

Women Studying and Working in Engineering:
Case Studies from UCT and Civil Engineering in the Western Cape

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Declaration

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Abstract

In this thesis two case studies were used to investigate women's involvement in engineering in the Western Cape during the early to mid 1990s. The first study provided a statistical profile of women engineering students (WES) at UCT as background to the second, a qualitative, in-depth study that used life-story interviews to identify experiences and attitudes of professional women civil engineers (WE).

In 1993, data on demographics, school and social background, reasons for doing engineering and university life of WES was collected in sections, by academic year, by groups of senior undergraduate Sociology research students for their individual final year research projects. The questionnaire they used was standardised and contained both closed- and open-ended questions. The analysis in this thesis of the WES database combined the data from the different individual Sociology research projects, culminating in a 70% (59 of 83) sample of 2nd, 3rd, 4th and postgraduate year white, coloured and indian women students registered at UCT in 1993. The results of this analysis showed that the majority of UCT students in the early 1990s were white, young, single women. By using data about parents education levels (50% of mothers and 75% of fathers had received some form of further or higher education) and parents occupations (two-fifths of the mothers and more than half of the fathers held qualified positions) they were found to be socially privileged. Individually, and as a group, their performance at school was outstanding, with the entire group achieving an A- or B- matric aggregate with many showing a clear preference for mathematics and science. Using a framework of categories refined by Jawitz and Case (1998), three categories of reasons for doing engineering, namely "Socialisers" (including having an engineer in the family), "Contact with Engineering" (through open days organised by educational institutions or engineering organisations) and performance and ability in "School Subjects", were found to be particularly significant. Isolated incidents of sexist attitudes from male colleagues and lecturers did not detract from an overall positive attitude to studying engineering by the WES, as evidenced by nearly 90% willing to conditionally or unconditionally support, over opposing, or not recommending, the decision by other women to do engineering.

The transcription of audio-taped life-story interviews, conducted in 1998 and 1999, with Cape Town-based women civil engineers provided the qualitative data of the WE study. In the analysis, resistance to entry by women to, and the creation of an unwelcome atmosphere for women on the building site, came strongly to the fore. Also, some women encountered serious incidents of sexual harassment and gender discrimination on the building site and even in the office environment. The existence of women's engineering organisations were found to partly fill the need for women to network and support each other in the face of a hostile environment in traditional male-dominated industries. The conflicting demands of motherhood and career were found to exact a heavy physical and emotional toll on professional women. These women, however, negotiated this conflict in coming up with unique, specialised and liveable solutions.

Chapter 1: Introduction

1.1 Background to the Study

Some would argue that the proportion of engineers in a country is one indicator of its economic wellbeing (Cooper, 1995). An increase in the proportion of engineers reflects that action is being taken to improve the infrastructure of a country. It therefore makes sense for a developing country like South Africa to increase the number of engineers in the country. In the early to mid 1990s, women¹ and black² engineers represented very small minorities in the engineering industry. Although the numbers have increased slightly, government, the engineering industries and tertiary institutions need to make special attempts to attract women, and other groups that are under-represented, into the industry. An important aspect of this is to accurately identify the situation of women in the engineering industry. To do this we need to explore the reasons behind their under-representation. This will, in turn, put us in a better position to remove the barriers to entry into the profession at all levels, making engineering and engineering study a more attractive option to a greater percentage of the population.

1.2 Aims of the Study

The primary aim of this study was to establish a profile or snapshot of the women involved in engineering during the mid-1990s in South Africa and provide the background needed to refocus and launch the debates surrounding women in engineering. Establishing the profile

¹ In this study I preferred the term “women” rather than “female” to emphasise that the experiences are gendered.

² In this study the term “black” refers to the apartheid era racial categories african, coloured and indian. Because this study focuses on the gender aspect of engineering, I deliberately used lower case letters to de-emphasise racial categories. As I explain later, the data on african women engineering students that were interviewed were not compatible with the rest of the database.

was achieved by looking at two case studies involving qualified women civil engineers and women engineering students, respectively.

The first case study focussed on the analysis of a database – very much a small, pilot study - of interviews conducted during 1993 by Sociology students with white, coloured and indian women students who were registered in engineering at the University of Cape Town (WES database¹). The students, in four groups of two, had collected the data as part of their 3rd year Sociology research projects. Each of the four Sociology groups had focussed on a specific year of engineering study (from 2nd, 3rd, 4th and postgraduate years) and attempted to draw a full sample. Overall, they managed to interview 70% of the eligible population using an essentially standardised but detailed questionnaire. After completing projects on the individual years, the data from all four groups were combined into a database in the form of a Microsoft Excel Worksheet. My analysis in this thesis is the only analysis of the complete database. The database contained collated demographic information about the students, insights into their university experiences and their reasons for studying engineering. The size of the sample and the detail covered by the questionnaires permitted a quantitative snapshot and also an in-depth analysis of a broadly representative sample of the women engineering students registered at UCT during that time.

With the statistical profile of women engineering students at UCT in 1993 as background, there followed an analysis of in-depth interviews that I conducted with Women Engineers (WE interviews) in 1998 and 1999. Qualitative life story interviews were chosen to gain an in-depth understanding of the experiences specific to women civil engineers as well as issues faced by women professionals in general. The WE interviews covered different aspects in the

¹ An example of a questionnaire that the WES database was based on is presented in Appendix A. African women engineering students were researched as part of a different project, the results of which were not available for this thesis as explained in section 2.2.

work and personal lives of 8 women civil engineers. Important information regarding experiences on the building site, issues and experiences of gender discrimination and sexual harassment and ways of coping with the conflict between motherhood and career was collected and are presented in the form of quotes and mini-stories in chapter 5. I felt that being an outsider to the world of women engineers, the life story interviewing method would help me access potentially sensitive experiences in a sympathetic way.

1.3 Personal Motivation

My interest in the topic of women in engineering comes from the broader issue of the transformation in South African civil society. Distinction on the basis of class, race and gender has been entrenched and much work needs to be done in order to firstly describe, secondly, analyse, and thirdly act against, a situation continuing where discrimination abounds.

The reason I decided to pursue this topic arose out of an interest and grounding in gender issues and wanting to participate in helping redress the inequalities that I observed that exists in South Africa.

1.4 The structure of the thesis

Although some of the data used in this study was collected prior to my involvement, this study can still be broadly termed to be exploratory. My first interaction was with the raw WES data in the Excel Worksheet rather than my identification of key hypotheses from literature that I wished to prove. For this reason, the study is also mainly descriptive of the

situation of women in engineering, whether it refers to their school and home background, their reasons for doing engineering, or the university and work experiences.

This study is comprised of five main chapters covering (1) the research methodologies employed, (2) the literature reviewed, (3) the analysis of school background and university experiences from the WES database, (4) the analysis of workplace experiences of women civil engineers from the WE interviews and (5) a report of the key findings presented in such a way as to initiate a refocusing of the debates within the area of women in engineering.

Chapter 2 outlines the methodologies employed in collecting and analysing the different data used in this study. The data used in this project were drawn from three sources. Firstly, literature, both local and international, on women in engineering and literature relevant to women in the workplace. Secondly, the WES database, compiled in 1993, containing demographic information, information regarding their career choice and experiences of studying engineering from a sample of women students registered in engineering at the University of Cape Town in 1993 undertaken by 3rd year Sociology students. And thirdly, transcripts and notes from in-depth life story interviews with women civil engineers, the WE interviews undertaken by myself.

Chapter 3 provides the empirical comparison, drawn from the literature, of the issues that relate to the analysis of the WES database and WE interviews. The issues dealt with in the literature therefore sets international and national debates as background to the material covered in Chapters 4 and 5. Key issues include reasons for doing engineering, experiences of engineering study for women, negotiating the conflict between family responsibility and career responsibility and the experiences of gender discrimination and harassment.

Chapter 4, the first case study, is the analysis of the entire 1993 WES database and is mainly quantitative in nature. The database contains demographic information such as race, age, marital status and indicators of social background, data on their school background that includes the type of school they attended, their favourite subjects and their performance in matric. Other analysis in this section draws theory from the literature and combines quantitative WES data with qualitative data from the WE interview data in order to generate categories of reasons for doing engineering given by women in engineering in the mid 1990's. The final section in this chapter deals with university life by looking at the source of university funding, their opinion of women studying engineering and their personal influences and experiences while studying engineering.

Chapter 5, the second case study, uses quotes and mini-stories from the WE interviews to provide insight into the issues facing women engineers in the civil engineering workplace. Issues specific to women engineers, such as experiences on the building site and membership of women's engineering organisations, as well as the way they deal with broader "women's" issues, such as gender discrimination, sexual harassment, coping with being a woman in a male oriented workplace, and negotiating the conflict between career and family are discussed.

Chapter 6 briefly summarises the key findings from the two case studies, on women engineering students and on women civil engineers, that was presented in chapters 4 and 5, respectively. The identification of the most important findings and the policy implication of these are also discussed. In conclusion, I attempt to start the debates raised by the findings of my research.

However, before delving into the data itself, a closer look at the different methods of data collection might be useful.

Chapter 2: Research Methodology

2.1 Introduction

Due to the complexity of the issue of women in engineering, I divided the study into three parts. The different directions represent three different methodologies that I employed.

Much of the *background* reading that I did informed the way in which the overall study was conducted. At this stage the literature that I had gathered, but not written up, was used to analyse the 1993 UCT women engineering students (WES) database and to structure the 1998 and 1999 women civil engineers (WE) interviews process. Subsequent to this analysis of the WES database and the WE interviews, I went back to draw together *all* the literature that I had gathered on the topic and wrote up an analysis of the existing international and local literature.

In the first part of this chapter I present the way I approached the analysis of my first case study using the WES database. The database combined information from 4 separate smaller studies by eight third year Sociology students and included quantifiable as well as some qualitative data that was gathered and analysed under general themes that were derived from the literature. The eight Sociology students conducted standardised questionnaire-based interviews with women engineering students in 2nd, 3rd, 4th and postgraduate years as part of their final year Sociology research projects. After submitting individual reports on the women engineering students in their specific focus year, the data was collated onto a Microsoft Excel Worksheet. This database, containing demographic information, data on schooling, parents and reasons for doing engineering, amongst other material from the WES formed the raw data that I analysed in Chapter 4.

The second part of the study was a case study of women professionals, focussing on women civil engineering and culminating in an analysis of the WE interviews. The interviews were detailed, in-depth and followed a life-story and mainly unstructured format. The transcripts of the audio tape-recorded interviews were the primary sources of data that I used, in conjunction with the existing literature, to identify themes relevant for women professionals such as sexual harassment, gender discrimination, coping with the conflicting demands of family and career, as well as the issue of the building site which is relevant specifically to women civil engineers or surveyors.

In the third section I describe the method that I used to identify the different meta-themes within the literature in order to discuss and compare subthemes such as the decision to do engineering and experiences of women engineering students (under the metatheme Choosing Engineering) and women in the workplace, issues of career and family, gender discrimination and sexual harassment (under the meta-theme In the Workplace) with the findings of my study.

2.2 WES Database

In 1993 eight women Sociology students (in groups of two for each of 2nd, 3rd and 4th year engineering faculty undergraduate, and one group of two for the postgraduate years of engineering study) interviewed 59 University of Cape Town women engineering students for their final year undergraduate Sociology research projects. The research projects were conducted as part of a Women in Engineering research project elective in the practical research course for third year students and were supervised by Dr David Cooper.

Table 2.1 Women Engineering Students Registered at UCT in 1993

Race	1 st year	2 nd year	3 rd year	4 th year	Postgraduates	Total number of women students studying engineering
African	13	12	5	2	2	34
Coloured	7	4	2	2	1	16
Indian	3	1	2	0	1	7
White	14	15	13	19	23	84
Total	37	32	22	23	27	141

Source: University of Cape Town Faculty of Engineering 1993 Registration List

The respondents were drawn from the 141 women students that were registered for engineering studies at UCT in 1993.

Table 2.2 Women Engineering Students in Case Study (sample in brackets)

Race	2 nd year	3 rd year	4 th year	Postgraduate	Total population from which sample was drawn
Coloured	(3) 4	(3) 2	(1) 2	(1) 1	(8) 9
Indian	(1) 1	(2) 2	(0) 0	(0) 1	(3) 4
White	(12) 15	(10) 13	(17) 19	(8) 23	(47) 70
Total	(16) 20	(15) 17	(18) 21	(9*) 25	(58**) 83

* One postgraduate student did not specify her race. Total postgraduate sample size equals 10.
 **One postgraduate respondent did not specify her race. Total sample size equals 59.
 Source: University of Cape Town Faculty of Engineering 1993 Registration List and the 1993 WES Database.

Of the total registered women engineering students, 83 were from the identified research population of white, coloured or indian students in their 2nd, 3rd, 4th and postgraduate years of study.

It was decided to exclude first year students on the grounds that they would not have had much experience of studying engineering by April of 1993 when the data was being collected.

A sample drawn from the 21 african women students in 2nd, 3rd, 4th and Postgraduate years were interviewed as part of a separate project. At the conclusion of the Sociology course in June of 1993, the project on african women engineering students were found to be incompatible with the other four projects and were not included in the database that I received in 1997. Subsequent attempts to find the data on the african women students proved unsuccessful as they had not been returned by the students.

Due to the small numbers available in each year of engineering to each group of 2 Sociology researchers, they attempted to interview the full 100% sample. As can be seen from Table 2.2, the population of white, indian and coloured engineering students in 2nd, 3rd, 4th and postgraduate years was 20, 17, 21 and 25 respectively. The reason why a full sample was unattainable was largely logistical. The group conducting interviews with 2nd year students had lecturers make announcements asking women students to volunteer to be interviewed. This method proved very successful as 80% (16) of the eligible twenty 2nd year students were interviewed. The researchers responsible for 3rd, 4th and postgraduate engineering students personally contacted their identified sample, which also proved successful with nearly 70% in each year agreeing to be interviewed. Because they did not attend lectures, and therefore could not be personally approached at one place, and because some desired not to be interviewed, the Sociology researchers could not get a full 100% sample of postgraduate students. Also, among the postgraduate students, 9 of the 25 had to be excluded because they had done a B.Sc. rather than a B.Eng. degree and therefore could not provide information on their experiences of studying for an engineering degree.

Consequently, as can be seen from Table 2.2, of the remaining 84 eligible white, coloured and indian women engineering students in 2nd, 3rd, 4th and postgraduate years of study, 59 (or 70%) were interviewed.

As a result of the small numbers that each individual Sociology group of 2 students had to focus on, it became necessary to approach each of the projects at a deeper level and detail than was usual for quantitative studies. In addition to collecting simple demographic data, they also extracted information about the school, university and work experiences of their sample as well as their opinions regarding their future careers. Quantitative and qualitative research methods are usually applied to achieve different objectives. A quantitative method usually better lends itself to the analysis of demographic variables and exploring attitudes of a large number of people. The most important feature of a quantitative study is that the “collection results in numerical and standardised data” (Saunders et al, 1997). This standardising of data makes it possible to combine and/ or compare the results with other studies. Although they were individually designed, the data from the 4 separate questionnaires covered the same material, and were captured in a database at the end of 1993. Except for the african engineering student group, because of good co-ordination at the research design stage of the 1993 Sociology projects, large portions of the questionnaires were fundamentally standard and the data from the four groups was easily combined to form the database. Unfortunately, the time allocated to the combined Women in Engineering project for the Sociology 3rd year course was insufficient to combine the data and results of the 4 projects, which were written up by each group separately. This thesis is therefore the only analysis of the complete WES database.

The responses from the 59 interviews were captured on Microsoft's Excel spreadsheet package. In the analysis of the database I used three types of variables, namely elementary variables, classified variables and composite synthesis variables. This distinction between the different types of variables follow the method I first developed in my analysis of a database of 80 african male engineering students (AMES) for my honours dissertation (Conrad, 1997).

"Elementary variables were the simple answers given to questions asked in the questionnaire, which could be coded in a straightforward way" (Conrad, 1997: 25). Elementary variables included data directly from the interviews such as Age, Race, Matric Performance, UCT Funding etc.

"Classified variables were the responses to single questions which I classified according to my own categories" (Conrad, 1997: 25). Parents' Occupation and Reason for doing engineering were examples of classified variables, which I classified according to my own scheme.

I developed the composite synthesis variable during my honours dissertation as "I felt that there were occasions when vital information existed beneath the surface of the available information. There was information in the respondent's answers, which was given not explicitly in the answering of specific questions. There were answers in the interviews to questions, both open- and closed-ended, I felt had not been "asked" directly from one question, but could be gleaned from a synthesis of a number of question answers and I set about a system where I could draw out the information." (Conrad, 1997: 26-27) The use of composite synthesis variables as a tool of analysis was limited to the comparison between a

combination of Mathematics and Science matric results and other matric subjects under section 4.3.6, Matric Performance and section 4.4.3, Reason for doing engineering.

Whereas deriving the composite synthesis variable for the Matric Performance was simply a case of comparing symbols for across matric subjects, the reason for Doing Engineering variable was both a classified and a composite synthesis variable. In the case of reason for doing engineering, “Why chose these matric subjects?”, “Favourite Subjects”, “Achievements”, “Did you participate in Lab work at school”, “Activities or Hobbies”, “When decided on engineering”, “Why engineering and not science”, “Key benefits of engineering”, “Type of toy most played with”, “Perceptions of those doing mathematics/science”, “Influence of Careers Day/Guidance Teacher”, “Who encouraged (decision to do engineering)” and “(Do you) Know any engineers” were the variables looked at to arrive at classifications, derived from Jawitz and Case (1998), of reasons for doing engineering.

The quantitative nature of the data and the good sample suggests a high degree of representivity, at least of women engineering students at UCT in the early 1990s, of the material presented in Chapter 4.

2.3 WE Interviews

2.3.1 *The Sample*

At the end of 1998, after a first cursory analysis of the 1993 WES database, initial attempts at contacting the South African Women in Science and Engineering (SAWISE) appealing for volunteers to participate in my study failed, prompted me to seek other avenues for

contacting women engineers. Using a contact, Dr Neetha Ravjee, at the Centre for Research in Engineering Education (CREE) at UCT, I obtained a copy of a list of women engineers that she was in the process of compiling for the organisation. I approached the 30 women listed in the then incomplete database of women in the engineering industry in the Western Cape, outlining my purpose of conducting life story interviews that focussed on their path to being an engineer and practising as an engineer. One-third of the women that I approached through email and mailed letters agreed to be interviewed although 2 of them later changed their minds. Thus, the final interview sample comprised eight women.

At the time that I obtained the list, the majority of the women on the CREE database of women in the engineering industry were civil engineers. Their presence on the database was as a result of their membership of Women in Civil Engineering (WICE), an active support group that met 3 to 4 times a year. During one of my WE interviews I learned that my project had been the topic of some unofficial discussions at one of the WICE meetings. One of the reasons against participating were that mine was just “another study on women in engineering” while the fact that I was a man doing the research was also an issue for some of the women. The first reason illustrates a danger of researching a minority in that the tolerance of the population under study reaches a saturation point towards being the focus of research. The second reason illustrates the inherent danger of studying an issue from the position of an outsider in that the respondents might not feel comfortable in being interviewed. Both of these reasons go some way in explaining the level of response regarding my approaches for interviewees.

Because of the positive level of response that I received from the civil engineers relative to women engineers in other disciplines, I decided to do a case study of women civil engineers

working in Cape Town. The case study would be a focussed in-depth look at the backgrounds and experiences of professional women in the engineering industry. Once the analysis of the interviews was completed, it was found to compare favourably with what had been found in the local and international literature. In addition to themes, such as discrimination, harassment, negotiating the conflicting demands of family and career, appearing in the interview data that had shown some comparison with existing literature, an additional theme, regarding membership of women's engineering organisation, was also found to exhibit some prominence.

The women who agreed to be interviewed provided rich data that covered a variety of experiences. They ranged in experience from newly qualified to partners in the engineering firms where they worked. In one case a young and relatively inexperienced engineer complained of gender related problems at her firm while another, more experienced one, mentioned that she had to get to the level of "partner" before she encountered gender discriminatory practises in her profession. It might also be argued that research focussing on women in engineering could attract respondents that had something to say. The women in my sample revealed sometimes similar but also different aspects of the experience of working as an engineer. Therefore the depth and width of experiences of these women suggests that the views, both positive and negative, of a relatively small population of women civil engineers were well represented in this study.

Attempting to use the snowballing method as a form of insurance in getting more women, I asked my respondents if they were able to give me contact details of their female colleagues. Some of the women that I interviewed from the database that were not part of WICE admitted that because of the small numbers of women in engineering in general, their

knowledge of other women engineers was usually limited to no more than 4 or 5 others. The matter of small numbers and the lack of visible organisation among women engineers in other industries made it extremely difficult to contact them. This served to reinforce the decision to concentrate on in-depth, life story interviews

2.3.2 Life History Method

Being an outsider and having decided to explore the experiences of women engineers in depth, it made sense to use qualitative oral life history interviews. In preparation for the interviews I successfully completed a research project with engineering students in a course on life history interviews in 1997 to hone my skills on life story interviews. As Slim and Thompson point out, “collecting oral testimony is about collecting subjective experience” (1995: 150). In order to research the perceptions, feelings and opinions of the WE sample it was important to acknowledge the subjective nature of qualitative research. Slim and Thompson further point out “that it would be wrong to try to compare quantitative and qualitative information (... instead they) are best regarded as complementary – the one informing and qualifying the other.” (1995:150) The use of the literature was used as the complement and counterpoint to the subjective experiences of the WE Interviewees.

Free form life story interviews were chosen in order to draw out private information, such as experiences of discrimination and sexual harassment, from the respondents in a sensitive manner. Because I was a man doing the project I realised that I had to work harder to convince the women that not only was I serious about the project but that I was serious about accurately capturing their experiences. I felt that although it would prove more time-consuming for the respondents the fact that I was allowing them to use their own words to

describe their reality would count in my favour in minimising their perception of me arriving with preconceived notions regarding their experiences.

This type of interview also has an advantage over other, more structured interview methods because questions flow naturally as part of a life story rather than merely as a question to be covered in a questionnaire. The unstructured nature of the interviews also allowed flexibility in questioning and revisiting sections in order to verify certain information.

Additionally, in order to establish a rapport with the interviewees, each interviewee was asked to complete a short biographical questionnaire with essential personal information prior to the interview that allowed me to refer to the respondents in an informed way. Where possible I telephoned the respondents to set up interviews and to introduce myself because it was pointed out to me that not all my intended respondents would know that Ashraf is a man's name.

2.3.3 The Interviews

Audio-tape recorded interviews, of between 90 minutes and 120 minutes, were conducted with the eight engineers who had agreed to be interviewed. The full transcripts of these interviews, together with my research notes, were the primary data that I used for this part of the study.

