry, 4=own business, 5=overseas organisation.
46. number of job applications (as given)
47. number of job offers (as given)
48. careers service at college; 1=yes used, 0=not used
49. careers information: friends; 1=yes used, 0=no used
50. careers information: family; 1=yes used., 0=no used
51. careers information: journals; 1=yes used, 0=no used
52. careers information: others; 1=civil engineering careers literature/ general graduate literature/ newspapers 2=past work contacts/ personal inquires to companies 3=visits from companies, 4= lectures at college
53. time off; 0=no/unspecified, 1=travelling, 2=holiday, 3=voluntary work, 4=learning a language, 5=sport
54. duration of time off; 0=no/unspecified duration 1= 3 months or less, 2= 3-6 months, 3= 6-12 months, 4= more than twelve months.
55. number of women on the course (as given)
56. codes for statements (as given 1-5, 0=missing)

SOME PARTS EXCLUDED UNDER INSTRUCTION FROM THE UNIVERSITY

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