The WE interview data was analysed in a three step process. The first step was to familiarise myself with the content of each of the eight interviews. This implied repeatedly listening to the audio-tapes, reading the transcripts and consulting my interview notes. In the second step

I would consult the literature and identify all possible themes that arose in a particular interview and collect the relevant quotes from each of the interviews. The third and final step was to rework the themes into meta-themes (the themes as they appear in Chapter 5) and combine the quotes from the respective interviews before writing commentaries on each. The combining of the two themes “advantage of being a woman engineer” and “coping strategies” into the meta-theme “5.5 Coping Methods at Work” is an example of this method.

The richness and depth of the qualitative life story interview data from the WE interviews could only be captured through the extensive use of quotes and mini-stories as presented in Chapter 5 and to a lesser extent in Chapter 4. Such is the strength and level of detail in the extracts from the life stories of these women that they are able to be analysed, as I have done, in the themes that emerged from a reading of all their stories.

In order to protect the anonymity of the interviewees and given the sensitive nature of certain issues, I decided against providing extensive biographical information about them.

2.4 Literature Review

As will be seen in the Literature Review in Chapter 3, the issue of low proportion of women to men in engineering has received a lot of attention in international academic circles. In the United Kingdom and the United States this problem has been studied for a number of decades while in South Africa the attempts to increase the number of women undertaking engineering study is a more recent phenomenon.

Although I had covered some of the reading in the initial stages of the study, the presentation of the review of the literature, the analysis of the WES database and WE interviews informed each other.

The review of the literature occurred in three phases. The first phase coincided with the analysis of the WES database. During this phase I gathered and examined literature specific to students on the topic of the reasons for doing engineering. The second phase of gathering and reviewing was done concurrent with the collection and analysis of the data on the WE interviews. The focus during this period of literature search was the experiences of women engineers in the workplace, including general issues such as gender discrimination and sexual harassment. The third and final phase, including the presentation of the literature came out of systematically combining the data and all the literature regarding all of the relevant topics. The final phase was probably the most significant as it summarises the method of reviewing the literature with respect to the issues that assumed importance, in terms of meta- and sub-themes, from my analysis of the two data sets.

This sharpening of the focus implied an initial step in looking at how different international studies use data on the reasons scholars, university students and women engineers gave for doing into engineering or science related subjects.

This sharpening of the focus had as its first step all the reasons given by scholars, university students and women engineers in various international studies, for doing engineering. The next step was a discussion of particularly strong factors, such as issues surrounding school and social background that emerged from the same body of literature. The final step was to

identify factors, such as issues of social identity, which was particularly applicable to the South African context and which had not been previously noted.

As a result of this, the readings by Ambrose (1997), Carter and Kirkup (1990), Jolly (1996), Wolpe (1971) Woolnough (1994) and especially the South African readings by Jawitz and Case (1998) provided a comparative empirical content for the analysis of factors affecting the choice to do engineering among the WES respondents outlined in 4.4.3.

The two meta-themes that emerged very strongly in the literature covers two different periods in the life of the women engineer. The first meta-theme, Choosing Engineering, covers the early childhood, school and university years of the engineer while the second meta-theme, In the Workplace, provides background to the work and personal life of women engineers. These two themes are examined in the literature review in Chapter 3.

2.5 Conclusion

One of the strengths of the thesis is the fact that the material discussed emanated from a variety of sources. Three methods of data gathering, each with their own strengths and weaknesses, were used to explain the different aspects of women in engineering. To a large extent the three methods used in this study complimented each other. The review of the literature provided comparative empirical content for the WES database and WE interview case studies. The analysis of the WES database used the literature as a basis of comparison with the situation of women engineering students in Cape Town in the early to mid-1990s, and provided a statistical profile of the academic and social background for the WE interviews. The WE interview case study, in turn, provided an in-depth look at the work situations and personal lives of women professionals in Cape Town. A useful point of

departure for the thesis is a discussion of the international and local debates surrounding the topic of women in engineering.

Chapter 3: Literature Review

3.1 Introduction

Chapter 2 outlined the methodology that I employed in compiling this review of both local and international literature relevant to the topic of women in engineering. The review is divided into two sections, Choosing Engineering and In the Workplace, and broadly covers two different periods in the life of the woman engineer.

The sections on “Choosing Engineering” covers the time from first interaction with engineering until the end of university life while the sections on “In the Workplace” focuses on issues not exclusive to engineers but to all women engaged in work outside the home. Included in the “In The Workplace” section are studies that deal with everyday perceptions, and misperceptions, of the engineering workplace, why students, and especially women, choose to study engineering or other science related fields and finally, particularly women’s experiences of studying engineering.

Although the issues in “In the Workplace” are broader than the experiences of exclusively women engineers, what I have focussed on are the way that literature from women in engineering projects deal with these issues. Major themes that are dealt with was how these women have negotiated between the demands of career and family, and a broad discussion outlining the concepts gender discrimination and sexual harassment in the workplace with specific reference to women.

The literature review provides a theoretical framework for the discussions in the following chapters that have also been roughly divided along the same timeline. Particular attention is drawn to the review of literature on highly theoretical debates surrounding reasons for doing engineering, gender discrimination and sexual harassment.

3.2 Choosing Engineering

3.2.1 Images of the Engineering Workplace

A useful place to start a discussion on the decision to do engineering, especially concerning women, is to explore images of engineering that everyone, especially those considering to study engineering, would encounter, to a greater or lesser extent, at some point in their decision-making process.

Coles' generated a list of positive images of engineering that included: "Creative, exciting; Intellectually stimulating; Theory into practice; Independence; Useful and People orientated" (Coles, 1994: 200) amongst others. These images paint a picture of engineering that would attract a large number of people from a cross-section of the population.

However, tempered with this list of positives, are certain negative images Coles has associated with engineering: "Rigid thinking; Physically demanding; and Family Incompatibility" (Coles, 1994: 200) being among the more prominent ones. In addition to these aspects often associated with "engineering", there exists a certain variety of physical spaces where the actual engineering workplace is concerned. For example, although only very little of specifically design, in mechanical engineering, implies association with a 'workshop', the image of a greasy workshop and heavy machinery is evoked. Similarly, the

civil engineering building site, together with attitudes of its “uncouth, uneducated, ignorant” workers prompts Greed to describe it as the “big bugbear” for women (Greed, 1991: 150).

When women are the group being targeted as the proposed engineers, the negative images take on an additional dimension. The fact that engineering industries are overwhelmingly male in all likelihood creates a possible hostile, but at least foreign, environment for women engineers.

3.2.2 The Decision to Do Engineering

A number of international and local studies have approached the question: “Why study engineering?” from different angles and at different levels. They have all explained that the decision to study engineering was never taken in isolation but that there are a number of factors that affect this choice. The similarity of reasons given between the different sources are what is particularly useful given the range of methods in the various studies below that were employed and the populations that were studied.

The international literature used is drawn from the context of western industrialised nations such as the United States (Carter and Kirkup, 1990; Shell et al, 1983), the United Kingdom (Carter and Kirkup; 1990; Wolpe, 1971; Woolnough, 1994) and one from Australia (Coles, 1994) because the South African case shares similarities with these countries regarding funding of studies

They cover research done on school-going young men and women studying at historically successful science high schools (Woolnough, 1994), on Engineering students at universities

and colleges (Coles, 1994; Shell et al, 1983; Wolpe, 1971) and professional Engineers (Carter and Kirkup, 1990).

Broadly, the influences that appear to affect the choice of engineering can be categorised into “Influences at home”, “Influences at School”, “Career Guidance outside of school” and “External Influences”.

A number of these studies (Carter and Kirkup, 1990; Coles, 1994; Shell et al, 1983; Wolpe, 1971) mentioned the positive effect of having a parent, often the father, or a sibling, often the older brother, or a role model doing engineering as a key factor in “informing” the prospective student about what engineering study entails and therefore providing a viable career option. Surprisingly, as Johnson and Stewart (1997) noted, Woolnough (1994) did not pick up on the effect of parents on the choice of careers in his study.

The “Influences at School” included primarily formal and informal advice from Mathematics and Science subject teachers (Carter and Kirkup, 1990; Wolpe, 1971) regarding future career choice, “the way science is taught in school” (Woolnough, 1994) and the content of mathematics and science courses (Shell et al, 1983). Also included in this category would be the advice from school appointed Careers Advisors or Guidance Counsellors (Coles, 1994)

“Career Guidance outside of School” refers less to the effect of private Career Guidance Counsellors but more to the role played by the various Women in Engineering societies’ Seminars, Workshops and Open Days (Coles, 1994; Carter and Kirkup, 1990)

The “External Influences” for doing engineering covers a large and diverse terrain. Within this grouping one would find not only “personal reasons” (Coles, 1994) and the influence of hobbies/ toys (Ambrose, 1997; Wolpe, 1971) but also work characteristics (Shell et al, 1983) that includes a good salary, challenge, job opportunities, etc.

A useful conceptualisation that Wolpe (1971) employed was a two-tiered level of analysis. “The first relates specifically to those skills acquired through both educational and home backgrounds whereby this group was in a position in which they were able to select their particular careers. The second level of analysis relates to those subjective elements in their environment which they perceived as having had some direct or indirect influence on their occupational choice, and their perceptions of the social constraints they experience as a result of their choice.” (Wolpe, 1971, p87)

Because we have already dealt with it and is more straightforward, we deal with the second level of analysis first. The second level of analysis relates to factors such as the influence of parents, older family member, teachers and personal interest that are regarded as having a subjective and direct or indirect influence on career choice.

In her first level of analysis Wolpe (1971) found that the engineers’ opportunity to continue their studies were possible because of two factors. As regards educational background, she found that her respondents, women engineering students, were high achievers and “had attended almost exclusively selective schools and predominantly single-sex.” (Wolpe, 1971, 103) She also found that on comparing the educational background and occupations of her respondents’ parents with the average university student, the women students in her sample were “markedly more (socially and financially) privileged than the average university

students". (Wolpe, 1971, 106) The inclusion of class position as a variable in determining the career motivations of the young person is an important consideration, which assumes an added dimension when referring to minority groups.

Shell (1983) widened the scope of his analysis of factors that influence career choice by specifying the different Career Planning Characteristics of women and ethnic-minority engineering students. They found different reasons for studying engineering between men and women and between white students and ethnic minorities (i.e. Black and Hispanic students). For women students, a number of work characteristics (especially job opportunities, the challenge of engineering, job security, problem-solving activities and independence), engineering-related subject matter and people (particularly mothers and contact with people in engineering related fields) played a significantly more influential role in their decision-making. For men, engineering related activities (electrical, mechanical and construction hobby) and technical publications (hobby magazine) played a significantly more influential role.

The gender difference is also emphasised by Woolnough (1994) who found that in general the boys and girls responded similarly except in certain cases. More girls responded favourably to the factors concerning "involvement with human issues". More boys responded favourably to the factors, "sophisticated techniques used in military weapons" and "scientific hobbies and fiddling with gadgets at home"(1994: 669).

The scope of career choices are, to a large extent, based upon the Social or Home Background of the individual. The opportunity to pursue higher education and a career in the

professions are reliant on ones social circumstances, the structural features that allow one to make a decision to study engineering.

In the previous section mention has already been made about the significance of the parents and especially father's career on the choice to do engineering. Wolpe (1971) highlights the fact that the identifying of parents' careers and also their education enables one to get a sense of the social background of the students in her study. In a comparison she found that, due to the high ranking of their fathers' occupations as well as the educational levels of both parents, UK women engineering students were more privileged than the average university student, women university students in general as well as their male engineering student counterparts. (Wolpe, 1971)

With reference to the school background, Wolpe (1971) found that the majority of the women engineering students in her study attended selective and therefore single sex schools. Although the system of selective schools has not been used since the 1980's (Carter and Kirkup, 1990: 51), the suggestion remains that women students benefit from the self-confidence built up in Mathematics and Science during their school years. As far as educational ability is concerned, Wolpe (1971) found that women engineering students were better performers at school than their male counterparts. However, she found that there was no significant difference between the school performance of women engineering students and women university students in general.

The South African literature that deals with the issue of the choice to do engineering incorporates the gender and race dimension as it is applicable in the South African context

and deals with specific factors, such as the changing political conditions, not elaborated on in the international literature.

Jawitz and Case (1998) sampled first year engineering students from three tertiary education institutions in the Western Cape to determine their reasons for studying engineering. Using free form response questionnaires they classified eight categories of reasons, including, Socialisers, School Subjects, Engineering Activities, Social Identity which were found to have influenced the decision to do engineering.

They found significant differences by race and gender between some categories, for example, Socialisers, such as the influences of teachers or the presence of engineers in the family, and School Subjects, which includes ability or enjoyment in science and/or mathematics, were two categories that were mentioned more by white than black students and among white students more by female than male students (Jawitz and Case, 1998).

School subjects, the category that reflects the quality of education received, and which varied greatly between population groups as a result of apartheid policies, affected the strength of influence between population groups. White students, who would have enjoyed a better quality of education, would more easily be positively influenced by their schooling in their choice of engineering than would black students, who often came from schools with little or no facilities. This, together with the poor quality of Mathematics and Science education at former black schools, could explain the reason for the discrepancy within this category between black and white students. In addition to this, the historical legacy of this inequality would thus imply that black students' opportunities to interact on a social level with

engineers from the previous generations would be very limited since few black students would have had the opportunity to pursue a career in engineering. (Jawitz and Case, 1998)

Jawitz and Case (1998) developed a new category, Social Identity, to classify those reasons that refer to the attitude of serving the community through doing engineering. They found that black students and especially black women students had a much bigger affinity, than all other groups, for doing engineering on the basis of their perceived roles in the community.

Similar to Woolnough (1994) and Shell (1983), Jawitz and Case (1998: 237) also found that responses for Manual Activities, such as working with one's hands and building things, were cited more among males than females.

In a review of the factors that affects the choice to do engineering, a US based study by Ambrose, et al (1997) identified a number of social factors that have been found to influence career choice among women. They found that "social factors", rather than issues of ability and interest, form the basis of the individual and group psychology of women's choice of engineering as a career. Through their own experiences (Socialisation), as well as through their interaction with key "actors" in their lives (Parents, Teachers/ Counsellors and Peers), women students learn not only what are the appropriate and inappropriate gender roles, but also adopt the mindsets of the people they interact with on a regular basis. Another important factor that is highlighted refers to how failure and success in Mathematics is treated differently for young men and women. The message that is conveyed to the young men and women is that for men success or failure depends on natural ability whereas for women success and failure depends on hard work.

Jawitz, Case and Tshabalala (2000) approached the logic behind not choosing engineering by looking at the career process of eligible female engineering candidates that chose other disciplines. They found that the career decisions for the majority of these women students were based mainly within Medicine, a 'gender neutral' profession, and Commerce, a career path vigorously marketed for its potential job opportunities. Jawitz (2000) also found that a positive attitude to science at school to be a strong factor influencing the possible choice of engineering.

As the literature review above has therefore shown, a number of causal factors lead to the decision to do engineering. This seems to be true irrespective of the population under study. One of the elements of my thesis was to explore the evidence of the many different causal factors that have influenced the women from both the WES database and the WE interviews. The categories of causal factors have been drawn from the range of studies reviewed above – but I have not drawn on any specific theoretical framework from any one of these.

3.2.3 Experiences of Women Engineering Students

In literature drawn from the United States (Carter and Kirkup, 1990; Ferrey, 1990; Saintjones, 1990), the United Kingdom (Carter and Kirkup, 1990; Greed, 1991) and South Africa (Jawitz, 1992; Pollock, 1996), a number of issues emerge regarding the experiences of women engineering students. These issues identify feelings of belonging and isolation within the relationships between these women students and other people (individuals and/or groups) and also how these women deal with these feelings and perceptions.

At least at undergraduate level, students interact most frequently with their classmates. A number of studies mention the fact that because of their minority status, women studying

engineering often draw comfort from the fact that there are other women also studying engineering (Carter and Kirkup, 1990; Ferrey, 1990; Greed, 1991; Pollock 1996; Saintjones, 1990).

The feeling of belonging in a class, however, does not often come from cliques of women but from the class as a whole, which, invariably, is still male dominated. To get a true feeling of collegiality, the women have to somehow be accepted fully in the classroom. This full acceptance does not necessarily imply acting like, or being accepted as, one of the men (Greed, 1991; Pollock, 1996) but being accepted as a woman, qualified to be there.. Greed (1991) notes that the majority of the men in her experience as a lecturer are enthusiastic about increasing the number of women doing engineering but that they ignore “their ‘special needs’ and the way they are likely to react to the ‘maleness’ of lecture material and service delivery, or they treat them as ‘different’ on the basis of outmoded *gallante* attitudes or inaccurate stereotypes which limit their role and development with the educational setting.” (Greed, 1991:122)

Pollock (1996) notes that although it is not always ill-intentioned, the behaviour of certain male lecturers have a negative effect on women students’ feeling of belonging to the class. She notes that lecturers’ comments to accommodate women students actually increase their conspicuousness and visibility as a group different from the majority. Jawitz (1992) illustrates how lecturers negative comments surrounding the lack of familiarity a woman student had with technical drawing through labelling it as “typical female logic” (1992:123) increases the feelings of difference and doubt.

The obstacles certain women face are not only based on sexist attitudes and behaviour, but also classist or racist attitudes (Carter and Kirkup, 1990; Jawitz, 1992; Saintjones, 1990). Through an interview with a UK woman engineer, Carter and Kirkup (1990) illustrates the way in which an under-privileged class position affects every aspect of one's life, in terms not only of the quality of education that is received, but the way education is approached in the home. In a quote from a student we see how for black women the feeling of isolation and lack of belonging can be multiplied due to racism: "I found it to be an extremely negative experience. The female whites are worse than the male whites. You are simply Black – not even recognised as a woman." (Saintjones, 1990:20)

Although unnecessary, negative experiences sometimes have positive consequences. Saintjones (1990), Carter and Kirkup (1990) and Pollock (1996) all show how, despite obstacles, women students overcome their lack of confidence and start to perform once they have not only proven to others, but more importantly, to themselves that they belong in engineering. Just as women students draw comfort from the fact that they have women classmates, the mere presence of women lecturers and/ or mentors were shown to be a significant symbol of support even if they were not used as a system of support. (Ferrey, 1990; Pollock, 1996; Saintjones, 1990).

The university experiences of women engineering students are neither wholly positive nor wholly negative. The way the experiences are dealt with are significantly dependent on the self-confidence of the individual.

3.3 In the Workplace

3.3.1 *Women in the Workplace*

“Everything and almost anything women do is work” (Kemp, 1992).

Accepting the above-stated position does not disguise the fact that the work that women do, especially in the home, is often unpaid. For the purpose of this discussion, women’s work refers to work that occurs in the economic sector and is therefore regarded as paid employment. Even in the economic sector however, women historically held, and until today still mainly hold, positions that are undervalued.

In her study on professional women who have achieved in a man’s world, Abrams (1993) identified themes that are common throughout her interviews. Prominent amongst these were “discrimination at work, the strain of trying to combine marriage and motherhood with a demanding professional job, the importance of family support systems, the reliance on paid and unpaid female labour in the home, the importance of a supportive partner, the centrality of motherhood to female identity”. (Abrams, 1993:193)

This section focuses on two important issues women face due to their participation in the workplace. The first deals with the way women negotiate their work responsibilities and their familial responsibilities given the fact that both are at times regarded as full-time occupations. The second posits the concepts Gender Discrimination and Sexual Harassment that sets the background to the experiences of some of the women in my study.

3.3.2 Issues of Career and Family

From a number of UK (Carter and Kirkup, 1990; Evetts, 1994; Greed, 1991) and US based studies (Carter and Kirkup, 1990; Preston, 1994; Taniguchi, 1999) we find that there are a variety of issues surrounding family for the working woman.

Negotiating the space to combine raising a family and pursuing a career can prove to be a complex dilemma for professional women. As Carter and Kirkup (1991) explain: “for those women with children (children and childcare) was the area of their lives which was most difficult to balance with a professional commitment.” (Carter and Kirkup, 1991: 101).

Achieving the balance is often a matter of negotiating between professional commitment and personal preference. The negotiation includes having children later in life (Greed, 1991), flexible and part-time working hours or “career breaks” (Evetts, 1994) and convincing themselves of the importance of spending quality time with their children (Carter and Kirkup, 1991). A common thread that runs through all of these is that the solutions are specific to the individual and are deemed to be “solutions” because they reduce the effect that family responsibility has on the general functioning of the woman engineer.

The logic behind, and the effect of, delaying having children, which was raised in the last paragraph, has been researched by Taniguchi (1999) who found that “the timing of childbearing shapes women’s life chances in a significant way.” (Taniguchi, 1999). She found that delaying childbirth has less of a negative effect on wages since enough work experience and “related skills” had been accumulated. (Taniguchi, 1999)

However, the issues that face working women in the home are not limited to issues of motherhood and childbearing alone. As Evetts (1994) points out, “(the) decision to remain child-free and focus the career identity on achievements at work is one way of resolving the dilemmas which motherhood presents for woman’s careers”. (Evetts, 1994) She also notes that not having children increases the amount of internal clashes experienced by women surrounding cultural notions of femininity of women in male dominated careers. (Evetts, 1991)

Also Carter and Kirkup (1991) point out that women are also responsible for, if not the maintenance of the household, then the organising of the maintenance of the household, which also commands a lot of time and energy.

3.3.3 Gender Discrimination and Sexual Harassment

The negative treatment that women, as a group, encounter in the workplace can normally be categorised as either discrimination or sexual harassment.

In terms of gender discrimination, women in the workplace face a number of obstacles, not only in terms of gaining employment, but also in terms of getting recognition for the work that they do once they are employed. These include, but are not limited to, access to certain careers, working conditions (part-time versus full-time with the consequences of benefits), compensation, and advancement opportunities due to their gender. In order to prevent unfair conditions with respect to discrimination on the basis of race, sex, class etc, governments legislate to regulate and minimise the degree of discrimination.

According to the Promotion Of Equality And Prevention Of Unfair Discrimination Bill of October 1999 in South Africa, gender discrimination is defined as: “(a) any distinction, exclusion or restriction made on the basis of sex, pregnancy, marital status, domestic or family responsibilities or sexual orientation, which is aimed at or has the effect of impairing or nullifying the recognition, enjoyment or exercise by women or men, irrespective of their marital status on the basis of equality between women and men, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field; (b) any act or conduct which has the effect of creating or sustaining systemic forms of domination and disadvantage which perpetuate and re-enforce unequal gender relations and prevent women from being able to develop to their full human potential and participate fully in society.”

Although the incidences of discrimination that I document in Chapter 5 happened before the legislation on discrimination in 1999 was passed, it is useful to use this definition as a point of reference regarding the extent and severity of discriminatory practises.

Saal approached the issue of sexual harassment by hypothesising that men hold the misperception that friendly behaviour of women (Stockdale, 1996) was a sign of “sexual interest, or availability” (Stockdale, 1996). He cites his own previous research, as well as others, looking at women’s and men’s perceptions, and found little significant differences between men’s and women’s perceptions regarding friendly behaviour and concluded that the hypothesis, although sounding plausible, had not been proved empirically.

What the above case suggests is that there is considerable confusion surrounding what constitutes sexual harassment given the possible different interpretations of certain

behaviour. For example, bum-pinching, publicly displaying nude pictures or even sexual intercourse is not regarded by Saal as the “issue” as much as the way these actions are interpreted.

With reference to laws passed in the US, Stockdale (1996:6), Dworkin (1993:52) and Whitehead (1996:43-3) outline the two broad categories of sexual harassment.

The first, ‘quid pro quo’ harassment refers to the “exchange of work related benefits or consequences for sexual favours through the use of bribery or threat” (Stockdale, 1996:6). The defining elements of the first form of harassment are the power relation that exists and the fact that sexual favours are held as leverage against work related benefits.

The second, ‘hostile work environment’, refers to “unwanted actions of a sexual nature that have the ‘purpose or effect of unreasonably interfering with an individual’s work performance or creating an intimidating, hostile, or offensive working environment” (Stockdale, 1996:6). In this case the formal power relation is not apparent but the effects of some exercise of power by one party, in the form of unwanted sexual actions, is perceived by another party.

Definitions of sexual harassment, such as the one above, have been criticised on two fronts. Firstly, McCarthy (in Wekesser, 1992) argues that the assumptions that the laws carry imply that women are “delicate” and in need of protection and also have greater potential to bring lawsuits on the grounds of sexual harassment. This, of course, works against the atmosphere of equality in the workplace that the law attempts to achieve. Secondly, Cohen’s (in Wekesser, 1992) opposition to laws regarding sexual harassment is based around the fact that

they are often so broad that they do not give adequate regard to acceptable cultural, nor normal man-and-woman, interaction (Wekesser, 1993).

A broader understanding of sexual harassment can perhaps be achieved by looking at the way in which Fitzgerald et al discusses psychological dimensions of sexual harassment. Fitzgerald et al (in Stockdale, 1996) distinguishes between *gender harassment*, *unwanted sexual attention* and *sexual coercion*. "Gender harassment involves generalised sexist comments and behaviour that convey insulting, degrading, and/or sexist attitudes. Unwanted sexual attention ranges from unwanted, inappropriate, and offensive physical or verbal sexual advance to gross sexual imposition, assault, or rape. Sexual coercion implies the solicitation or coercion of sexual activity by promise of reward or threat of punishment." Stockdale (1996:6)

3.4 Discussion

The level of detail captured in the different sections relate to their reason and relevance. In Choosing Engineering (3.2), the section Decision to do Engineering (3.2.2) received much more attention than the section on the Experiences of Women Engineering Students (3.2.3) because of the role it plays in the subsequent chapters. On the one hand, the section on Decision to do Engineering (3.2.2) captures the theoretical framework for the discussion on the WES respondents' factors affecting the choice to do engineering in Chapter 4 while, on the other hand the experiences of Women Engineering Students (3.2.3) is much more experiential and is less useful to compare between studies.

In In the Workplace (3.3), the sections on Gender Discrimination and Sexual Harassment (3.3.3) were merely used to illustrate a point of reference for these debates in the subsequent

chapters while the Issues of Career and Family (3.3.2) has a number dimensions that needed to be identified to aid the discussion of Coping with the Conflict between Motherhood and Career (5.6).

Chapter 4: School and University Experiences

4.1 Introduction

As discussed in Chapter 2, in 1993 eight women Sociology students (in groups of two for each of 2nd, 3rd and 4th year undergraduate respectively, and one group of two for the postgraduate years of engineering study) interviewed 59 University of Cape Town women engineering students (WES data) for their final year undergraduate research projects in the Sociology Department. (See Appendix A for questions asked on demographics, schooling and university experiences.). This is the only analysis of the full database that was combined and standardised at the end of 1993.

Chapter 4 commences with summary demographic information about the students. Demographic information that I include is the race, age, marital status and indicators of social background of the respondents. This chapter therefore provides a broad statistical basis for a more in-depth look at the experiences of women engineers in the workplace that is presented in Chapter 5.

The section thereafter provides an overview of the School Background of the students with data that includes a distinction between government and private school, a distinction between single-sex (girls-only) and co-educational schools, their favourite subjects, their school achievements and their performance in their matric year.

After the section on their school background, I focus on how the decision to do engineering came about. In this section, I use qualitative data from interviews with women engineers

(WE data) that I conducted in 1998 and combine that with information from the WES data of 1993 to draw out some of the important influences in the decision to do engineering.

The final section in this chapter deals with the University Life of the women engineers and women engineering students. This section incorporates the source of finance, their opinions on women studying engineering in general and their personal views and influences during engineering study, presented more quantitatively of, firstly, the WES data and, secondly, and more qualitatively from the interviews contained in the WE data.

4.2 Summary Demographic Information (all WES sample)

4.2.1 Introduction

As noted, the demographic information about the WES of 1993 provides for the reader a sense of which women registered for engineering at UCT in 1993, in terms of the demographic variables Race, Age, Marital Status and Social Background. The section on Social Background is further broken down into Parents Education and Occupation.

Since 1993, more active recruitment of young women into scientific careers by organisations, such as the South African *Women in Science and Engineering (SAWISE)*, and specifically local higher education institutions such as the Peninsula Technikon⁴, has caused the situation to change. What is presented here is a snapshot of the background and experiences of women engineering students during early to mid-nineties.

⁴ This information was obtained through personal discussions with Dr Jeff Jawitz, Education Development Officer, Faculty of Engineering, UCT.

4.2.2 Race

It can be argued that all studies conducted in South Africa need to be conscious and sensitive to the issue of race and the impact that racial discrimination has had on society due to the legacy and history of apartheid. For this reason, the analysis here includes the variable “race” as defined by the respondents themselves.

Race played an important role in the level and quality of education received by all South Africans as a result of apartheid. African WES data was gathered as part of a different project but unfortunately the students responsible for that project misplaced the data and it could therefore not be included in this analysis.

Table 4.1 Women Engineering Students by Race

Race	Undergraduate WES		Postgraduate WES		Total	
	No.	%	No.	%	No.	%
Coloured & Indian	10	(20%)	1	(11%)	11	(19%)
White	39	(80%)	8	(89%)	47	(81%)
Total	49	(100%)	9	(100%)	58*	(100%)

* One respondent did not specify her race. Total sample size equals 59.

In Table 4.1, above, we see that eleven of the 59 or around one-fifth of the Women Engineering Students that participated in the study were either coloured or indian. Of these eleven respondents, 10 were involved in undergraduate studies. Just over four-fifths of the white WES were doing undergraduate studies. Approximately the four fifths of of the total number of students in the sample were white.

The difference in opinions and experiences of coloured, indian and white women students were not probed by the interviewees. However, these differences only became apparent during my combined analysis of all the students’ interviews. Specific racial differences were

not explored in the interviews and were only used at a superficial level for the section on social background of the respondents.

Because of the overwhelming majority of white undergraduate students in the sample, the demographic, views, opinions and experiences in this study were reflective of this group unless specifically stated.

4.2.3 Age⁵

The age of the undergraduate WES respondents ranged from 18 to 23 years. Nearly two-thirds of the sample (31 or 63%) went straight to university from school although 4 (8%) of these had first enrolled for a Bachelor of Science.

Except for three 30 year olds, the group of 10 postgraduate WES ranged in ages from 21 to 24 years. Once again, the relative youth of most of the postgraduate WES, as also confirmed by other parts of the interview, indicate that they, as yet, had no or very little work experience but had continued onto Postgraduate studies directly after completing their Bachelors degrees. The three 30 year old women were white, married and two of them had two years of work experience each, while the third had already worked for five years.

4.2.4 Marital Status

Of the 49 undergraduate women engineering students, only one was married. In the interview she mentioned that she wished to have children but added that she would place her work before both her husband and children. The issues surrounding family commitments are explored in depth in the following chapter that contains an analysis of the WE interviews.

⁵ The data on age of WES respondents was sourced from the 1993 WES database.

The three married postgraduate students were significantly older than their single postgraduate counterparts, as noted above. They were all 30 years of age compared to the others that ranged in age from 21 to 24 years, as noted. All three of them had had work experience, and at the time of the interviews none of them had children.

It can be argued that marriage sensitises one to feelings of familial commitment, duty and belonging and could have either negative or positive effects. For women students, the positives could be support of a partner while negative effects could be increased demands on time for maintenance of the household.

4.2.5 Social Background

Variables in relation to respondents' social background were probed fairly vaguely in the original interviews. The data on Parents' Education and Occupations were dealt with as independent variables and, in the concluding section here, as inference of social privilege. Despite the fact that this method might not be accurate for each individual case, I feel that it was useful to include in order to establish a sense of the general level of social privilege for the group as a whole i.e. I feel general trends can be established at the aggregate level.

Race in the South African context is very important and I will include the distinction between coloured and indian and white respondents for my analysis of the section on Social Background, even though the coloured and indian sample are small.

4.2.5.1 Parents' Education

I will look firstly at the WES parents' education before moving to their parents' occupations as significant factors in establishing Social Background. The level of parents education was an important factor because it suggested the level of privilege of the parents and therefore also of the respondents.

Table 4.2 Mothers' Level of Further and Higher Education

Level of Further and Higher Education	Coloured & Indian WES		White WES		Total	
	No.	(%)	No.	(%)	No.	%
None	6	(60%)	19	(48%)	25	(50%)
College/ Technical College	3	(30%)	7	(18%)	10	(20%)
Technikon			1	(3%)	1	(2%)
University	1	(10%)	13	(33%)	14	(28%)
Grand Total	10	(100%)	40	(102%)*	50**	(100%)

* Rounding Error

** Nine respondents (of 59 total undergraduate and postgraduate respondents) did not specify an answer to this question.

Overall, 50% of the interviewees that responded to this question said that their mothers had received some form of further or tertiary education. 28% specified that they received education at university.

Across the race groups half, 25 (19 or 48% white and 6 or 60% coloured or indian) of the WES's mothers had no higher education. Only one coloured woman student's mother had received a university education compared to nearly a third of the mothers of white women students who had received a university education. Therefore, the mothers of just over a quarter of the sample (14 respondents) had completed their university education.

Table 4.3 Father's Level of Further and Higher Education

Level of Further and Higher Education	Coloured & Indian WES		White WES		Total (%)	
	No.	%	No.	%	No.	%
None	6	(60%)	7	(16%)	13	(24%)
College/ Technical College			2	(5%)	2	(4%)
Technikon	2	(20%)	6	(13%)	8	(15%)
University	2	(20%)	29	(66%)	31	(57%)
Grand Total	10	(100%)	44	(100%)	54*	(100%)
* Five respondents (of 59 total undergraduate and postgraduate respondents) did not specify an answer to this question.						

Overall, very significantly, three-quarters of the interviewees that responded to this question said that their fathers had received some form of further or tertiary education with more than 50% having attended university. These proportions were much higher than for the respondents' mothers, the situation of a typical male-centred professional family.

Nearly three-quarters (41) of the fathers of the respondents had received some form of tertiary education. For white students the percentage of fathers with tertiary education was even higher with 84% (37 respondents) and of this nearly two-thirds (29 respondents) have attended university.

The relatively high level of parents' education is the suggestion of the relative social privilege of the respondents.

4.2.5.2 Parents' Occupation⁶

The parents of the respondents had a wide range of occupations. In Table 4.4 below, I have classified the parents' occupations into occupational categories according to a classification scheme of my own construction. The occupational categories reflect the nature of the job as

⁶ Although it could be argued that a link exists between the influence of parents on the decision to do engineering, I was wary of making that assertion based on the data available in the WES database. The question

well as the experience and educational qualification required. In Appendix E there is a key to the occupations specified by the respondents, discussion of the categories and rationale for this classification into these occupations and, where possible, the qualifications that I looked at in order to classify them.

Table 4.4 Parents' Occupation of Women Engineering Students

Occupation Category	Mother				Father			
	C&I	White	Total		C&I	White	Total	
	No.	No.	No.	%	No.	%	No.	%
Upper Management						4	4	(7%)
Elite Professionals		7	7	(12%)	2	21	23	(41%)
Middle Management		2	2	(3%)	1	6	7	(13%)
Middle Professionals	4	8	12	(21%)		2	2	(4%)
Technical Degree Occupation		4	4	(7%)		1	1	(2%)
Non-Manual Skilled	1	9	10	(17%)	3	4	7	(13%)
Manual Skilled	1		1	(2%)	3	2	5	(9%)
Manual Unskilled								
Self Employed					2	5	7	(13%)
Housewife	5	15	20	(34%)				
Unemployed								
Unspecified		2	2	(3%)				
Grand Total	11	47	58*	(99%)	11	45	56**	(102%)
* Mother: One respondent did not answer this question.								
** Father: Three respondents did not answer this question.								

In total, 20 (34%) of the WES indicated that their mothers were housewives. 43% of the respondents' mother's occupations were categorized into the Elite Professionals, Middle Professionals, Middle Management or the Technical Degree Occupations categories. 17% of the mothers had occupations that were categorized into the Non-Manual skilled category.

Overall, the father's occupations of just over 40% - very high - of the interviewees were classified into the Elite Professionals category. Only a fifth of the respondents had their fathers in occupations that were categorized into Non-Manual skilled and Manual Skilled categories.

pertaining to the effect of parents was not directly asked for the WES study (by the 3rd year Sociology students) but did provide an issue that I was able to probe in my WE interviews.

In more detail, two-thirds (38) of the WES respondents' mothers were involved in paid employment⁷. Quite a large number (25 or 44% of the total) of these were in occupations that required some form of tertiary education and included the occupation categories Upper Management, Elite Professionals, Middle Management, Middle Professionals and Technical Degree Occupations. Twelve (21%) WES respondents' mothers were involved in Middle Professionals Occupation category, chief of which were Teacher and Nursing Sister. A further seven (12%) of these respondents' mothers were in the Elite Professionals occupation category. Occupations in this group included careers such as Research Scientist, Botanist and Accountant. Ten (17%) of the mothers were classified as Non-manual Skilled and included occupations such as Secretary, Sales Person, Estate Agent and Credit Controller.

The Elite Professionals Category (including nine who were engineers) was the Occupation Category with the largest percentage, with 23 (41%) of the WES respondents' fathers falling into this group. Other occupations in this category include Researcher/ Administrator, Accountant and Doctor. A significant number of respondents' fathers were also in the Middle Management (7 or 13%), Non-manual skilled (7 or 13%) and Self-employed (7 or 13%) categories.

4.2.5.3 Summary of Social Background

Firstly, because the question was not specifically asked, and secondly, because categories of social class are dynamic and often fiercely contested, determining a measure of social class in the confines of the data is very difficult. However, a number of indicators exist in the data

⁷ Paid employment includes all occupation categories listed except Unspecified, Unemployed and Housewife.

to suggest that many of the women engineering students come from families that could be classified middle to upper class.

Four factors imply that the majority of respondents were from the relatively more financially secure sections of the community. Firstly, like all young students at tertiary institutions the opportunity to attend university, either because of the high tuition or because of the opportunity costs, is often not usually afforded to young people from the working classes. A second reason for inferring the middle-class level of the majority of the respondents is the fact that many of their parents had received tertiary education. Half the respondents' mothers and three quarters of the respondents' fathers had received some form of tertiary education. The third and fourth reasons for inferring that the respondents come from middle to upper class families is the employment status and occupations of the respondents' parents. None of the respondents listed either of their parents as being unemployed. In addition to this, the fact that the majority of parents, especially fathers, have occupations that require a skill and that a large number of these obtained their skills through university education, strengthens the assumption that the majority of these women come from families that have some form of financial security.

4.3 School Background

4.3.1 Introduction

A number of variables were analysed regarding the school background of the women engineering students. Issues that came out were the Type of School Attended: Government or

Private Schools and Co-educational versus Single Sex and, their subject interests, the performance of the students over their school careers (measured by School Achievements) and their performance in matric (measured by Matric Results and comparison by matric subjects).

4.3.2 Type of School: Government or Private

Regarding the type of school that they attended, the respondents were asked whether they attended a government or private funded school.

Table 4.5 Attendance at Government or Private School

Type of School	Coloured & Indian WES		White WES		Total	
	No.	%	No.	%	No.	%
Government	6	(67%)	35	(80%)	41	(77%)
Private	3	(33%)	9	(20%)	12	(23%)
Grand Total	9	(100%)	44	(100%)	53*	(100%)

* Six respondents did not specify an answer to this question.

From Table 4.5, above, we see that more than a fifth of the respondents in the WES study attended private schools.

It can also be argued that attendance at private schools is an indication of social privilege.

4.3.3 Type of School: Single-Sex or Co-educational

Ambrose (1997) suggests that girls-only schools provide an environment for studying that is more accommodating for women students studying Science and Mathematics because it allows them to excel without appearing intimidating to their male counterparts.

Table 4.6 Attendance at Co-educational or Single-Sex Schools

Type of School	WES No.	WES %
Co-educational	31	(53%)
Single-sex (girls-only)	27	(47%)
Grand Total	58*	(100%)

* One respondent did not specify an answer to this question.

From Table 4.6, we see that just under half (27) of the WES respondents attended girls-only schools.

Among the undergraduate women, 43% or 21 students (18 or 46% white and 3 or 30% coloured and indian) attended girls-only schools. The three indian women students went to the same school. One of these mentioned a former pupil that was the first pupil from their school to study engineering, as being someone who inspired her choice to do engineering.

It can be noted that a significant proportion of the postgraduate women attended girls-only schools. Two-thirds, or 6, of the postgraduate women attended girls-only schools. All of the six, or 75%, were white.

4.3.4 Favourite Subjects

In her study on women engineering students Wolpe (1971) found a high level of achievements in Mathematics and Science amongst her study. In order to explore the extent these women did well in Mathematics and Science, they were first asked what their favourite subjects were.

Table 4.7 Favourite School Subjects

Favourite Subjects	WES No.	WES %
Science and Mathematics	48	(87%)
General	5	(9%)
Other	2	(4%)
Grand Total	55*	(100%)
* Four respondents did not specify an answer to this question.		

From Table 4.7 we see that a very large majority (48 or 87%) of the WES sample specified Mathematics and Science as their favourite subjects. Only 4 respondents “didn’t know” or were not asked the question. Very small numbers of women, (9% or 5 respondents), specified “General”, denoting that they enjoyed all their subjects, or “Other” (4% or 2 respondents), denoting subjects other than Science and Mathematics, as their favourite subjects. There was thus clearly a strong affinity for Science and Mathematics among the WES sample.

4.3.5 School Achievements

The women were asked whether they received prizes, awards or certificates at school for achievements in specific subjects and/or whether they were allowed to compete and represent their schools at Olympiads. The level and extent of school achievements among the respondents would indicate the level of ability and/ or the amount of work dedicated to schoolwork.

Table 4.8 School Achievements

School Achievements	WES No.	WES %
Science (Physical Science and Mathematics)	31	(53%)
General (All subjects including Science)	18	(31%)
Other	3	(5%)
None	6	(10%)
Grand Total	58*	(100%)
Note: Achievements were defined as prizes, awards, certificates, and/or being chosen to represent the school, for subjects.		
* One respondent did not specify an answer to this question.		

In the table above, we see that a very high proportion, or 53% of the respondents (7 or 70% coloured and indian and 19 or 49% white) mentioned that they had only received recognition (in the form of prizes, awards, etc) for their performance in Physical Science and Mathematics. Very few (3 or 5%) of the respondents mentioned achievements that did not include Science.

The bias towards achievement in Physical Science and Mathematics (in the categories Science and General achievements) could be explained by the fact that the sample was engineering students. Since above average achievements in Science was a requirement for admission to engineering at UCT it is expected that students in this sample would have excelled in Science at school.

4.3.6 Matric Performance

Good performance, being a C-Matric Aggregate or above, was a requirement for the acceptance into engineering at UCT⁸.

⁸ In personal discussions with Dr Jeff Jawitz the Education Development Officer, Faculty of Engineering, UCT, it was noted that in the Engineering Faculty in the 1990s, the matric results of the average women engineering student was much higher than the male counterparts.

Table 4.9 Matric Aggregate

Matric Aggregates	Undergraduate WES		Postgraduate WES		Total	
	No.	%	No.	%	No.	%
A-Aggregate	21	(52%)	7	(87%)	28	(58%)
B-Aggregate	19	(48%)	1	(13%)	20	(42%)
Grand Total	40	(100%)	8	(100%)	48*	(100%)

* Eleven respondents did not specify an answer to this question.

From the above table we see that the women undergraduate respondents were very high achievers. More than half the respondents (21 respondents) received an A-Matric Aggregate while the rest received a B-Matric Aggregate.

Even more than undergraduate women students, the postgraduate students were excellent achievers with only one of the nine postgraduates not receiving an overall A Matric Aggregate.

The reasons why only women with excellent matric results do engineering are unclear but an important finding. The policy of the engineering faculty is to consider all matriculants with at least 50% in Higher Grade Mathematics and Science. One reason could be that only women with high marks feel confident enough to cope with engineering studies, but this would need further research.

Data on the matric results of the WES were collected and enabled a comparison with performance in Mathematics and Science versus performance in other subjects (Table 4.10). The categories for the comparison were (1) "Mathematics and Science better", where the average result for these subjects were better than their other subjects; (2) "All good", where the results for all the subjects were usually an A pass; (3) "All same" where the results for all

subjects were equal, usually a B pass and; (4) “Other better”, where the results in other subjects were better than the results in Mathematics and Science.

Table 4.10 Comparison between a combination of Mathematics and Science Matric Results and other Matric Subjects Results

Matric results	WES No.	WES %
Mathematics and Science better	32	(57%)
All good	6	(11%)
All same	14	(25%)
Other better	4	(7%)
Grand Total	56*	(100%)
* Three respondents did not specify an answer to this question.		

The majority, 57% or 32 respondents, of WES had Mathematics and Science marks that were better than their overall matric aggregate.

Overall, a look at the school performance of the WES respondents revealed them to be excellent achievers in all their matric subjects and even more so with regard to mathematics and science.

4.4 The Decision to do Engineering

4.4.1 Introduction

As the literature in Chapter 3 has shown, the decision to do engineering is a multifaceted issue. In order to detect the presence of a number of different factors, and to explore the relative influence of these factors, I decided to study both groups (1) the *quantitative data* of the reasons why WES decided to do engineering with (2) *qualitative data* from my own interviews of a sample of Women Engineers (WE) about their early childhood and family factors that influenced their decision to do engineering⁹. I start this chapter with a review of two women engineers I interviewed who related incidents in their early childhood that suggested engineering as a career choice. Following this I look at the influence of family on career choice. I conclude this section with some qualitative data on the reasons Women Engineering Students gave for doing engineering, from the interviews by the Sociology 3rd year students.

4.4.2 Childhood and Family Experiences (WE sample)

Although there may be incidents early in one's childhood that influenced the eventual career choices, one is not always conscious of these influences.

Since they were separate projects by the Sociology 3rd year students, only the group of postgraduate women students was asked what toys they had played with while they were

⁹ In terms of decision to do engineering, although the WES database gave evidence of the presence of a number of factors that had appeared in the literature, due to the nature of the research method employed by the 3rd year Sociology students, it lacked depth regarding the influence of the different reasons. The reasons for doing engineering that was drawn from the literature and the analysis of the WES database provided a point of departure for my in-depth interviews with the women engineers (WE sample).

children. Six of the 10 postgraduate WES mentioned that they played either with boys toys only (such as Lego, Mecano and cars) or that they played both with toys for girls and boys.

In the literature review in Chapter 3 it was noted that some authors drew attention to how socialisation in early childhood guides specific career choices. This socialisation included giving toys to, and playing games with, boys that encourage hand-eye co-ordination, spatial complexity and interaction with the physical world, while giving girls toys that did not actively encourage the acquisition of these skills (e.g. Ambrose, 1997) In the interviews with the women engineers, I asked a number of questions about their childhood in order to probe their awareness of the factors that influenced their career choice. In the cases of Caroline and Diane they recalled specific incidents that relate to the choice of engineering as a career. I asked Caroline:

- A: Any toys that you played with, like Lego or something, that you particularly liked?
- C: Oh, well I hated dolls. I positively would not ... anybody who gave me a doll I considered a complete moron. I can't enjoy errr. Ya, playing in the mud with cars and building roads and dams for little boats and trains and whatever ... any kind of ... and general kinds of things that kids play with like that. I didn't ... no. Oh ya, I also used to build make ..paper houses, and paint them and they would collapse from the weight of the paint .. (Laugh)¹⁰

Interview with Caroline

I found it interesting to note that Caroline started with a negative statement about dolls and it seems obvious that she received dolls as gifts when she was younger. Caroline's statement

¹⁰ I use "(laugh)" to denote an action.

I use "<break>" to denote where I deleted unnecessary parts of the quote.

I use "." and "..." to denote two different pause lengths.

I use "[no]" to denote where I insert what is intended but not said outright.

that she enjoyed building from a young age suggests that she made a connection between her preferred childhood toys and her work.

In the interview with Diane, I established that not only her father but also her maternal grandfather had been involved in the construction business. I therefore found it significant when she said:

D: just.. um I think it was because I was so used to looking at buildings and even before I went to primary school they would normally say draw a picture of your family and they would have to tell me twice because the first thing I would draw was a house and um.. I ..was used to structures. I was used to things like that. It was a normal procedure for me to think that like.. in fact I never, I never even realised that it wasn't something that women normally did.

Interview with Diane

Diane was a civil engineer and throughout the interview made specific note of her interest in “structures”. The story she tells, of drawing a house as the first thing when asked to draw her family, implies the emphasis that she places, and has placed since childhood, on the importance of structures.

Both Caroline and Diane relate events where they were left to themselves without the influence of an adult. Their experiences and preferences, Caroline for building roads and dams with mud and Diane for drawing structures, were significant factors personal to them that developed through their youth.

For Eve, the introduction to the construction industry was very comfortable. In the section on questions about her parents, I asked about her father:

A: Did you visit him at work?

E: Ya .. no, he always, I mean, the quarry was open on a Saturday, we all went with.

A: What did you do?

E: Just sat there and played around .. I mean .. he's quite cool too. You stand on the scale and Daddy weighs you. (Laugh) .. Ya, no I mean.. all the family will drive into Eerste River for the Saturday morning .. we all go shopping in town afterwards, I mean, you must remember this is people from Paarl coming to the big city, so .. ya .. I did visit my father at work.

Interview with Eve

The enjoyment that Eve got from playing around the quarry where her father worked was enhanced by her father's participation. In comparison with Caroline and Diane whose experiences were related as individual activities, Eve's father played an active role in involving her at his place of work.

Just as there can be many reasons for doing a specific career, there can be as many reasons, e.g. financial, opportunity, aptitude and parental pressure, for not going into a career. The fact that incidents during childhood may have an effect on one's eventual career does not, necessarily, imply that these are the main or only causal relationship shaping and your vocation. For example, the very fact that you enjoyed playing with mud, trucks, and Lego may not necessarily lead you to a career in engineering. What is recorded above is a retrospective look, by the respondents themselves, at what were significant influences which they feel have had some effect on their career choices and these do appear to have been important factors.

Influence of family on choice of career was noted wherever there was either a strong direct opinion expressed by a family member with respect to the career choice of the respondent or where a family member established a contact between the respondent and engineering. None of the women I interviewed described entirely positive encouragement from their family in their desire to do engineering although many of them indicated that parents were “supportive” of or “encouraged” them in whatever they wished to do.

The first example of family attitudes was Diane’s case. As mentioned in the previous section both her father and grandfather were involved in construction. She recalled an incident from her youth when I asked her about her father’s occupation. I asked her where her father worked after he stopped working at the bank. She replied

D: He began to work for my granddad... they have a building contractor firm.

A: your granddad from your dad’s side?

D: yes, that’s right.

A: a building contractor firm ... what position .. did he work in?

D: well he came in as sort of director

A: Ok and the training that he received for that was through the bank?

D: that was basically in-house training at .. at my granddads firm .. he went straight into without any experience and he just picked it up .. as he went along

A: do you remember your father... visiting your fathers work?

D: yes definitely

A: and your granddad as well?

D: yes, I was always on site.

A: What sort of things did you do?

D: Ah well I helped them unload, not that I could help very much but I .. I tried to help ... and I ... I loved going to houses and walking through them

... trying to see what it would look like in the end ... I know I used to colour in all the plans for my dad....

A: how old were you then?

D: five-six from then on I can remember ...

Interview with Diane

As we see from the quote above from my interview with Diane, the exposure to engineering was provided by her father, an engineer himself, involving her from a young age by taking her to work with him.

In Eve and Rene's cases the influence of family attitudes was negative. The primary opposition to Eve's choice of engineering as a career came from her father. I asked Eve what her parents' reaction was to her choice of career. She replied

E: My father was outraged because now working for a construction company at the time, he knew what it was about and, ... but he just worked for a construction company so he didn't have much experience in the consultancy field .. and he was outraged he didn't even want me on the site, he said it was not the environment for his daughter to be in. but I just stood fast and .. and tough.. and in fact we fought for long and hard because he .. I was still a minor and he had to sign my application form and he refused to until I nearly missed the cut-off date and eventually he conceded.

Interview with Eve

Eve's father tried to discourage her from doing engineering because of his experience of working in the construction industry. Knowing what the industry was about and knowing how women were treated, he was in no doubt over his view on his daughter doing engineering. The irony of the situation was that his involvement in the industry and during her young days her accompanying him to his place of work on Saturdays, sparked her interest

in engineering in her opinion. In addition to this the fact that she could get a bursary from a former employer of her father's solidified her decision to do engineering because it made it an economically viable option. In other words, negative attitudes are counteracted by other factors. The next two cases illustrate this in greater detail.

In my interview with Jean, she spoke about her family's displeasure at her choice to do engineering. Her choice to do engineering was affected to a large degree by her attendance at an engineering summer school. Speaking about this experience Jean says:

J: Basically what it did was it set out a path ... that seemed very obvious and ready-made. So although afterwards I discovered that people are going to react with shock and horror, you know, "What do you want to do Chemical Engineering for?" But, the experience of that week was, sort of, solid enough, that it got me through those kind of reactions.. because my family wasn't very happy, a) they weren't happy that I wanted to go so far away, from the Eastern Cape, err my brother and my sister both went to Rhodes, but Rhodes doesn't offer engineering, and then, secondly, the fact that I wanted to do engineering .. my brother and my sister both did science subjects .. so they weren't happy about either of those things.

Interview with Jean

In the quote above we see that the family's opposition to Jean's doing engineering stems partly from the fact that engineering meant her leaving not only the family home but also the city of residence. There was, therefore, no direct opposition to engineering as a career but to the effects that studying engineering meant to the family dynamic.

Rene's interview and her family influences were extremely interesting. I asked her about her siblings:

- A: And your brothers were all ..brother and sisters ..were older than you and had gone onto ..
- R: Ya ... they all went onto university.
- A: Just .. what did they do?
- R: They .. the oldest one went to UCT doing Town ..Regional and Town Planning .. and the second sister .. did a BA Law and an LLB ... and brother did Mechanical Engineering ..
- A: Were you very close to your brother and sisters?
- R: Ya I think fairly .. fairly close.
- A: Any of them encourage you to do engineering?
- R: No, I think my brother did.

Interview with Rene

Having established that her brother was one important factor in helping her decide on a course of study, the focus of the interview shifted to her parents:

- A: your parents, did they expect you to choose a career, or did they choose for you?
- R: no, my mom gave me the opportunity to choose, my father wanted me to become a teacher ... plain and simple.
- A: you specifically, or any of you?
- R: no, I really .. I always ... I actually thought of becoming either an engineer or a doctor... ya.
- A: when did you decide?
- R: matric ... I think...
- A: ..what did your father do once you already decided that you would be a doctor or ...
- R: errm well, lets see, he thought I was crazy because females aren't- shouldn't do stuff like that and I wouldn't make it.
- A: Did he tell you that?
- R: ya, he told me that..
- A: and what did you say

R: he he said that I should I should take my career or my future seriously,
and that I should go study something that I was capable of doing.

Interview with Rene

The delivery of the final sentence above was very matter-of-fact, especially so given her choice was unaltered by her father's wishes. The conflicting attitudes to her doing engineering did not, seemingly, discourage her from her initial decision to do engineering. Elsewhere in the interview she mentioned that one of the reasons she did engineering was that it was a challenge for her, as a woman, to do engineering and it seems that her father's opinion managed to broaden the extent of the challenge. In addition to this, her brother's encouragement was an important factor in her decision.

What was important to note in this section on family influences was that the decision to do engineering amongst this group of interviewees was unaltered by a negative reaction as is obviated by the fact that all of them became engineers. If other factors and experiences that lead to the decision were, as Jean describes, "solid enough", then the effect of negative reactions were minimized. In some of the interviews that I did, it is obvious that the resolve to do engineering was "solid enough". It is equally obvious, as Ambrose (1997) points out, that young women and young men come under substantial pressure to conform to certain career choices. The unfortunate effect comes about when the pressure away from a desired choice overtakes the desire to enter a given field, and the person involved is forced to conform to a more "suitable" career choice in terms of family pressure. In the next section I look at a number of reasons given by the Women Engineering Students (WES sample) for their decision to do engineering. From the fact that they are studying engineering it can be assumed that any possible negative influences were not as compelling.

4.4.3 Reason for Doing Engineering (WES sample)

It can be argued that two of the best predictors for longevity in a career are the reasons for doing it and the experiences in that career. In the next chapter I will have the opportunity to discuss some women engineers' experiences as engineers. However, in this section I will try to explore some of the reasons given, either directly or by looking at responses to other questions, by women engineering students for having chosen engineering as a career.

The responses given in the interview have been recoded using a framework refined by Jawitz and Case (1998). According to this framework, all reasons given by the women students were classified according to the following categories: *Socialisers* (including the presence of an engineer in the immediate family and recommendations to do engineering from family members, teachers or guidance counsellors), *Career Activities* (including Engineering Open Days or similar activities organised either by schools, tertiary institutions or other organisations), *Rewards* (after qualification or through bursaries), a particular interest in science-based *School Subjects*, *Manual Activities*, *Mental Activities* and *Social Identity* (including personal identity to be a woman engineer or to make a contribution to society). The reasons for doing engineering was not extensively probed in the WES questionnaire which meant that I had to synthesise the reasons for doing engineering from responses to other questions asked of the respondents. I had already successfully used this method of synthesising a variable from a number of other responses in Conrad (1997).

Table 4.11 Reasons for doing Engineering

	Category	Undergraduate WES		Postgraduate WES	
		No.	%	No.	%
SOC	Socialisers	37	47%	5	36%
CAR	Contact With Engineering	19	24%	2	14%
SCH	School Subjects	13	17%	4	29%
REW	Career Rewards	5	6%	1	7%
MAN	Manual Activities	2	3%		
MEN	Mental Activities	1	1%	1	7%
SID	Social Identity	1	1%	1	7%
	Grand Total	78	99%	14	100%

Nearly half the undergraduate respondents (47% or 37 respondents) had a *Socialiser* as a reason for doing engineering. A significant *Socialiser* in the decision to do engineering was the close family member (father, 11, and/ or brother, 8, and/ or sister, 3) that was doing engineering. This positive effect of having a parent or family member in an engineering career on the individuals choice of engineering has already been widely reported (Ambrose, 1997, Carter and Kirkup, 1990; Coles, 1994; Jawitz and Case, 1998; Shell et al, 1983; Wolpe; 1971).

Contact with Engineering through Careers Days organized by schools and institutions, Engineering related activities in the media and involvement in the industry was a reason of just more than a quarter (27% or 21) of the respondents.

Thirteen or 17% of the respondents had the enjoyment or performance of *School Subjects* as a significant reason given by the group of women undergraduate students for doing engineering.

Postgraduate students gave similar responses to the undergraduates with *Socialisers*, *Contact with Engineering* and *School Subjects* listed as the most popular reasons for doing engineering.

The pattern of these three most popular reasons given for studying engineering, *Socialisers*, *School Subjects* and *Contact with Engineering*, is consistent with Jawitz and Case's (1998) findings amongst white female students, the demographic which made up 80% of this study.

4.4.4 Conclusion

As I noted in the introduction (4.4.1), the literature suggests that many factors are involved in the decision to do engineering. . The categories that emerged from the literature: influences at home, influences at school, career guidance outside of school and external influence were also present among both the WES respondents and WE interviewees. Amongst both groups in my study, the two categories: – influences at home including the influence of family members and external influences, especially interest in engineering/ science related activities, were particularly important. As I illustrated above, this interest can be manifested in the young person in the form of preferred toys or in growing 'awareness of structures'. Family plays an important role in many of the decisions that we make. A close family member can either be a role model or can offer effective positive encouragement when choosing a career. However, it was also noted that the opposite could also be true when family members oppose a career choice for whatever reason. From the quantitative and qualitative data from the interviews analysed above, there proved to be a number of categories of factors that influenced the women engineering students' choice to do engineering. In the WES data, my interviews with the women engineers as well as in the literature, *Socialisers*, *Contact with Engineering* and *Performance in School Subjects*, more specifically *Mathematics* and *Science*, proved to be the most popular categories of reasons listed for studying engineering.

4.5 University Life

4.5.1 Introduction

The first two sections, on funding and recommendations to other women, were drawn from the WES data while the study experiences of the women engineers are related in the subsequent section in the form of quotes.

4.5.2 Financing of Studies (WES sample)

External financing of studies, in the form of Scholarships, Awards and Bursaries, is given on the basis of merit or need.

Table 4.11 UCT Finance

UCT Finance	WES No.	WES (%)
Financial Assistance	42	(72%)
No Financial Assistance	14	(28%)
Grand Total	56*	(100%)
* Three respondents did not specify an answer to this question.		

The students in the WES study were asked whether they received bursaries for their university studies. Of the 47 undergraduate students that responded to this question nearly three-quarters (72% or 34 students) confirmed that they received bursaries. 68%, or 26, of the white and nearly 90 percent, or 8, of the coloured or indian undergraduate women students constituted this figure. All except one of the indian WES received funding for her studies.

Seven of the eight white and the only indian woman postgraduate said that bursaries funded their studies. The only white student whose studies weren't currently funded was a married 30-year-old chemical engineering student whose husband was a consultant engineer.

Although her postgraduate studies weren't funded through a bursary she mentioned that she did receive funding for her undergraduate studies.

From the table above we see that for all the students, nearly three-quarters, representing 42 of the 56 respondents received some form of financial assistance for their studies.

The analysis of matric performance in section 4.3.6 clearly shows that the women engineers were excellent performers and many of them excelled in mathematics and science. It could therefore be argued that because of this high level of achievement among women engineering students, the percentage of them being awarded merit-based bursaries would also be high.

4.5.3 *Recommending Engineering to Other Women*

The coded variable "Recommending Engineering to other Women" was used to help determine the women students' feelings about their own studies. The interviewees' open-ended responses to the question: "If you were approached by a woman, would you recommend engineering as a course of study and career?" were recoded using a five item scale. The scale included: *Oppose*; *Not Recommend*; *Support Independent Choice*; *Conditional Support* and; *Unconditional Support*.

Table 4.12 Recommendation to Other Women Wanting to do Engineering

Recommendations to other women wanting to do engineering	WES No.	WES (%)
Oppose decision (i.e. Would argue against someone's decision to do engineering)	1	(2%)
Not recommend (i.e. Would not recommend engineering to other women)	1	(2%)
Support independent choice (i.e. Would support whatever choice that the person already made)	5	(9%)
Conditional support (i.e. Would support the decision to pursue engineering study upon certain conditions)	27	(47%)
Unconditional support (i.e. Would support the decision to pursue engineering study unconditionally)	24	(41%)
Grand Total	58*	(101%)

* One respondent did not specify an answer to this question.
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An overwhelming majority of the WES respondents indicated that they would, to a greater or lesser extent, support another woman's decision to do engineering. This finding is similar to Saintjones (1990), who asked whether his sample would encourage their daughters to pursue engineering and had 98% respond favourably.

Just over 40% (24 respondents) said that they would unconditionally support a woman's decision to do engineering. Comments that confirm their unconditional support included: "it is very satisfying" from a 20-year-old 4th year woman chemical engineering student, "If they should ask me, I would encourage them, I encouraged my cousin" from a coloured woman civil engineering student and, "Yes, I would encourage her to do engineering for I haven't experienced difficulties or unpleasantness during my course of study" said a 20-year-old Indian woman chemical engineering student.

Just over 40 percent of the sample also indicated that they would conditionally support another woman's decision to do engineering. The most popular caveat against studying engineering was the hard work and long hours: "be prepared to work very hard" and "Must be prepared to sacrifice your lifestyle" while other conditions that they gave when asked if they would recommend engineering included: "see if you like it", "Yes, if you know what it is going to be like" and "Yes, if this is what you enjoy".

A small percentage (9% or 5 respondents) mentioned that they would support any choice, including engineering, but that they wouldn't specifically recommend engineering.

Less than five percent of the respondents said that they would either oppose (2% or 1 respondent) or not recommend (2% or 1 respondent) engineering to other women.

Because of a negative experience during her vacation work, one chemical engineering student stated that she would discourage a woman if she asked about doing engineering. The white 21-year-old student said: "I have worked on a plant for 3 years and it is a hard environment I'm glad I did it, but would not want my daughter to do it."

Two out of 9 postgraduate respondents gave unconditional support while 6 out of 9 postgraduate WES respondents indicated that they would give conditional support to women desiring to study engineering. Probably because they have been studying for longer, the warnings that some of the postgraduate women gave were more substantial than those the undergraduate women gave. Drawing on her own experience of studying and working, a 30-year-old chemical engineering student said, "I would try and make the pitfalls more apparent than they had been made to me and emphasise that 'a female in a males world is' not glamorous and exciting, as I thought it would be, .. but you have to be very confident and self-assured to handle being made to feel like a 'freak' and undermined and treated with suspicion."

4.5.4 Study Influences and Experiences of Women Engineers (WE sample)

In the last section I explored the WES respondents' experiences by looking at the advice that they were likely to give other young women. This section deals more directly with how a few of the WE that I interviewed described their study experiences

In a section on their study experiences it was obvious from Diane and Sarah that their time at university was a wholly positive one. Amongst other areas that I probed, I asked Diane about her interaction with various people:

- A: Simple interaction ... do you .. do you think you were treated differently from the other students by, firstly, the lecturers?
- D: Well, no not really .. no.
- A: no comments made?
- D: No never.
- A: From the .. students .. differently?
- D: No .. there's .. I mean a .. they're basically typical university students but its not as if they have anything against you studying engineering ..
- A: Your gender was never an issue for you while you were studying?
- D: No. I mean in the .. in the classes itself, and on the academic wavelength there were no problems, it's just the same as it would be in any other class at university.
- A: Were there any women lecturers?
- D: Once yes, in our second year. And I think that's about it. .. and I guess most of the mathematics lecturers.
- A: Did the students react any differently to them?
- D: .. no

Interview with Diane

From the above quote, Diane remarked that she did not receive special treatment because she was a woman student. Furthermore, the paucity of women lecturers did not affect the way that women were perceived.

- A: Was there any negative experiences you had while studying engineering?
- S: Unless I've blocked it out, I don't remember, ..
- A: Would you have been more comfortable had there been more women doing engineering?
- S: I I wasn't uncomfortable, so I did .. I don't think it would have made much difference ...

Interview with Sarah

Both Sarah and Diane mentioned the fact that neither the paucity of other women students nor the fact that there were so few women lecturers detracted from their engineering study experience. The women engineering students in Pollock (1996) were also largely unconcerned over the fact that they encountered so few women lecturers. Furthermore, the fact that they expected this situation allowed them to mentally prepare for it. (Pollock, 1996)

Isolated negative incidents were, however, mentioned by Eve and Jean.

In general, Jean's study experience was positive and the only thing that she mentioned as being unfriendly about the environment was the fact that it was sometimes "unfriendly" to women students.

A: Did you have any experiences that were discriminatory.... while studying?

J: At UCT? No, I wouldn't say so. I was on good terms with the faculty, I always found people very encouraging ... erm .. aghh.. the guys .. I'd say my fellow students .. weren't always fantastic from that point of view ... sort of rough tough rugger buggers .. and .. all of that.

A: They were? In what way was it a problem?

J: Well in that the engineering environment at that time was a very very male environment .. things like boat races .. those kinds of things .. which aren't designed with women in mind .. (laugh)

Interview with Jean

The "male" environment and activities organised are not always sensitive to the admittedly few women students. However, making a group feel unwanted could lead to the detriment of members of that group. The point that Jean makes is that the activities are centered on

interests of the “macho” male. If these activities are meant to convert to networking and team-building exercises then they should include all the groups, especially those that fall outside the existing structures.

Rene was the only woman engineer that I interviewed that studied at technikon. The attitudes of some of her male classmates were obviously sexist.

A: Did you get on well with the men?

R: Ya ... very well, ... there were the sort of groups that erm, looked down on me .. thought you were stupid, .. females weren't supposed to be there .. but I ignored them mostly ..

A: Did you get any comments from them?

R: Ya .. often ...ya.

A: What sort of comments .. ?

R: The typical sort of erm ... “What do girls know?” “What are you doing here in any case?” ... ya .. typical.

Interview with Rene

It can be argued that being bombarded with “What do girls know?” can have a very negative effect for women studying engineering because it conveys the message that women are not welcome.

So far we have seen that personal incidents and activities, even though isolated, can make the engineering study environment unfriendly and hostile to women students. The fact that these women overcame this hostile environment showed their resolve to succeed.

The fact that there were so few women lecturers was noticed by Eve.

A: You say your classes were male dominated, and your lecturers?

E: Male .. all male, obviously.

A: Did you have any thoughts at the time about the male-dominatedness of the environment?

E: Well, I mean, it was just to be expected but I didn't "expect" it, I didn't have any thoughts on it ..

Interview with Eve

The tragedy of the above quote was not the fact that there were only male lecturers but that the fact that there were only male lecturers were accepted as being "expected" or normal.

The problem with allowing an unfriendly-to-women environment is that it can very easily become openly hostile. In the quote related below, Eve described an incident that illustrated the powerlessness of being a student when confronted by a sexist lecturer.

A: Did you have any bad experiences at varsity?

E: ... erm .. on varsity your life .. varsity life .. in the class I had a .. okay, I don't know whether it's on record but .. we had quite a sexist incident with one of the lecturers that he showed girly pictures on the overhead, and .. the whole class obviously burst out laughing .. and the guys turned around ... to us the women ... 'What are you going to do about this now?' very arrogant about it .. and I couldn't afford to publicly attack this lecturer because I needed to pass.. and he was the type of guy that would mark you down .. what I did was I I went to .. I just mentioned to the Head of Department ... and he- well, I hope without mentioning any names, reprimanded the lecturer and ... yea ... that really made me understand exactly what was thought of women in the class...

Interview with Eve (p13)

The most unfortunate part of this negative incident that Eve suffered was the fact that her "fate" was still in the hands of her lecturer. Sanctioning the behaviour of the lecturer becomes necessary to ensure that "exactly what the lecturer thinks of women" isn't carried over into the attitudes of the men students.

- A: And the males in class were they supportive or?
- E: Of what?
- A: Of the women in class?
- E: No no .. it wasn't them .. it wasn't as if they were discouraging anything .. they were just very aware that there are women engineers in the class .. and .. and it's a big thing .. and obviously they watch you, they observe ..
- A: Was it a big thing for them, do you think?
- E: I don't know, I wasn't really interested, they were just very arrogant ... they were .. ya, it was almost like look at .. "Look at these girls in our class. Why are they here?" I didn't .. I don't know .. I mean, as I said I really wasn't interested in .. what was happening in the class but the bottom line was it wasn't .. we weren't .. I can't say that we weren't accepted .. but we weren't accepted as one of the guys, that was for sure, ... not that I wanted to be one of the guys, but still ..
- A: Did you want to be accepted?
- E: I think we all want to be.
- A: Would you have been more comfortable if there had been more girls in class?
- E: It could well have been. I don't know, I have unfortunately.. I can't say.

Interview with Eve

From the comments that Eve had overheard, it was obvious that women students were not made to feel welcome and accepted as part of the class.

Later in the interview Eve mentioned how an intimidating atmosphere was also created for her as a result of the predominance of white students who had come from advantaged schools and had affected her negatively. She explained:

- E: going from a small coloured school, now you're sitting in a classroom with mostly white people, I mean the number of blacks and the number

of coloureds .. were like.. there were probably ten in the class then ... it was really quite daunting .. and all of us I think just couldn't- I mean I'm not used to all this hi-tech equipment, I mean, Yorh!.. it was .. in second year I just managed to find that perfect approach, I had a good social life and I had a good varsity life .. and I didn't fail anything thereafter .. my grades were quite good.

Interview with Eve

In the above quote Eve illustrated how the gap in quality of education disadvantaged black, coloured and indian students, especially in first year. This disadvantage would obviously affect the confidence of the students involved which would only serve to multiply the educational disadvantage that they already suffer.

Of the women that I interviewed, Eve was the only one that felt that having more women students would have insulated her more from the sexism that she encountered. However, the fact that Eve was coloured could add another dimension to the alienation she felt while studying. Given the extent of her negative experiences it is a testament to her resolve that she remained in the profession.

Except for a few negative experiences during their study years, the overall study experiences of the WE interviewees were positive. These women were not intimidated by the small number of women students or women lecturers and for the most part excelled in the academic side. However, the attitudes and behaviour of their male colleagues had the effect of making some of the women feel unwelcome.

4.5.5 Conclusion

A number of important issues need to be emphasised in my analysis of the 1993 WES Database.

Firstly, as had been explained in chapter 2, approximately 70% of the total number of white, coloured and Indian women studying engineering at UCT in 1993 were interviewed. It can therefore be strongly argued that the results of the analysis are generalisable to the total population of white, coloured and indian women engineering students at UCT in 1993.

Secondly, as far as the social background was concerned, data on the education level and occupations of the WES respondents' parents suggest that a large proportion of them could be regarded as coming from privileged homes.

Thirdly, WES respondents were shown to be very high achievers during their Matric year with the entire group having achieved an A- or B- Matric Aggregate. This compared very favourably with the overall C-Matric Aggregate that was required for acceptance into engineering. Also, their results in Mathematics and Science were superior to their results in their other subjects.

Fourthly, the decision to do engineering was shown to be a complicated one that often starts in childhood and is both positively and negatively shaped by the interaction with family. Additionally, a number of influences were identified as being particularly important in the decision-making process for these women. Three categories namely, *Socialisers* (incorporating family member as an engineer and the recommendation from a school teacher/ educational psychologist), *Contact with Engineering* (incorporating career activities

organised by tertiary institutions, schools or through the media), and performance in *School Subjects* were found to be the most influential among the group of UCT WES in 1993.

Fifthly, and finally, the overall experience of studying engineering for these women had been positive despite isolated negative experiences. The fact that they were committed to studying and doing engineering was based on their own determination.

Chapter 5: Women Professionals:

Interviews with Women Civil Engineers

5.1 Introduction

The first objective of this chapter is to illustrate the unique experiences of women civil engineers in their various engineering workplaces. Having established that women engineers experience the workplace fundamentally different to men engineers, I show how these women develop a number of skills, structures and procedures not only to cope with problems specific to engineering but with the general problems and conflicts women may encounter in the general workplace.

The chapter begins with women engineers' experience of the building site (see Chapter 2 for the discussion of selection of this research context). Women engineers have a more textured experience of site because they encounter various forms of direct and indirect resistance to their entry. This is due less to the nature of the work than the attitudes of their male managers and on-site technical and manual workers. The chapter then broadens the discussion about negative experiences in the workplace by dealing with issues of discrimination against, and harassment of, women in the workplace. Finally, I focus on the way these women encounter or cope with the workplace, in the conflict between motherhood and career and, finally, within women's organisations.

5.2 Women Engineers' Site Experience

The building site is often perceived as the defining space of the civil engineer. Few engineering spaces conjure up a more masculine image than the building "site" and nowhere

will a woman engineer look and be made to feel more out of place. As Greed (1991, 150) stated, "the big bugbear is the building site and the attitudes of the workers, the uncouth, uneducated, ignorant ones". Not only were there a majority of men in the industry, on site women were confronted with a wholly male workforce. Whereas in the office there may have been a number of women, (including clerical workers, lawyers or clients) in the day to day dealings of women engineers, the construction worker was still exclusively male. It is for this reason that women civil engineers face a situation on the building site markedly different from other places where engineering business occurs. Also, it is worthwhile to point out that other than the issues of discrimination specific to the building site that I set out in this section, some issues dealt with in this chapter are of a more general nature, applicable to most professional women. This will be noted at various points in the discussion.

From the 1993 WES study on 59 women engineering students, we find that 21, or three times as many, women students registered for chemical engineering over the seven that registered for civil engineering. Since they were at university still and most had not experienced the building site, no question was specifically asked about their attitudes to civil engineering or site work. Nonetheless eleven of the 59 respondents and two of the seven civil engineering students portrayed civil engineering in a negative light because of the requirement of site work. Indications of a negative portrayal included listing civil engineering as being unsuitable for women, unpleasant for women, bad for women because they have to manage large teams of labourers or a personal preference away from civil engineering. One civil engineering student affirmed that she did anticipate problems in the workplace because when she previously sought employment she was laughed at by some of her male colleagues. She also showed signs of anxiety because she would have to tell male subordinates what to do.

Another civil engineering student said: “Construction sites could be unpleasant for a female if she is not prepared for it.”

The fact that the building site was not a place for women was emphasised by the absence of ablution facilities for women. A question I asked Hannah on the help given to young women engineers by Women in Civil Engineering (WICE) led her to mention the lack of toilets for the woman engineer. I asked about her membership of WICE:

A: You said you're part of ... Women in Civil Engineering?

H: Ya we've got a group .. we just try and help erm .. the young students go through many teething problems .. or if .. and they want advice about the job and what it's like for other women and .. do you have maternity leave problems .. but then maternity leave is just a generalised thing anyway ... You've got the same when you- if you're a typist or a .. not necessarily women engineers .. but there might be site problems and .. and that type of thing. I mean I was advised that we'd have to do workshop training .. at the technikon .. we actually went to ... the railways .. for welding or something .. we had to find out how they weld .. and one thing I did pick up is that the railways don't have toilets for ladies so .. We had a guy standing on guard so it all changes into a funny situation .. a humourous situation .. because you're not in a profession where .. it warrants two toilets .. one for male and one for female .. (laugh).. so it's actually quite funny ..

Interview with Hannah

Although Hannah pointed out the funny side of the situation, the lack of facilities can make the woman engineer feel unwelcome. Whereas the lack of facilities may be an indirect way of saying women should not be on site, there are occasions when women engineers were directly told not to go on site. Rene mentioned an incident where one of her previous employers did not want her to work on site because she was female.

- A: Any positive experiences or negative experience there? Were there any other women engineers?
- R: No, there weren't any other women engineers. Negative experiences, I think my whole career at (a large parastatal), I found it one big negative experience. It's actually difficult to differentiate small .. experiences. Erm, I often got discriminated against blatantly ... erm, "You can't do the work", because .. "Why not?", "Because you're female." They'd prefer it if a male did the work. I mean, they actually ... in the early days some of the men actually blatantly discriminated against me.
- A: What was the nature of the work.. that they felt a woman couldn't do?
- R: Erm, well .. when I started working I had to work ... erm .. basically maintenance work on the railways ... and erm ... because you work outside quite a lot .. and you work with .. sort of very .. labourers type people, they would prefer you not to .. they prefer you not to work alone ... because they thought I wouldn't be able to tell the labourers what to do.

Interview with Rene

From the above quote in the interview with Rene, we see that "because you're a woman" was sometimes the only "reason" given for discrimination. At other times, sometimes because it was a male enclave and sometimes because the area where the site was located was perceived to be unsafe, the site was regarded as unsafe for women and therefore they were prevented from going onto site. The attitude that they "wouldn't be able to tell the labourers what to do" undermined their ability to do their job as an engineer. There was therefore the perception that a female could not assert herself in a setting of such male dominance.

Sarah recalled two incidents. The first was made at one of her previous jobs where she had to earn the respect of the “guys” while the second one concerns a comment made to her about going to a possibly dangerous site¹¹. Sarah said:

S: oh this was a sweet one though .. we were on site. We had a big site meeting and the guys that run .. you don't really run the sites anymore, you just, like, supervise it. And I was at the meeting, and I was just chatting to like a real old “padmaker”¹² ... he must have been like late fifties, early sixties, a real “padmaker” ... and we're chatting, and the job had gone superbly well, it was one of the good jobs. We were talking afterwards, and I cannot remember all the lead up to it ... but he'd always like smile when he spoke to me .. and we got on quite well but I could feel that .. something was not quite as it appeared to be ... so I said to him one day- I can't remember his name, I said to him, “You know, why are you smiling?” He says: “No, I just find .. find the situation so amusing”, and I said, “What situation?”, he said: “That you're telling me what to do on site.” I said, “But why?” and I said: “Its my job... I'm running this job”. “Well”, he said, no, well he doesn't think that's right. I just .. he was so old, that I just laughed, I mean what could I ?.. I couldn't argue. I said, “Ok, now well what do you think?”. He said, “No” and he believes that this is a man's job and I shouldn't be doing it. I said, “Has the job gone well?” and he said, “Ja, no, superbly well.” So I said, “Well, then?”. No, he still just doesn't believe I should be doing it. But now that type of stuff ... you can only just laugh at .. he he's being stupid, but there's nothing I can do about it. So I just say, “Well, as long as I'm doing the job well, you should be happy about it” .. and he just laughed .. so that type of stuff does happen, but aagh...

A: What do you do?

¹¹ A number of photographs from a building site, similar in location to the one referred to by Sarah is presented in Appendix G.

¹² Loosely translated as a roadmaker. The term literally means someone who has “paved the way” i.e. been in the industry for such a long time it seems as if she/he has been there from the beginning. In this context the term refers to an old or middle aged conservative white male who would be resistant to the idea of a woman being on the building site.

S: In that case what do I do? I could do nothing, here I can fight it, because I can change .. but he's .. he's at the stage .. I could never change his mind .. I couldn't alter what he believed, at that late stage so .. I could say, "But I proved you wrong, this has been a superb job, despite the fact that I have run it" .. that's all you can do .. and all you can is hope one day he will say, "You know she ran the job damn well, can't .. there can't be anything wrong with her". Well, that's all but I think that happens a lot and I don't know about it. ..But it's almost a case of as long as you're doing it well, they can't ... no, they can't .. they've gotta almost say, they can't say, "Bloody stupid woman" They've gotta say, "Well, her jobs have always gone well." What happens the day it doesn't go well, ya ...

Interview with Sarah

A: Chauvinists?

S: This whole thing that .., the fights we had in the beginning, that's when I started this group for women engineers, here ... purely because I realised this is what other woman could have, could be putting up with, and I'd never experienced it, up to now ... everything I've told you, no discrimination ever .. until I got here .. and I thought to myself, "This must be what the others are talking about" which is .. you see, I'm fiery, I'll fight, <break> but I will fight and say: "We're not going to do that" ... "You you have no right to ... to force me", their attitude was ... "You may not go to any of the Khayelitsha¹³ sites", I said: "Why?", "No, I'm not taking the risk of a woman going into Khayelitsha", so I said: "Are you, do you die easier than I do ..". I mean, "if something is going to happen to me, it it could happen to a man, why?", "No, but you could be raped", so I said: "So could a man." "It's my .." that type of story ... it's the first time that it had ever

¹³ Khayelitsha is a black township on the outskirts of Cape Town. Because of the high level of violent crime in South Africa and inadequate policing in especially black townships there is a very real issue of safety for everyone, even more so for people unfamiliar with the area.

happened to me ... So I was like, “Well, I’m sorry, I don’t care what you say, if I want to go into-” then I would do it like almost on principal. Err stuff like that ... Oohh!. Well meaning... the bottom line .. I suppose it’s well meaning, but it’s unacceptable you don’t do that especially if the woman says to you: “Well, I think it’s my choice.”

Interview with Sarah

As one would expect, nearly all the women that I interviewed mentioned that they faced resistance to their entering various parts of the workplace. They particularly mentioned opposition to their participation from older men in the industry. Sarah describes one of them as a “padmaker” while Eve used the term “old uncles” to describe the established middle-aged male contractors and engineers. Although all young engineers would be required to prove themselves, women on site have a harder task because they are perceived to not know anything to do with civil engineering. They therefore have to prove themselves not only as competent engineers but also as superior to their male counterparts. Both Carter and Kirkup (1990, 84-85) and Greed (1991, 150) give examples where women engineers, having been allowed on site, have had their competency (and nerve) tested by, amongst other things, having to climb onto high scaffolding.

The trouble women engineers encounter with respect to visiting the building site, however, is not confined to the discriminatory and paternalistic attitudes by senior staff. As I said above, “site” is perceived as *the* enclave of male machismo, as “offensive” to male sensibilities as a woman on site would be, a pregnant woman on site would be doubly so. Eve recollected that when she was 7 months pregnant she was the site engineer and was required on site:

E: I found it very .. very tough erm, probably more so because I was pregnant, .. and erm ... it was really tough, and I ended up managing two sites at the same time, one out in Melkbosstrand, one out in Jamestown Stellenbosch ... so I had to drive, I mean I was seven

months pregnant I had to drive two hundred “k”s between the two every day ... and that was very tough ... and the black labourers ... the black labourers didn’t ... in their culture I suppose it was just not the proper thing .. to have a ... female supervisor .. and her being pregnant I think that was a big sin ... I mean I was pregnant, I was- I had to look after myself and according to them I wasn’t and they were in fact quite abusive at some stage shoving me around, I mean that’s part of the job, you just .. take the punches and .. start swearing back ... which is what you do ... (A: Verbal?) Ya, I mean you you just pick it up, it just part of your language ... my language was truly atrocious in my opinion then (A: and shoving around, physically shoving?) Ya, it happened once... but erm I ... I mean obviously on site I don’t have any supervisory input over ... over the labourer force, I’m just there to ensure quality, I mean as a site engineer, okay, now as a resident engineer, that’s the correct term, I’m there to ensure quality control ... on behalf of the client now, so I’m basically just an observer, I provide technical input when and where required, I can’t sort out the labourers, I mean that’s not .. they’re not my responsibility. So, when in fact ... I I it just I I ... I just avoided I mean I wasn’t going to get into a full out brawl and I was not going to tell the site agent that somebody shoved me ... I mean that is just ... like an indication that I can’t take care of myself, and I wasn’t going to do that. (A: Why did they shove you?) I don’t know. There was a whole big .. obviously they were going on in Xhosa¹⁴, a whole big discussion, I happened to be standing nearby ... and then pointing at me, laughing at me .. and then somebody shoved me ... six months pregnant at the time and they shoved me ... so ...

A: You were not impressed?

E: putting it very mild ...

A: How unimpressed were you? What did you do?

E: (laugh) No, I mean, there was absolutely nothing I could do as I said I wasn’t going to take it up with .. with anybody else ... I was just going

¹⁴ Xhosa is an African language mostly spoken by the indigenous inhabitants of the Western and Eastern Cape and it was obvious that Eve did not understand what they were saying.

to do .. I didn't deal with it .. I was just... my way of dealing with it was just avoiding it and I am better than this ... I don't need to confront, get involved in a confrontation to .. to settle that now ... its his problem not mine.

Interview with Eve

The fact that she was seven months pregnant made the long distance driving between sites even more physically demanding than it would normally have been. The incident that she describes above, where she was shoved by the “labourers” (manual construction workers) because they apparently felt that “site” was no place for a pregnant woman, may have lead to physical injury to herself, her unborn baby or both of them.

The racial sensitivities of the South African psyche could add a racial dimension to the reason behind this incident. In many traditional African cultures men aren't opposed to even pregnant women doing physical labour. The labourers could, however, have also had resentment against the fact that Eve had become an engineer by using the opportunity afforded to her, but denied them, by virtue of her race, to study at university.

Being on site for two years is one requirement of the professional qualification of the Engineering Council of South Africa (ECSA) and is therefore something every engineer has to complete in order to register as a professional engineer. While lack of facilities and attitudes of workers on site can make the experience on site very uncomfortable for a woman engineer, attitudes by management can severely affect a woman engineer's opportunities of advancement by holding her back, for whatever reason, from getting to site. Reasons employers gave for not wanting their women engineers to go on site was that they either feared that they wouldn't be able to assert themselves in the company of men or because they “feared” for their safety. Because it is such a bastion of masculine expression, site more than

any other location requires a women engineer to assert herself or to “prove” herself to her fellow male colleagues. What is perhaps most frustrating about this situation is that even when she had done an outstanding job one of my respondents felt that she still didn’t manage to change many of her fellow male site workers’ view of , and attitude towards, women engineers.

Being on a building site is only one of the duties of a civil engineer. According to Eve, participation on site is a duty often consigned to junior engineers since it is unproductive to have an experienced engineer overseeing on site when she or he could be utilised more productively in the office. Ironically, one of the most testing situations for the junior women engineer therefore occurs at a time when she is practically inexperienced and therefore least prepared for it.

5.3 Gender Discrimination

In this section I discuss the experiences of gender discrimination that I defined in section 3.3.3 of the literature review. Gender discrimination refers to discrimination in terms of sex, pregnancy, marital status, sexual orientation, etc, that invalidates equal enjoyment of human rights in all social spheres and in this case specifically to the workplace. Alternatively, it is an act or acts that create systems of advantage and domination that retard the development of an individual’s potential and full participation in society. Sexual Harassment is usually defined in terms of two broad categories. The first, “quid pro quo” harassment, refers to the “exchange of work related benefits for sexual favours through bribery or threat” (Stockdale, 1996:6). The second, “hostile work environment” refers to “unwanted actions of a sexual nature that have the ‘purpose or effect of unreasonably interfering with an individual’s work

performance or creating an intimidating, hostile, or offensive working environment".
(Stockdale, 1996:6)

As often happens, when comparing gender discrimination with sexual harassment, gender discrimination is made out to be the lesser of these two evils. As the examples of discrimination will show, discrimination is different to harassment and should be handled in a different way.

With the experience of having worked in the industry for more than 10 years, Sarah explained how initially she was not aware of any gender discrimination in the industry. Later, when she became more senior, she expressed to me her then newfound realisation and dissatisfaction with discrimination and more importantly what she did about it:

S: This whole thing that .. erm .. ooh, the fights we had in the beginning, that's when I started this group for women engineers, here ... purely because I realised this is what other woman could have, could be putting up with, and I'd never experienced it, up to now ... everything I've told you, no discrimination ever .. until I got here .. and I thought to myself, "This must be what the others are talking about" which is .. you see, I'm fiery, I'll fight, <break> I will fight and say: "We're not going to do that" ... "You you have no right to ... to force me", their attitude was ... "You may not go to any of the Khayelitsha sites", I said: "Why?", "No, I'm not taking the risk of a woman going into Khayelitsha", so I said: "Are you, do you die easier than I do ..". I mean, "if something is going to happen to me, it it could happen to a man, why?", "No, but you could be raped", so I said: "So could a man." "It's my .." that type of story ... it's the first time that it had ever happened to me ... So I was like, "Well, I'm sorry, I don't care what you say, if I want to go into-" then I would do it like almost on principle. Err stuff like that ... Oohh!. Well meaning... the bottom line

.. I suppose it's well meaning, but it's unacceptable you don't do that especially if the woman says to you: "Well, I think it's my choice."

A: What else?

S: What else ... erm, oh medical aid stuff .. well it didn't affect me, but it was certainly something I fought. Is that .. erm, it's practices, whole practices, that are discriminatory .. A married woman may not have medical aid ... because it's assumed that her husbands got medical aid, but .. what if her husband doesn't have medical aid, .. she's entitled to medical aid. "No, it's the breadwinner." Well, who's making more money? Who's the breadwinner. Now stuff like that I'd never had to deal with before hey, .. and shocked the pants off me, I thought to myself: "I don't believe this". Or a case oh it was that, it was, erm: "Girl ..". Now, again, a lot of it was meant probably well meaning, ... but it's not well meaning. Erm, I've never in my life been called girl, it'd be: "Hi! Morning girl." And my hair just rose everytime I heard- and I would walk in and now these "girls" are all ... some of the "girls" at the back, if I could say, are over forty. Now you don't walk in in the morning and say: "Hi girl", "How're you my girl?" .. "my girl, my girl" ... and I don't know, it just irritated me, and I said to them: "Does it irritate you guys? Or is it just me who's funny?" ... and they say: "We just got used to it" .. and I said: "But why get used to it? Say no, don't call me a girl, I'm a grown up woman, you don't call me a girl!". Which we did, and we don't hear that anymore so, it's a silly thing, and it was never meant.. horribly ... it wasn't meant badly .. but it's- you don't do it ... there's a lot of things that aren't meant horribly but they're not acceptable to the person. ... What else, ... no salary discrimination, I mean that I would have ... although they tried, .. but that one we didn't- .. the only salary discrimination is the medical aid business, because obviously you all get a package, and your medical aid is either included or excluded .. so, of course it benefits to exclude it .. (break) Now what do you do? I don't even know why I'm telling you these things, but not even- not against me .. bec- you see, any discrimination against me, I can fight, and I could overturn. Why I

have to fight it in the first place .. is .. alone a big error. But now what is starting to happen is I'm seeing it with the women underneath me, .. and I'm sort of saying, "How can I sit at a meeting, as a woman, and agree with discrimination against these other women ..", I cannot do it, so, what happens? At every meeting there is a fight. Because I'm saying we've got a a .. (break) Ahh another discrimination .. I go .. um err err .. to a meeting, ahh this was this .. they fell into the trap they are such "willys".. erm and it was a really acrimonious meeting ... where you couldn't even try and be nice to each other because it had long passed that okay, ... and I walked into the meeting and I said, "Listen guys, tell me" exactly like I talk to you "tell me what you want .. we'll see what we can give you, and we try to meet each other halfway but .. I can't do anything until you tell me- you're not telling me what you want", because they were talking around and- "What do you want? Just answer that question." Do you know what he did? He looked and he said: "Why are you so aggressive?" And I I just packed up laughing you know, I didn't say it, I laughed but in my mind I was saying it: "Now if I was a man, you'd never have said that", he would never have said that. That's the type of thing. But I know I could be wrong if I was a man he could have said, why are you being so aggressive, but if I think if I was a man and I was being aggressive it would have not been in my voice, I don't know.

Interview with Sarah (pp33-34)

Later in the interview the topic of discrimination came up again when I asked her:

- A: Was there anything that happened to you ... at (your place of work) positive or negative.. .. that happened to you specifically because you are a woman?
- S: Let me just remember no .. no it was actually quiet .. besides putting me in the library and and in a way ... as they say, I'm like friends with the guy that I worked with (interruption)
- S: Where were we ...
- A: experiences at ...

S: (The company) ... wonderful. Worked, I mean I'm ... friends with the guy I worked with now .. worked for .. now and erm, it was fine ... it was I was a little "pik" at the time, so you can't really put too much on it ... one experience I do remember, which stood me in good stead, I might tell you .. is that when I was wanting to leave teaching I started applying for jobs, right, okay, luckily I only applied for two, and I got the second one, but the first one I applied for was at [large petro-chemical company],<break> Phoned up, went for this ad, with [large petro-chemical company], now this would have been one of the industry ones, 'cause it wasn't consulting, all the way from [outside the city], ha .. I drive in for this big interview, and we're chatting and we're chatting and we're chatting, .. and this guy .. ahh he started to ask questions that I must have just realised that hang on, where are we going with this, erm, and at the end, towards the end of the interview he basically, but I can't remember exactly, but he basically said something along the lines of ... well it was really interesting to meet you, erm, we we definitely wouldn't be employing a woman, but I just had to ... but your CV and that was so interesting I just had to meet you. I tell you, I will never forget that, it it was.. I never- I just thought, "How could you make me come all the way from Stellenbosch just because- you had no intention of giving me the job", but he really just wanted to meet me, ... that blew my mind,

Interview with Sarah

A number of issues were raised in the above quotes from Sarah. Firstly, we see that even at the company policy level there existed much discrimination against women, specifically regarding conditions of employment in the form of salary issues, where it pertains not only to doing the same work for different pay, but also for matters of medical aid and other benefits. Secondly, we note a paternalistic attitude towards women in the workplace. This was illustrated in two very different ways. By the continual use of the term "girl" there was reinforcement of the gender difference and lead to undermining the value of the woman and

her work. By continually calling the women “girls”, the male employer was subtly reminding the woman of her “place” that is subordinate to the man in charge. When the employer assumes the role of protector and decides for the woman engineer (apparently for her own good) what sites are too dangerous to go to, he undermines the position of the woman and her ability to decide for herself what is best. Thirdly, when women engineers are treated in a condescending manner by their seniors, in itself an unacceptable situation given the seriousness and the level of responsibility of their jobs, then this prejudiced attitude goes unchecked through the system and can manifest itself with human resources staff which could not only severely hamper the woman engineers chances of employment but more importantly and dangerously also exposes her to sexual harassment from other members of staff.

On the question of discrimination Rene recalled a comment from her boss that she felt undermined her ability and authority. I asked Rene:

A: And .. Did you have any experiences of discrimination from them?

R: Ya, I've actually, I've actually recently written a letter to the top management in the company because there are frequently comments such as, well- for one thing one person actually, when I got registered as a professional engineer, now this was a very senior guy .. he said, “Oh, I didn't know they were lowering their standards to allow females to become professional engineers”, he was quite serious, he wasn't making a joke. Erm .. I think that is a .. very very big anyway .. there is quite often ... one of the senior guys also recently told a girl that he didn't see why she had to .. why she must be ... given a big increase because her husband earns a lot of money.. and that has been said to me as well, I don't need earn that much money because my husband earns a lot of money. And erm ... ya, things like .. “What does she know, she's a female”, that sort of comment comes

out quite .. quite frequently .. and it's not only from ... , at (large parastatal) I experienced this sort of things coming mostly from junior guys who felt threatened by you but in this company it comes from senior people as well, and that's another reason why I'm not so happy ... because .. erm .. you know, when it comes from the junior guys at least you can do something about it, but if it comes from the senior guys .. it's a bit of a problem. ... erm, ya.

Interview with Rene

In the above quote Rene mentioned the fact that women engineers often have to deal with sexist attitudes, not only from their subordinates, but also from their seniors. It is easier to deal with subordinates because it is possible to regulate the amount of work that they do and one could deal with a problem by making life difficult for a subordinate. However, dealing with a superior with a sexist attitude requires a different approach. Your senior has power over you and obviously has more of a history with the company, is better connected in the industry and is therefore more valuable to the company. Even by using official channels, like Rene was, you could leave yourself open to being identified as a troublemaker for challenging the establishment. Challenging those in power can have repercussions for the work you get assigned as well as how your work is evaluated and can therefore severely affect chances of promotion and salary increases.

Earlier in the interview, when I asked if they treated her differently she said:

R: (Laugh) Hell, no, I don't know.. I can't remember .. they treated me nice I don't know if they done things different for .. than they treated other guys ..

A: They treated you better, you think?

R: Ya,

A: No negatives?

R: Ya I I suppose it depends what you would see as negative .. I I got irritated because they didn't want to send me out to site alone .. and stuff like that because they were scared for my ... that they thought I couldn't do anything on my own..

Interview with Rene

After that I asked her if she had had any negative experiences at her next job, and whether there were any women engineers there. She replied:

R: No, there weren't any other women engineers. Negative experiences, I think my whole career at (a parastatal) I found it one big negative experience. It's actually difficult to differentiate small .. experiences. Erm, I often got discriminated against blatantly ... erm, "You can't do the work", because .. "Why not?", "Because you're female." They'd prefer it if a male did the work. I mean, they actually ... in the early days some of the men actually blatantly discriminated against me.

Interview with Rene

From the above quotes from Rene's interview it is apparent that she has encountered a number of, what she termed, blatantly sexist attitudes in engineering. Other than the obvious disregard for the ability of the woman in question, comments of such a nature have a number of consequences. It leads to a lack of respect from both sides and works against the self-confidence of the person. Another consequence of having a senior staff member making sexist remarks is that it undermines the authority of the woman engineer in the face of other, sometimes junior, members of staff and thus affects her ability to operate effectively.

The issue of gender discrimination that I outlined above showed the pervasive nature of discrimination against women not only in the engineering but also the greater workplace. From the above quotes, we see that sexual discrimination in the workplace operated mainly at two levels, on an official level and on an unofficial level. I will deal with the unofficial

level first. What I have termed unofficial discrimination is discrimination at a personal level and included in this are comments that undermine, in this case, a woman's ability and authority. Unofficial discrimination does not stop here but often goes as far as to attack the integrity and character of the injured party. It is not always easy to judge whether comments of this nature are deliberately sexist or merely accidental. However, it can be argued that at both levels they are improper because the consequences are equally serious. At the deliberately sexist level it is improper to pass comments of a sexist nature because it denies the fact of equal humanity to women. Even at the level of accidentally sexist, these remarks show insensitivity to the situation of women in the workplace. Official discrimination is gender discrimination based on unfair stereotypes and a traditional patriarchal view of women in the workplace manifested in company policy. Company policy is the basis of conditions of employment and involve issues of unequal pay for equal work, whether hidden within issues of medical aid and housing subsidies or overtly such as differing wage rates for men and women. Company policy can also have severe effects when they determine the unsuitability of women for senior positions and promotions based on the fact that they may get pregnant and need time off from work because of this. The additional problem of official forms of gender discrimination is that it appears to give tacit approval of unofficial gender discrimination. Whereas it should be the responsibility of the employer to discourage sexism in the workplace, official discrimination would be seen to endorse it.

5.4 Sexual Harassment

Out of the eight women that I interviewed, two of them related to me evidence of some form of sexual harassment.

As I mentioned in the previous section, sexual harassment covers incidents that fall outside of relationships based on mutual attraction but on power relationships and attraction from one party negotiated through unwanted sexual advances.

Carter and Kirkup (1991) explained the complexity of the issue of sexual harassment by incorporating the definition from Hearn and Parkin (1987). Hearn and Parkin defined sexual harassment as “activities and actions; eyeing up and down; suggestive looks at parts of the body; regular sexual remarks and jokes; unwanted cheek kissing on meeting and parting; asking out on dates despite refusals; unwanted touching or patting; pinching or grabbing; direct sexual propositioning; forcible sexual aggression; the pinning up and maintenance of pin-ups. (1987, p. 43)”

Carter and Kirkup added: “It can also be seen more subtly as a process more to do with men exercising power over women.” (Carter and Kirkup, 1991, p95)

Engineers encounter many different types of people on a daily basis. These include professionals, such as engineers, lawyers and architects, technical help, such as draughters, and site managers, labourers and clerical staff.

Rene mentioned that in the engineering workplace women encounter abuse, not necessarily by engineers, but by men in subordinate positions.

A: Have you been harassed?

R: Ya, no .. verbally ya.

A: And have you had to take it further?

R: No, men are bloody scared no, erm .. physically as well, you know men pinching your bum and stuff like that.

A: So that.. does that happen?

R: That actually still happens and I mean ... (laugh) ... ya, it's just a case of, you see the thing is .. especially with secretaries and so on .. a secretary wouldn't normally open her mouth about things like that because .. her job will be threatened if she does .. because it's normally a senior guy... and ... but .. so they think that it's acceptable to do it .. and then does .. tries the same with a person who has more ... more .. more senior status .. and it's just not on.

A: Do you get harassed by .. people on the same level as yourself?

R: Very seldom. It's mostly .. it's mostly .. people on lower levels ... you know the draughtsperson .. the technical people, the administrative people ..

Interview with Rene

Sexual harassment, like bum pinching, makes the work environment unpleasant for the person being harassed. Rene does point out that bum pinching and verbal abuse was more prevalent among the mostly male technical staff and because they get away with it against persons in the majority female-dominated secretarial and administrative positions. She also noted the power relations associated with the different occupations and commented on the mindset of those involved. Firstly, the women in secretarial positions are on a lower rung than the technical staff and would not speak out against abuse from members of the technical staff. Secondly, the mostly male technical staff knew that they could get away with abuse against women in lower positions and then think they can also get away with that type of behaviour with other women, even those in positions superior to them. Thirdly, women engineers, perhaps because of their seniority to technical, secretarial and administrative staff are unlikely to allow unwanted advances by their, not necessarily junior, subordinates.

There were thus a number of social dynamics involved in the above situation. The first dimension was a class dimension between the woman engineer and the woman secretary.

The actor that brought out the class distinction was the male technician. The second dimension was a straightforward power play on the basis of gender. The male in a technical position believed himself to be superior to women and felt that he could get away with harassment. The fact that he avoided censure harassing women secretaries, who are normally in subordinate positions, reinforced his perception. The third dimension was again one of class difference. This time a class difference between the professional woman - the woman engineer, and the male technician. The elevated class position of the woman engineer elevated her beyond the reaches of harassment from the male technician.

For Jean, harassment behaviour took the form of sexual advances from her married superior. Having mentioned no previous problems of any kind while studying engineering, I asked her if she had had any bad experiences to which she replied:

J: Ya .. that was my first real, sort of exposure to big sexual harassment problem.

A: How?

J: From my boss ...

A: Your immediate boss?

J: Yes.

A: Can you tell me what happened.

J: So, well, it was actually the main reason I left. Erm .. it was just .. just incredibly difficult. I mean, he was married, so he had no honorable intentions whatsoever .. I mean, they were entirely dishonorable .. and .. very persistent .. so, like what do you do? You leave.

A: Did you report him?

J: No. It was a very difficult situation because he was coloured.. so .. there were two coloured guys in sort of management positions .. and .. he's actually .. I'm .. he's doing quite well, so I won't mention names.

A: Are you likely to take it further now?

J: No .. but it was very very difficult .. it was awful actually.

- A: Were there any other experiences that happened to you?
- J: Erm ... no, I was reasonably comfortable. I mean, one gets the sort of sexist remarks that one has to field .. but ... I mean up 'til then my experiences had been good enough that .. that the sort of sexist experiences I could handle relatively easily. That was the first thing that I found that I really had great difficulty in handling and interfered with my work. I used to cry on my way to work and .. it was just awful, awful, ya.
- A: And that's the reason you left?
- J: That was the main reason I left, ya... and they wanted to transfer me to (large petrochemical company) in London because I said I wanted to travel .. by that time I was so "gatvol" of (large petro-chemical company) I said, "No thanks."
- A: After that, what did you do?
- J: So I went backpacking, I went travelling..

Interview with Jean

The seriousness of the abuse that Jean had to endure was extremely tragic. What made this incident worse was the fact that it happened at her first job and by virtue of that fact she had no experience of dealing with it. The effects of this type of abuse were long lasting, not only to the abused but also to the company and the industry as a whole. The ability of the engineer was beyond question, as was illustrated by her subsequent work. The engineer lost some years of her career that it took to consolidate her life after such a traumatic event and the company and industry had lost this very able engineer. What further complicated the situation was that she was white and her boss was part of the "coloured" minority and he was perhaps therefore a bit more protected due to the nature of racial politics in South Africa.

Sexual harassment is sometimes seen as being more serious than gender discrimination because it personalises the action. Whereas official and unofficial gender discrimination has

an injured party who is not always visible and aware of his or her situation, sexual harassment is a direct “attack” on a “Jane” or “Mary” and is therefore more personal. Sexual harassment reduces the woman to only the sexual part of the person and denies the humanity of the person. Apart from the possible physical and emotional injuries the person also loses out financially. The industry loses out not only the product of the woman who is harassed but also loses out because of the attitude of the perpetrator who fails to appreciate the value of the female sector of the labour market.

5.5 Coping Methods at Work

In the next three sections I explore the positive aspects these eight women engineers drew out about their careers as engineers. The first section, Coping Methods at Work, deals with innovative ways in which these women overcome negative sexist stereotypes to their advantage in the course of their duties. The second section, Coping with the Conflict between Motherhood and Career, deals with the ways in which they affirm their roles as mothers without forsaking their career. The final section explores the role Women’s Engineering Organisations can play in ensuring that Women Engineers not only survive, but thrive.

Groups that are discriminated against can sometimes use negative stereotypes about themselves to their advantage against whoever holds these opinions. Stereotypes of stupidity, laziness, non technically-mindedness, illiteracy and innumeracy are widespread and often those being stereotyped are willing to “play dumb” in order to gather information. There is no situation where an individual or group has no power at all.. However, sometimes it is difficult to exercise one’s power and it depends on the resourcefulness of the individual, or group, to firstly, realise that they do have power, and secondly, to exercise it.

I wish to start with a theme that I believe illustrates how these women used the positive aspects of their marginalised status. They were not only academically capable but also resourceful by being able to use what was stereotyped as their weaknesses to their advantage.

For many civil engineers a large part of their job entails daily interaction with the City Council. When I asked Hannah if there was an advantage to being a woman engineer, she replied:

H: Oh I get away with a lot at City Council .. sometimes you've just got to look dumb and they do all the work for you... (laugh) or they help you ... No, I'm only joking. Erm, ya, I think .. people actually go out of their way to be helpful ..

Interview with Hannah (p17)

In the above quote we see how Hannah used her awareness of entrenched sexism and acts according to her “part” in order to get her job done with a minimum of hassle for her. Acting dumb and allowing others to do your work for you goes beyond just being lazy, sitting back and taking advantage of people. The dynamic involved here is that instead of having your work stand up to extremely close scrutiny every time that you submit and re-submit work, you place yourself in a position where you, firstly, allow your work to pass through the normal channels, secondly, place yourself in a position of power to judge others' work instead of having them judge yours continually, and thirdly, get your job done in a non-confrontational way and make your path easier for your future dealings. This situation closely echoed the sentiments expressed in one of my casual conversations with a woman engineering student who remarked that it is often better to make an obvious mistake for one's, usually male, partners to pick up than to have every step of your work being intensively scrutinised

Apart from dealing with the Council, the industry by its very nature was made up of a large group of middle- and old-aged white men. According to Eve, these “old uncles” needed to be dealt with carefully. Additionally, she mentioned the fact that it is harder for them to refuse young women. I asked Eve:

A: Are there any benefits .. to being a woman in engineering?

E: Ya, I mean you get these old uncles ... that erm they date from way back then ... they treat women with a .. their little poppies, you know ... and I mean I use it to my advantage obviously ... erm ... they want to be “uncled” and you must just pacify them and just, you know ... make them little stars <break> Ya, then .. there is an advantage to .. to to .. its very difficult for old uncles to say no to young women ... um especially if you look at the local authorities, the provincial structures I mean these are the people we deal with everyday ... its difficult for them to say [no].

Interview with Eve

As it is for most people when first entering the workplace, minorities find that they need to familiarise themselves with the way things work. The problem for minorities is that not only are they in junior positions but they also have to deal with negative stereotypes and negative discrimination. Being in a junior position makes it very difficult to directly confront these issues. Eve manipulated the patriarchal system by assuming the role of the “harmless” woman and avoided unnecessary confrontation and its possible consequences.

When I asked Rene if there was an advantage to being a woman engineer, she spoke about her treatment by her colleagues at her first job:

A: Did they treat you differently?

R: (Laugh) Hell, no, I don't know.. I can't remember .. they treated me nice I don't know if they done things different for .. than they treated other guys ..

A: They treated you better, you think?

R: Ya,

Interview with Rene

The way people treat you is often a reflection of the way you behave. Although not referring to a specific incident, Rene brings across the notion that women are treated with more respect than the men.

From the three quotes above we saw that because of the low numbers of women involved in engineering that they would be easily discernible. Hannah showed how it was possible for her to turn a perceived weakness of her sex within the workplace to her advantage and getting her job done by using those who think they know better to do the work on her behalf. Similarly, Eve played on the fact that the established order carried over social interaction with women into the engineering workplace and was therefore able to beat them at their own game when she acted out her perceived role and they were left with no option but to do the same. Rene mentioned the fact that at her work, because she is a woman, she was treated better than her male colleagues.

Sarah cautioned against using the advantages of being easily identifiable and using sexist notions against the men that hold those opinions. She was one of the more senior women engineers in the field and told me that being easily identifiable was not always a benefit, especially when you do something wrong or when your male colleagues become jealous of the attention that you may get. She responded to my question on whether there was a benefit of being a woman in engineering in the following way:

S: Oh, I don't know... err I think so .. I'll tell you how it is, I'll tell you how it is... Is that if I go .. if I make an appointment to see someone, they'll always see me .. remember, engineers don't see women generally .. so even sometimes these engineers at the municipalities don't see women .. so they're sometimes quite happy to (laugh) just to see a woman and talk rubbish to them. And I tend to be able to chat quite nicely and all the rest of it .. so if- I can normally get in to see people where guys would be put off for a few days .. and they're quite happy to see me .. if I pop my head in .. marketing .. I'm talking marketing and seeing people. I pop my head into an office, it won't just- to say, "Hi", it won't just be- I know he'll call me in and say, "Have some coffee". So there, .. it could, I don't think it could happen to the guys as easily as it would happen to me. Going to big parties and stuff, .. where like, all the important people are there. I know they'll come talk to me, I don't have to go talk to them .. I'm the only woman there for God's sake, of course they're gonna talk to me ... so, from that point of view ... whether I'm comfortable with that is another story, but I certainly know .. it's there, it's useful. And everybody knows who I am ... I mean everybody practically knows who I am ... so I suppose that's also maybe good, as long as I do .. the right thing it's good. I suppose the moment I do something bad the whole industry will know as well. But, maybe there it's good.

A: Is it good? I know its useful, but is it good?

S: It's useful, is it good, yah, see that's what I find a bit debatable, you know what I found would happen, is you- yah .. I I know .. I I think saying, "It's good", is debatable. That's where I said I've got a quandary is that yah ..

A: So now when there are so many women engineers that you don't stick out anymore...

S: Oh, I'll be old by then, so it's fine. But you see, by that time, hopefully, they know that .. well I still think that .. as long as opposite sex attract each other I think it's always going to happen. If there were fifty women and fifty men, the men would still seek out one of the

woman rather than another man. Hm? You know, unless they have different ... but so I think that will always be a plus. <break> as long as there ..certainly there will always be a smaller number of women engineers than men, right, always, I believe that <break> remember I said I don't necessarily know if it's good... it's very difficult if you've been friends with someone and chatting away .. to .. two or three days later go say I want work from you .. you know what I mean, you've almost gotta like draw another line, very .. you've gotta learn that its a long thing to get through ..

Interview with Sarah

The quote from Sarah showed the whole dynamic of the position of women in engineering. She began with the simple fact that the engineering workplace, whether it was the site, the municipal offices, the office or at work-related functions, was completely male dominated and because of this an engineer's interaction with women in their day to day activities were extremely limited. Therefore, according to her assumption that most engineers display heterosexual tendencies, she found that women engineers, because of their small numbers, were more likely to be sought out by their male counterparts. She went further and said that although this attention was not always wanted it was very useful in terms of networking with others in the field. Another point she made was that if you are easily identifiable because you were a woman, then the work you did was closely watched. This presented no problem when your work was faultless, however, when you did make a mistake then it would be exaggerated.

In the last sentence in the above quote, Sarah remarked that it was inadvisable to take the advantage of being a woman to the extent where instead of being the reason for you not being employed, it became the only reason for you being hired. Taking this one step further,

Sarah spoke out against building a work relation from a social relation because it would put both parties in a compromising position and raised moral and ethical complications.

Later in the interview with Eve she also pointed out the danger of abusing being a woman engineer

E: .. no, no ... we just work ... My- I mean my- I believe that .. if .. if you want to receive special treatment as a woman, you will receive special treatment as a woman engineer ... because that whole thing is written over you ... and it it it appears in the way you conduct your business... I ... my whole starting point is ... I do a job and I will do it to the best of my abilities ... the fact that I am a woman .. is not relevant ... is not relevant to the discussions or to the issues at all ... If I don't do my job its because I am incompetent or if I can't do it its because I'm incompetent ... I'm not experienced enough not because I'm a woman, that's not part of the equation ... so that whole thing is written over me ... and obviously people pick up .. people respond to you in the way you project yourself... so I found that to .. to aid me ... I I I ... I'm not a woman engineer, I'm an engineer, period, I mean I do the job.

Interview with Eve

Eve used technical language to make an appeal against the way in which women's work in engineering is inevitably evaluated and discussed. She opposed the system that includes irrelevant facts, such as sex and race, in the evaluation of her work. This is a very common appeal from many minority groups who feel that their minority status, firstly, is the reason why it is so closely scrutinised and secondly, gathers negative stereotype momentum through their possible errors. Therefore, being a minority, especially in a work situation, increases the pressure to perform because not only is your work being continually monitored but also because the price of a mistake is not always only paid by oneself but by every member, and future members, of the minority group.

Before and during the interview phase of my research I tried to probe if there were any benefits to being a woman engineer in the South African engineering industry. On closer inspection I realised that what I termed “benefit” or “advantage” in the interviews were instead mechanisms of coping with a work situation where they are likely to encounter being discriminated against and where their abilities were questioned. The level to which the coping mechanisms were used by these women is a personal decision and the boundaries to which it is used is the result of their individual attitudes and experience.

One coping method that was immediately apparent arose in the interview with Rene. In response to my question on whether men and women work differently, she explained that the way you conduct yourself as a woman could have a bearing on how much negative attention you attract. I asked:

A: Do they tone down being sexist or do they go on pretty much as normal?

R: No .. they're more, they're definitely, I think, toned down... because most of them realise that erm .. they can't- because you see the thing is .. I I don't hesitate to threaten a guy with sexual harassment charges .. and I've done that a few times, and they've toned down immediately. There's no place for that sort of thing in the company. I believe, I actually believe that a company is a place where people should be colour-blind and sex-blind.... It shouldn't make a difference what you or who you are... you must just be there to to .. to do the work, erm ya. I mean people tell me, “Listen, you can't do that because you're a woman”, or “Hello liefie”, or something like- erm harass or sexually harass me or something like that .. I immediately react .. ya.

Interview with Rene

The fact that women have to negotiate the unwanted attention of their male colleagues is evident by the legislation that protects women and minorities from discrimination and harassment in the workplace. The existence of legal mechanisms to protect women from harassment is the tool that Rene used to successfully repel unwanted attention. A strong character and the threat to expose them appeared successful in combating the power relations that allow males to sexually harass their female colleagues.

Although this section on “coping in a man’s world” is by no means complete, what this section does is it deals specifically with instances where these women have turned a negative impression of themselves into something positive. In other sections, with the help of the women, I illustrate individual cases, such as coping and surviving harassment and thematic cases of coping with motherhood while maintaining an engineering career.

5.6 Coping with the Conflict between Motherhood and Career

Acar (in Stolte-Heiskanen, 1991:154) explains that role conflict caused by the needs of having both a family and career is a major cause for, firstly, the decrease in performance of women in academic institutions, and secondly, their resigning from their career. Four of the eight women interviewed were married and three of the four had children. All three of them mentioned the conflict that arose from their roles as mothers and their roles as working women. The conflict arose because, firstly, both mothering and engineering are full-time occupations and, secondly, both mothering and engineering is seen as full-time occupations. The consequence of the first part of the conflict is that doing both requires a large amount of time, implying that one, both or all three of the woman, the child and the career will suffer. The consequence of the second part is that the attempted balancing of the “primary roles”

that of mother and professional exacts a heavy emotional toll on the mother because the working mother is perceived, at some level, to be neglecting her mothering role.

Another interesting aspect common to all three mothers was that they developed long-term strategies to cope with the situation of being both a mother and an engineer.

Eve had a young son and mentioned that she had trouble coping with raising the child and working.

E: Ya, no, there is time .. not now, my life is pretty full, I've got a baby that keeps me running.

A: How old is the baby?

E: He's twenty months old ... ya, a boy.. giving us a tough time. Not coping well with .. with motherhood at all, but I mean it's too late now, no turning back, so you just cope... but I've got a very supportive husband ... my son dotes on him .. which is quite fine with me .. just to get the pressure off me... ok

Interview with Eve

Later in the interview she spoke about the time she took off to have the baby.

A: How old is your baby?

E: Twenty months

A: How long before you gave birth did you stop working?

E: Two weeks before ..

A: How long did you take off?

E: Three months .. that was all I was allowed, it was all we could afford, so ya, that's what I took.

A: What did you do during your time at home?

E: Boring, I was extremely bored at home, I hated it .. no, that's too strong a term .. I hated not doing anything .. but it takes time for your body to unwind .. I mean you get into that very relaxed mode of operating .. and I reached that stage about two weeks before I had to go back to work .. and I really enjoyed the last two weeks and I didn't

want to go back, but in the beginning stages I was extremely bored ... it was just me and the baby and the dog .. my husband is studying (at technikon), so he gets home after nine .. so my first adult conversation was after nine in the evening .. and that's when I just wanted to switch off .. so it wasn't really a good time .. it was fun though but .. it could have been better ..

A: Who looked after him after that?

E: My neighbour's mother, lives in (adjacent area) and she's been looking after children all her life which .. she is a stunning woman .. a truly stunning woman, old woman, in her seventies already .. but I mean, for babies you need that .. doting grandmother .. I mean there's nothing better than a doting grandmother .. not that she's not an actual grandmother .. but erm .. he calls her "Ma", we call her "Ma" ..

A: How do feel about leaving him ..?

E: Obviously guilty .. what mother wouldn't feel guilty but erm .. it's the best thing because I would not have .. I wouldn't manage at home .. alone with a baby, without any other ... input in my life .. that somebody .. would go crackers ..

Interview with Eve

In the above quotes from my interview with Eve it was evident that she had been experiencing problems with having to cope with the time demands of being an engineer and a mother. Her comment, "it's too late now" is not one of disappointment or regret about having the child, as it is their "plan" is to have another one, but more a statement of fact and gives the impression that she approached the situation from a logical or should I say, "engineering", perspective. The baby is not regretted, it is a given, therefore look at all your "givens" and come up with a workable solution.

Despite the obvious guilt with having to leave her child with someone, Eve mentioned that she did not feel that she could stay home and be a full-time housewife and mother. Her

comment that she would go insane “without any other input” probably stems from her being a person who needed a lot of diverse interests. e.g. she mentioned in the interview about her school days when she had been involved with many activities, ranging from drama and ballet to netball and running. For this reason she concluded that leaving her son with a very capable day mother while she worked was an optimal solution.

Elsewhere in the interview, when I asked her to explain what she meant when she had said that being an engineer was not an “eight to five job”, she maintained that she had tried to bring a minimal amount of work home and she emphasised that her family was her first priority. Also, despite saying that she couldn’t say absolutely that she enjoyed what she was doing because of the current demands on her time, she did concede that she was working in what she describes as a lovely environment.

During the interview I found the conflict that Eve felt to be almost tangible. I had the feeling that to her even the optimal solution was not perfect, that she was struggling with not being able to give more than one hundred percent to both her family and her career and although she was coping on a day to day, a week to week and a month to month basis, that the situation was taking a heavy toll on her, both physical and emotional, well-being.

Jean said that she experienced a tough time when she was forced to work when her daughter was two months old. At the time she was working half the day at the office and half the day at home and was thus able to spend time with her two toddlers.

A: And .. juggling the time with looking after the baby?

J: Well, it was quite hard, so .. at first she had a nanny, so she would actually be in the house with us and that was hard because I heard her crying and that .. and then I’d always want to go to her, so from the

time she was nine years old, then we found a childminder which is a British institution which is very expensive, but it is a .. woman who has two or three children with her at home .. and .. it was actually a wonderful environment for [S], so she stayed with that childminder until she was two. A lovely lady called [J], so she would actually be out of the house between eight and five .. so .. I got on with things in that time .. ya.

A: How did you feel about leaving her?

J: ... To start off with it was very hard. Erm .. ya. But I carried on breastfeeding her, so I felt that .. that the bond was always there, I breastfed her 'til she was two .. and ... you know, looking back it enabled me to do things that I otherwise would have been incredibly difficult to do... because I I had the time .. so .. and the childminder was being paid for that time so .. one felt one might as well use it, you know. So, so we were able to do everything. But it was really good, you know, I I was consultant to a whole range of people, local authorities, <break>... you know. I had a research fellowship to write a book <break>.. which I did, I got published and .. so the research fellowship was also kind of a consultancy contract because I could sit and do it at home .. I treated it as a contract with a .. deadline.

Interview with Jean (p28)

As with Eve, Jean acknowledged the difficulty in trying to combine motherhood and being an engineer. She described a scene at her home while having to work and hearing her child crying in another room and wanting to see to her needs. Working from home, either for the full or half day, is a possible solution for working mothers but requires a lot of discipline and often implies having to listen to your child crying and not being able to go to him or her. Also, this option is usually only seriously open either to those women who hold seniority in a company and is not required to be in office or on site, or to women who are comfortable in their current position in the firm.

An alternative to women staying at home to look after the child, Jean mentioned the option of employing a childminder or nanny. The increasing number of career women, with their resulting high salaries, looking to combine motherhood with a career will create an increasing tier of “professional” nannies. Jean used a portion of her salary to employ such a “professional” to look after her daughter out of the home during the day in order for her to work at home during the day. Despite using the services of a childminder, she emphasised the importance of the connection between mother and child and explained how she used to breastfeed her daughter to solidify and maintain this bond.

During her second year of engineering studies, Sarah was pregnant and, during one of her classes, went into labour. She surprised me with her response to my question on how well she related to her classmates:

S: Oh I had ... no not really ... although no no no .. no I lie, I lie, there were two guys that were married, and they were old ... they were very very much older than me ... that had two guys had their own families .. that were married and had worked before and had now come back to varsity .. Erm, and funny enough that's when I got to know them, when I was pregnant and I had a best friend though, Tim¹⁵ was a one of the guys in my class, and he and I were best friends .. I mean he's the one who sat ... when I was in labour, sitting in class in labour ... Tim was writing the times down ... I mean that's how ludicrous it was .. it was hysterical ... and then eventually he started to get nervous and he said to me, “You've gotta phone your husband now, this is getting to close .. “ (laugh). We're still very good friends ..

Interview with Sarah

Later I asked her:

A: How would you compare your two pregnancies?

¹⁵ Not his real name.

S: I think .. you should have your kids young. If you're having them young it needn't inhibit your working ability one iota. I sat in that classroom until I went into labour. There is nothing stopping a woman sitting at her desk going into labour, I went back a week later and wrote my exams, sitting on a bloody ring, I mean you don't know about these things yet, but trust me I was in pain sitting on that ring, nothing was affected, I could do everything I was meant to do ok, so I had no problem, however, and here this is where the latest trend is for women to have their babies much later, ok, and they're only having their babies late twenties early thirties, .. a different story, .. they cannot .. I don't believe at that age work till the end, somehow or other they just cannot do it ... so it depends, if you said to me, "Would you employ a pregnant young woman?", I would say: "No problem at all." If you said to me: "Would you employ a pregnant thirty-four year old?", I would think very very hard about it .. so I admit that I would discriminate purely because its a fact .. a a pregnant older woman is not as ... as .. as fit almost as .. a young one ..

Interview with Sarah (p25)

Sarah offered the opinion that despite the heavy workload while either studying or early on when they are trying to establish yourself in their careers, younger women are able to cope better with the demands of the combination of pregnancy, motherhood and working than older ones. Using herself as an example she bore testimony to the fitness and resilience of the younger Sarah and compared it to her older version.

Sarah had given birth to both her children before she started working in the engineering field. She did, though, have her baby when she was studying. I picked up from her words that there may have been a conflict for her not being able to spend much time with her baby:

A: Was it very hard to study instead of looking after your son?

S: It .. you know, it wasn't hard, it's this whole guilt thing. I had a full-time maid, [the maid] was working remember, so it was fantastic. I had a full-time maid, she was absolutely fantastic .. erm, and she looked after [my son] but .. so I'd be .. swotting and I'd be quite ... I'm not into little things, little kids ... so .. I'd be swotting and I'd hear [my son] playing with [the maid] and life was good but ... there's that guilt of knowing that you should be playing with this child and you're not ... you're in the room, but you're not playing with it. And like, she'd bath him, she'd feed him, she'd do everything ... I'd like go .. "Hello baby", back to my work ... and I think if anything, that was it .. that I said, the next baby I want to enjoy ... it didn't work out but I said I want to enjoy, so therefore I'm not going to have it next year ... I mean I wouldn't have anyhow .. you think it's like easy to have ... you know ... be pregnant .. have a baby, its not that easy ... so .. that was that was ... I think it was guilt, and in retrospect ... it would have made no difference, because I think if I had even been at home I would have ... I just now realise that I'm not very good with baby babies, so, no matter what .. hey..

Interview with Sarah

At her current job, the promotions and the harder work that went with the promotions caused problems. I asked Sarah:

A: Did it affect your homelife?

S: What?

A: Your work problems .. with the amount of work that you had to do?

S: Aah. If you ask the kids they would probably say that there were times where I wouldn't see them like for a whole week ... because I'd get home so late that they would already be in bed. But, we're lucky that we had .. [My husband's] like one of these modern day fathers and he's just as comfortable with the kids as I would have been, so it was a bit of this and that, so it wasn't too bad. There were times that I wouldn't see them for the whole week, but Shaun would be home with them .. so I wouldn't feel too bad about it.

Interview with Sarah

During the course of the interview I learnt that she had her second baby while teaching:

A: You taught where?

S: I taught at BF High School for a year ... and then at MF for a year and a half

A: And ... how was that?

S: Oh, I hated every minute of it... But, I could .. I had my my daughter then .. so it worked perfectly I could go home at two o'clock be with the kid ... no ways you do this job [i.e. engineer] and have a kid, I don't know how these women do it if they do it.

Interview with Sarah

She also spoke about how she tried to keep the mother-child relationship very close until the children were two years old:

A: Who looked after the children while you were teaching?

S: We were lucky, he, that they were when, with [first employer]. Oh wow.

A: From the time that you had the second, while you were teaching, until you got the job at [first employer]?

S: When I was teaching, well I only had the one then, 'cause I went and .. I had the other one, no no no no no ... I had .. then I had the other one .. and I went home when I had two, ya no, that's right. [first employer].. then I .. that was the decision hey, I made that decision that I could come into the workplace.. into engineering, when [my daughter] turned two, .. because at least she could walk and talk and stuff like that. Then what happened, .. is oh that's right. They'd both been ... for the mornings, they'd been at at .. err playschools, crèches .. and .. we were just so lucky, oh god we were lucky, there was a playschool in [DV] where we lived, it was absolutely fantastic, the kids loved it there. Erm .. and I think the year they left, it changed ownership, so we were just, I I'm a very lucky person I think .. and erm, they they .. we dropped them off in the morning, and then they ...

had taught, they got schooling or whatever ... and then they'd have lunch, and then they'd sleep .. they'd wake up at three o' clock, they'd play and we'd pick them up... Either [my husband] or I would pick them up, depending, so they were there .. and then they went to school, and luckily the school had an aftercare ... so they'd go from school to their aftercare, and we'd pick them up from there ... so we've always luckily had something .. I've had this .. after a certain age I didn't want them to go home, to .. the maid huh, because .. I know they would have got bored, I I .. it just wasn't right. So they had both these facilities, .. now they're big they go home but then, that's what they did.

A: Do you wish that you were a mother that was at home?

S: Oh no no no ... <break> .. I still don't know the answer to this one ... I believe my kids have grown up quite independent, quite adult almost ... because they've had to ...<break> .. so they're like quite self-sufficient now, right? I also believe- and they also get on very well with people, they're very socially well adapted, which I think was playschool .. <break> ... whereas you look at the children that stayed home with their mommies, .. not .. remember this whole acceptable thing .. <break> .. most kids go to aftercare ... because mommy and daddy work, end of story... <break> the ones that stay at home with mommy.. don't. Plus, the ones that are going to school, are being .. not activated ... stimulated, the whole time .. because they have activities for them .. the ones that stay with mommy, don't ... ok, then the other day I had this- my son, who is who's big ha, .. I took leave while they were at school, .. so, of course, when they came home from school I was there .. now, I don't know .. and (my son) doesn't get picked up .. I mean, (my son) goes to school, and he cycles, and he comes home, and (the maid) is there. I mean they adore (the maid), we've had her forever.. but, there's obviously a difference because he came home when I was there, and I could see, even though, like, boys don't say, I could see that he was happy that I was at home. Why? I don't know .. but I could actually see (my son) was quite .. "Oh my mommy's at

home...". <break>. I think the best solution is what I am doing with [my daughter] now, is that you're picking them up and taking them home .. they're still seeing you when they come out of school, there's their mom.

Interview with Sarah

Talking about early in her son's childhood, Sarah described the situation when she was forced to study instead of giving all her attention to her son as "the whole guilt thing". The situation was made difficult because of the guilt of not being able to indulge the baby. She went on to say that she wished to "enjoy" the next baby which indicated that she views child-rearing in a positive light even though she argues later on that she was not "very good with babies".

With her children a bit older, her career progress also gathered momentum, which required her to work harder and for longer hours. The result was that she would see very little of her children during that time. Whereas her maid took over a lot of the care of her son when she was studying, when her workload increased her husband became the more prominent parent. As Eve did earlier, Sarah also mentioned the benefit of having a supportive and hands-on husband and father and attributed a lot of being able to cope with motherhood and career as a product of the input of their husbands as involved parents.

Another way of coping with motherhood and career simultaneously that Sarah shared, this time with Jean, is of working only for half a day. Depending on the type of job you have, it is possible to devote enough time to both motherhood and career. According to Sarah, teaching provided her with the opportunity to perfectly balance her home and work roles. She waited until her children were of pre-school-going age before she started working in engineering.

Sarah also discussed ways to maintain the mother-child bond. Where Jean had continued to breastfeed her young daughter, we see that Sarah, who has older children, decided her visibility and availability to pick up her daughter were the best ways to affirm her role in her children's eyes.

The "conflict between motherhood and career" has two facets, a time aspect and an emotional aspect. Firstly, there is the physical constraint of having 24 hours in the day that you have to split between "time for your career", "time for you child" and "time for your family" and all of them requiring an ever increasing portion of your attention. And secondly, there is the inner emotional conflict and guilt of being a full-time engineer and feeling that you are not fulfilling your social role of "mothering". For all of these women both conflicts are evident. These three women dealt with this conflict through working half-days, employing a nanny or childminder to look after their children and making use of their supportive husbands.

5.7 Membership of Women's Engineering Organisations

A few of the engineers that I interviewed mentioned their membership of women's engineering organisations. Level of participation in these organisations and reasons for involvement differed among them but overall they viewed Women's Organisations as being able to play an immensely positive role in ensuring equity for women engineers. The proportion of women in my sample that are members of women's engineering organisations as opposed to those that are not, could be higher than a pure representative sample as a result of the pool of interviewees that I had to choose from on the CREE database as discussed in section 2.2. Although this may skew the results in this section, I deemed this section important to raise awareness of the positive influence of these organisations.

In an earlier section, Jean admitted that a sexual harassment incident led to her eventual association with women's organisations. This, in turn, led her to become very involved with women's issues, especially those relating to science and engineering. Her involvement in these organisations became clearer when I asked:

A: Why did you decide to do your Masters? Why did you decide to go back to studying?

J: Because I decided that that's what I wanted to do .. There was absolutely no way that I wanted to go and do a job. (Laugh) Erm .. I never discussed the experience with anybody actually .. and it was only sort of much later when I .. started to become sufficiently in gender issues and .. and WISE type organisations and talking to younger women about sexual harassment .. that I became able to start talking about it .. at the time, and through- like through the 'Eighties, it was a big issue for me, but it was never something that I discussed and ... it was such a horrendous experience I did not want to go and work in the workplace

A: Would you be more comfortable if we don't talk about it?

J: No, it's fine .. erm .. it's- it's not fine, but it's okay. I think it's important, actually .. because it shows just how much an event like that can shape your career .. or disfigure it.. you know, really.

Interview with Jean

In an earlier section I discussed the costs when an incident of harassment occurs. The emotional costs are better calculated elsewhere but in terms of human resources the sufferer may be lost to the industry altogether or may shift her focus from the field in which she shows most potential. It is a tribute to Jean that she overcame this very negative experience. She mentioned her involvement in women in engineering organisations as being significant in helping her talk about her ordeal and because of that experience she became more involved with issues of gender in science and engineering.

Sarah was also very involved with a Women in Engineering organisation. Her involvement resulted from the fact that her relative seniority and the experience that she gained enabled her to discover incidences of discrimination in the workplace. I asked her about the number of women in top management at her firm to which she replied “one out of four”, I then asked:

A: (Are you the) only woman?

S: Ya .. this is the biggest bunch of chauvinists you’ve ever, now maybe you see, there you go .. maybe that’s why I came here, is to try and convert this bunch .. ‘cause “Wowee!” are we “Wow!” .. I mean unbelievable .. unbelievable .. but I actually don’t know how I ever became a director because they- I know now, you only find out what people are like after a while ... “Aaah!”, but they’re coming around.
(Laugh)

A: Chauvinists.. ?

S: This whole thing that .. erm .. ooh, the fights we had in the beginning, ... purely because I realised this is what other woman could have, could be putting up with, and I’d never experienced it, up to now ... everything I’ve told you, no discrimination ever .. until I got here .. and I thought to myself, “This must be what the others are talking about” which is .. you see, I’m fiery, I’ll fight, <break> but I will fight and say: “We’re not going to do that” ... “You you have no right to ... to force me”<break> Oohh!. Well meaning... the bottom line .. I suppose it’s well meaning, but it’s unacceptable you don’t do that especially if the woman says to you: “Well, I think it’s my choice.”

Interview with Sarah

Sarah only became aware of the extent of discrimination against women after many years of working as an engineer. Having reached a position of relative seniority she was able to see what was happening to other women engineers. She goes on to acknowledge her own feisty

personality and realised that her seniority allowed her much more room to argue her case. The reason for her involvement with a Women in Engineering organisation came from her seeing this need to help other, possibly younger women engineers. The nature of assistance that she could provide was the dealing with women-specific issues, such as which firms are “women-friendly” and “women unfriendly”, and general issues of support or advice when asking for a salary increase.

Hannah, another one of the more experienced women engineers, explained that she was involved with the organisation in order to help the younger women who were just entering the field.

A: You said you're part of ... Women in Civil Engineering?

H: Ya we've got a group .. we just try and help erm .. the young students go through any teething problems .. or if .. and they want advice about the job and what it's like for other women and .. do you have maternity leave problems .. but then maternity leave is just a generalised thing anyway ... You've got the same when you- if you're a typist or a .. not necessarily women engineers ..

Interview with Hannah

Later in the interview she explained more:

A: The Women in Engineering- Women in Civil Engineering group .. do you think that it's a useful service that they provide?

H: We try to make it useful .. I think some of us oldies try and help the young ones and I think they appreciate it .. and .. erm .. ya .. if they have got problems they will discuss it with us and we try and .. erm ... get some interesting topics on the agenda ... and not just purely sitting around a table .. just idle chatter .. But we try and help them with jobs as well, and who to go to .. who to approach .. and .. whether you want to be out on site or in the office or..

Interview with Hannah

Hannah moved up through different levels to get to being an engineer. She showed a very strong desire to help young women engineers in coping with the problems she encountered along the way. These included general problems for women in the workplace and specific problems for women engineers such as site-related problems.

In the discussion on Jean's quote we saw that helping women come to terms with issues of discrimination and harassment is one way that women's organisations can prove to be useful. However, this "curative" measure only offers one part of the solution to the issue of discrimination and harassment in the engineering workplace. The issue of prevention also needs to be addressed by these organisations. I would argue that it is important for women to network among themselves, and in the wider context, in order to counter the effects of the existing "Old Boys" networks in securing employment and other work related matters. However, networking is also important when it comes to issues of coping with women-specific situations such as balancing motherhood and career.

5.8 Conclusion

As a result of the gender imbalance in the engineering workplace, women engineers face sometimes similar, sometimes different situations to men during the course of their careers. Women have been a part of the engineering landscape for many years but in such small numbers to still hold novelty value in the industry. What I have attempted to do here is to isolate the fact that women engineers experience the career of engineering in a very different way to men engineers.

The survival of any minority group is often dependent upon the ability to turn the negative into a positive. This ability to cope with difficult situations was present in all the women that I interviewed.

In section 5.2 I dealt with three women's experiences regarding working on site. Because it is a requirement for registration the hostile nature of site towards women causes problems beyond their immediate job responsibilities.

Section 5.3 deals with two respondents' experiences of sexual discrimination of two women. I found it very useful to distinguish between discrimination at an official level and discrimination at a more personal unofficial level. Discrimination at the more personal level is damaging because not only does it affect the individuals morale but it also affects her work environment and her productivity. At the official level discrimination is damaging because it inculcates in both men and women an attitude that women are less valuable, less valued and more unwelcome in the workplace.

The next section, 5.4, deals with the issue of sexual harassment in the engineering workplace. The first incident was of a more casual nature and wasn't directed at a specific person but at any woman in general. In this case the perpetrator was in a subordinate position. The second incident was a direct sexual advance by the woman's boss which caused additional problems for the engineer.

In section 5.5, I illustrated three instances where the inescapable negative gender stereotypes are used by the women as a means to achieving a desired end. I would argue that the method

they use to achieve the ends are extremely logical, a defining characteristic. They follow what I perceive to be the purpose of engineering: "Make it work!"

The conflict between motherhood and career is very real to the three women engineers who are also mothers. The nature of the conflict is the competition for time. The heartening aspect of the situation is that they have all found their own way of coping with the guilt of not being full-time mothers, have taken measures to maintain the mother-child bond and have managed, although sometimes with much difficulty, to continue working.

The final section, 5.6, deals with the membership, meaning and usefulness of Women's Engineering Organisations. The reason for their existence is that the engineering workplace is not adequately accommodating women. Three of the women were quite senior in the organisation and seemed very eager to improve the position of women engineers and to help junior women engineers even though they have not benefited from the services of such an organisation. The other engineer mentioned that she had benefited from the support of a women's organisation while she was coming to terms with harassment.

Chapter 6: Conclusion

6.1 Introduction

The preceding chapters have shown that the results of my study provided both confirmation and elaboration of the circumstances, as set out in the literature, of women civil engineers in Cape Town in the early to mid 1990s, as set against the broader fabric of women professionals in a male dominated work environment. The analysis of the women engineering students (WES) database provided a statistical profile of women engineering students, based on the overwhelmingly white sample and population of women students registered in engineering at the University of Cape Town during this time. The analysis of the qualitative interviews with a sample of women civil engineers (WE interviews) provided a unique opportunity to better understand the personal and work situation of women professionals in the South African context.

This chapter will start with a brief summary of the findings of the two case studies, on women engineering students and on women civil engineers, that was presented in chapters 4 and 5, respectively. The next two sections will identify and discuss the key findings of the research and start a discussion on policy implications of these key findings. The final section will draw together what I have tried to achieve through this thesis.

6.2 School and University Experiences

The case study presented in Chapter 4 used quantitative methods in analysing and providing a statistical profile of WES respondents registered at the University of Cape Town in 1993. The information for the WES database was gathered by four groups of two 3rd year

Sociology women students with each group focussing on a specific engineering senior (i.e. 2nd, 3rd, 4th and postgraduate) year as part of their final year Sociology research projects. Although they completed reports on each individual year, this analysis is the only one combining the data from all the engineering senior years. The sample used for the WES database was drawn from students in the white, coloured and indian historical racial categories. African women could not be included in this study due to logistical reasons. Because of the small population in each year of engineering that was available to each of the Sociology research groups a very high proportion of the population was sampled and a highly detailed level of data was gathered. The benefits of good co-ordination of the Sociology projects was that the data was standardised and could easily be compared.

The majority of women students that registered in engineering at UCT in the early part of the 1990s were white. There were, however, small numbers of coloured and indian students in the sample. The WES respondents were young and came to university directly after completing matric. Since they had not worked in the engineering industry before, their only exposure to engineering came through family members or friends who were in engineering, through university open days or through the media. This exposure, as has been seen and will be summarised below, was found to be very significant among the WES sample's decision to do engineering.

The parents of the WES respondents, and especially the respondents' fathers, were highly educated. Half of the WES respondents indicated that their mothers had attended at least one of college/ technical college, technikon or university. Nearly three-quarters of the WES respondents' fathers had received some form of tertiary education. In addition to this, the majority of the occupations of the WES respondents' parents were categorised in the more

prestigious occupation categories. A significant proportion, two-fifths, of the respondents' mothers had occupations that were categorised as either Elite Professional, Middle Management or Technical Degree Occupations. The same proportion, two-fifths, of the respondents' fathers had occupations that were categorised in the Elite Professionals category alone. The high level of education and prestige of the occupations of both parents suggests that the majority of women students in the sample came from middle and upper class families and would have enjoyed a relatively comfortable level of financial security. The higher level of education and occupation rank of the respondents' fathers relative to the level of education and occupation rank of their mothers typifies the male-centred professional family.

The majority of the WES sample attended government funded schools as opposed to privately funded schools despite, as I argued above, the fact that they come from the middle and upper classes. On the whole, the respondents had a very definite affinity for Physical Science and Mathematics and this affinity was borne out by the fact that the majority of them received recognition, in the form of prizes and awards, during their school years. They recorded excellent results in their matric year with all the respondents having achieved either A-aggregate or B-Aggregate passes. Given that a C-Aggregate matric pass was the requirement for acceptance into engineering, these women were obviously exceptional achievers. Just under half of the students had attended girls-only schools. The fact that so many of them attended girls-only schools allowed them to excel without appearing intimidating towards, or competing against, boys in their class, a reason sometimes given for the under performance of girls at school

At a qualitative level, the effects of exposure to engineering or technical activities in early childhood were found to be significant in informing the decision to do engineering among the WE respondents in the study. The exposure to engineering was usually early in the life of the respondent through a parent working as an engineer or in an environment related to engineering.

At a more quantitative level, the key reasons given for doing engineering among the WES respondents were linked to socialisation into the culture of engineering and/or an aptitude for science related activities. The socialisation into the culture of engineering included factors such as having a close family member doing engineering or exposure through contact with engineering open days organised by engineering associations, tertiary institutions or the media. The aptitude for science-related activities included factors such as the type of toys, Mecano, Lego and others as well as their performance in Science and Mathematics at school.

As illustrated by their “recommendation to other women wanting to study engineering”, the impression of engineering study that the WES respondents had formed through their study years were very positive.

Some of the WE interviewees mentioned incidents such as a lecturer showing “girly” pictures, having certain colleagues making undermining comments about a woman’s abilities or only having activities in the faculty suitable for men as examples of negative experiences that caused them some discomfort. Despite these isolated negative incidences, the WE interviewees also found their overall study experience to be positive.

The analysis of detailed information from such a large proportion of women engineering students increased the accuracy of the profile that was used as a statistical setting to the case study on women civil engineers that is summarised in the next section.

6.3 Women Professionals: Interviews with Women Civil Engineers

The case study presented in Chapter 5 used transcripts from qualitative life story interviews with women civil engineers to illustrate the position of women professionals in the workplace during the early to mid 1990s. Because I was an outsider, being neither a woman nor an engineer, I decided to conduct in-depth interviews in order to capture, to a high degree of detail, the experiences and attitudes of women civil engineers regarding their work and personal lives in a way they felt most comfortable with. The unstructured nature of the interviews allowed the women to tell their stories in a richly detailed and narrative way with occasional prompting. Their experiences, presented in the form of extensive quotes and mini-stories confirmed that the method employed delivered favourable results for the topic under study.

It was found that many of the issues that women engineers face were common to women professionals in other industries. What distinguished the women in my study from other women professionals was that they faced unique experiences as women civil engineers on the building site. The uniqueness of the experience was as a result of the nature of civil engineering and became a key focus area for my research.

The building site offered the engineers in my study a unique challenge at a time when they were just entering the profession. The building site served as the most obvious manifestation of the aura of masculinity that used to surround (and still surrounds) civil engineering. This

aura of masculinity was maintained under the guise of “protecting” women by preventing them from going onto site. Another incident, where one of the WE interviewees visited a site when she was 7 months pregnant and was assaulted provides some insight into the resistance to feminine images in this male domain. The resilience and strength of the women allowed them to overcome this resistance and reduce the possible effects of their ill treatment.

Some of the women mentioned that their minority status provided both positive and negative consequences. On the positive side, the scarcity of women engineers in this male-dominated field assisted them in terms of recognition when competing for jobs. However, this recognition factor and increased visibility also decreased the latitude that they were allowed in their day-to-day tasks. Some of the women felt that being so visible they were watched closer than their male counterparts and their errors were given much more attention than would have been the case if they were men.

Interviewees also reported instances where they were undermined on the basis of their gender. In one case, the interviewee explained how she was instructed that she could not to go to a site in a dangerous area because she was a woman. At the time her seniority in the company allowed her to impose herself and visit the site as she wanted to. In another case, the comment from a colleague that the engineering council was “lowering their standards to allow females to become professional engineers” was typical of the sexist remarks that prompted her to lay a complaint with her firm. Once again, it is a testament to the mental and emotional toughness of the engineers in my study that they were willing to deal with the obstacles and affirm themselves rather than be intimidated by the behaviour of their colleagues.

With regard to sexual harassment, some of the women described serious experiences that exacted a heavy emotional toll. Although it affected them for a while, they also managed to successfully overcome it. Their experience increased their awareness of these issues and they channelled this negative episode into a positive through their involvement with women in engineering organisations. Apart from the support offered when confronted with discrimination and/or sexual harassment, these organisations were also shown to be useful in combating the patriarchal environment and old boys' networks that developed as a consequence of the male hegemony in engineering.

The conflicting demands of motherhood and career, prompted creative problem solving for the mothers in my WE sample. The solutions included having children earlier in life to minimise the effects on career progress when taking off work for having children, working part-time or from home once the children are born and using the services of childminders. Spending some "quality time" with the children was seen as non-negotiable to these mothers. Finally, the full support of their husbands was also mentioned as being significant in their ability to cope with the twin demands of raising a family and building a career.

A number of findings, both specific to engineering and generally for women professionals, illustrate the richly textured experience of the women civil engineer. A key characteristic in these women was their ability to overcome negative experiences and sometimes even to use these as a point of departure for helping other women colleagues. Some of these findings need to be taken special cognisance of, as I do in the next section, in order to contribute to the debate regarding policy measures in attracting more women into engineering.

Key findings

Although all the findings are summarised above, a number of findings emerged that were particularly noteworthy.

Firstly, the data suggests that the WES respondents came from middle to upper-middle class homes. The education levels of both parents were usually very high and the occupation categories tended towards either upper management, professional or skilled occupations. The occupations of the respondents' fathers were usually superior to that of the respondents' mothers, which suggests that they came from traditional male-centred professional families. As a consequence, these respondents not only enjoyed financial security but also possessed a sense of cultural capital in the form of confidence, know-how and familiarity with a university culture.

Secondly, the school performance of the WES sample showed that they were exceptional achievers. These were students whose results were at the very top end during their matric years and who performed particularly well in Mathematics and Physical Science. The confidence of performing well in Mathematics and Physical Sciences would have contributed to the overall levels of confidence regarding study at university.

Thirdly, the WES respondents had an overwhelmingly positive experience of studying engineering at UCT. Negative comments about women doing engineering were either absent or not noticed by the respondents. The positive experience of studying engineering prompted a great majority of the women students to be encouraging towards other women wanting to study engineering.

Fourthly and finally, the chauvinism, discrimination and sexual harassment reported by the women civil engineers serves as warning that entrenched and negative attitudes towards women in a male-dominated industry still exists, to the detriment of the women and the industry as a whole.

These findings have very definite implications for those who attempt to increase the number of women that choose to do engineering by setting out the situation that existed in engineering in the early to mid 1990s. These implications are dealt with in the next section.

Policy Implications

The first key finding, the relatively privileged social background of the respondents imply that, at least for white women entering engineering during this period, their reasons for doing engineering was not directly linked either to the need for monetary reward through funding for university studies on the basis of need or the need to fulfill certain social needs as was found among african women in Jawitz and Case (1998). Rather their exposure to engineering in their childhood and an affinity for science-related activities were found to be the key reasons affecting their choice to be engineers. These were thus women that come from middle to upper class homes and attended schools that offered good quality education that would have allowed them to pursue good academic performances. When combined with the fact that the performances of these women were of an excellent standard, the areas to focus on to attract these women would lie in stimulating interest in science or science-related activities as a part of the school curriculum and exposing more of these women to engineering or science open days run by schools, tertiary education institutions, engineering associations, etc.

The positive effects of the favourable experiences of, and attitudes towards, studying engineering at university among these women were offset by the fact that discrimination and sexual harassment continued in the workplace. It seems that at least at the university level there is a growing acceptance of the women engineer. However, chauvinistic attitudes in the workplace would understandably be more difficult to combat because of the different types of people that engineers deal with on a day-to-day basis. Even if the number of women civil engineers increase dramatically, as is likely given the legislative requirement of employment equity, the building site is still likely to remain very much male-dominated for the near future, given the nature of the work and the chauvinistic attitudes of contractors.

Concluding Remarks

The objective of this project was fourfold. The first objective was to outline the current international and local debates that surrounded the phenomenon of women in engineering into the latter half of the 1990s. This was effected through a review of literature that provided comparative empirical content to case studies of women engineering students (WES study) and women civil engineers within the broader framework of women professionals (WE study). The second objective was a case study that involved providing a statistical profile of respondents in the WES study in terms of their social background, their schooling, their reasons for doing engineering and their overall experiences of studying engineering at UCT. The third objective was a case study on women civil engineers in relation to their status as women professionals in a heavily male-dominated industry. Areas of focus in this case was both specific to civil engineering, namely experiences relating to the building site, and issues that affect professional women in general, namely dealing with gender discrimination and

sexual harassment and negotiating the conflicting demands of motherhood and career. The fourth and final objective was to provide a meaningful portrait of the status of women in engineering, encompassing students and professionals, in Cape Town in the early to mid 1990s and giving renewed focus and impetus to the debate surrounding increasing the number of women engineers by emphasising key features that emerged from my research.

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Appendices

Appendix A: WES Questionnaire

Appendix B: WE Letter of Approach

Appendix C: WE Biographical Questionnaire

Appendix D: WE Interview Guide Questions Checklist

Appendix E: WE Occupation Categories

Appendix F: WES Reasons for Doing Engineering

Appendix G: Photographs of a Building Site

Appendix A: WES Questionnaire

SURVEY INTO THE RECRUITMENT AND CAREER PATTERNS OF WOMEN ENGINEERING STUDENTS

This questionnaire has been designed with the aim of ascertaining the motivating factors behind engineering as your career choice, as well as your present and future career path.

SECTION 1: DEMOGRAPHICS

- 1.1 Age:
- 1.2 Year of Study:
- 1.3 Course of Study:
- 1.4 Population Group:
- 1.5 Do you live: In a family home?/ In a university residence?/In a shared flat or house?/ Other?

SECTION 2: SCHOOLING

- 2.1 Where did you go to school? Primary Secondary
- 2.2 What type of school was it? Private/Public/Technical College/Other?
- 2.3 Was your last secondary school: Co-educational/Single Sex?
- 2.4 Did you change from one secondary school to another? Yes/No
- 2.5 If "Yes", please state the reason for the change.
- 2.6 What subjects did you take for matric? Subject- Grade- Mark
- 2.7 What was your matric aggregate?
- 2.8 What matriculation certificate did you write? House of Representatives/ House of Delegates/ TED/ CED/ NED/ DET/ JMB/ OED
- 2.9 Please state briefly the reason for your choice of subjects
- 2.10 What was your favourite subject(s) at school?
- 2.11 What was it your favourite? Because
 - 2.11.1 The teacher was good/interesting
 - 2.11.2 You enjoyed the subject
 - 2.11.3 Other
- 2.12 Did you partake in any hobbies or extra-mural activities at school which influenced your choice of career?
- 2.13 Did you feel that the boys in your class received more attention from the teachers than the girls?
- 2.14 Did you receive any science awards at school?
- 2.15 How were people doing science, and doing relatively well in it, perceived at your school?
- 2.16 What was the reaction of your class-mates to your choice of engineering as your career?
- 2.17 Did you participate in lab work at school?
- 2.18 Did your school have a careers day, or a guidance teacher? If so, did either influence your choice of engineering? Please state how.

SECTION 3: AFTER SCHOOL ACTIVITIES

- 3.1 After matriculating did you go to university the following year? Yes/ No
- 3.2 If "No", what did you do in the time between school and university?
- 3.3 If you worked, was it to:
 - 3.3.1 Earn money to pay for your studies?
 - 3.3.2 Earn a place on a bursary?
 - 3.3.3 Better your matric marks

- 3.3.4 Take time off to make sure of your career choice
- 3.3.5 Other.

SECTION 4: UNIVERSITY

- 4.1 When did you decide to pursue a career in engineering?
 - 4.1.1 Always wanted to
 - 4.1.2 Before choosing Standard 8 subjects
 - 4.1.3 Other
- 4.2 What was the major factor in your decision?
- 4.3 Please state whether any of the following people influenced your choice of career in engineering

	Strongly	Marginally	Not at all
Father			
Mother			
Brother(s)			
Sister(s)			
Friend(s)			
Careers teacher			
Other (please specify)			
- 4.4 Are any of the above engineers? If so, who?
- 4.5 Did you feel encouraged by any of the above? If so, by who and what were their reasons?
- 4.6 Did you feel discouraged by any of the above? If so, by who and what were their reasons?
- 4.7 Are there any other factors that you think influenced your career choice?
- 4.8 Did you win a bursary for engineering? If so, with which company?
- 4.9 If you did, or if you had a bursary, would this have markedly influenced your choice?
- 4.10 What is your father's occupation?
- 4.11 Did he complete a course of further or higher education after he completed his schooling? If so, what?
- 4.12 What is your mother's occupation?
- 4.13 Did she complete a course of further or higher education after she completed her schooling? If so, what?
- 4.14 Did your mother work after getting married?
- 4.15 If relevant, how long after having children did your mother take to return to work?

SECTION 5: MOTIVATION

- 5.1 Was engineering your first choice?
- 5.2 If not, what was your first choice?
- 5.3 Are you experiencing any problems with the work?
- 5.4 Are you going to finish your degree in four years?
- 5.5 Could you please state 5 of the worst things about engineering, and rate them 1 (worst) to 5 (tolerable).
- 5.6 Could you please state 5 of the best things about engineering, and rate them 1 (best) to 5 (a bonus).
- 5.7 Do you think there are any advantages in being a woman engineer?
- 5.8 Do you feel discriminated against in practicals or lectures?
- 5.9 Do you feel ostracised by men and women in other faculties?
- 5.10 Do you have any girl-friends that have dropped out of engineering?
- 5.11 How did this affect you?

- 5.12 Have you ever had a vacation job working in an engineering firm? If so, with which firm?
- 5.13 Did you experience any problems in the working environment which related to you being female?
- 5.14 Do you feel during vacation jobs that you have to prove yourself or work harder to earn the same respect as a man?
- 5.15 Did the firm that employed you, have any other women, holding similar positions to you, under their employ?

SECTION 6: FUTURE PLANS

- 6.1 Are you going to follow a course in management or in actual engineering?
- 6.2 Please indicate by ticking the general nature of the work you hope to do in the future: Research/ Development/ Design/ Systems analysis/ Production/ Construction/ General technical administration/ Sales/ Teaching/ Technical Information/ Construction/ Other (Please specify)
- 6.3 What is it about this work which you think you will enjoy?
- 6.4 Do you think there are any sections of engineering that are not suitable for women?
- 6.5 One woman scientist once said: "The majority of girls may never want to be scientists, but those who do so choose are sometimes made to feel odd rather than happy about their decision". Have you felt your career choice has made you "feel odd"? If "yes" please specify in what way.
- 6.6 Are you married or single?
- 6.7 When you are older/ ready would you like to get married? Yes/ No.
- 6.8 If married, will you work? Definitely/ Only if financially necessary/ Not if you have children/ Other (please specify).
- 6.9 Do you think it will be a difficult task balancing the roles of wife, mother and engineer?
- 6.10 Do you think that being a woman engineer would mean you would have to work harder than your male counterparts to receive the same recognition?
- 6.11 Do you think you will have difficulty in obtaining employment once you are qualified? Please state briefly the reasons for your answer.
- 6.12 Do you think that you will have the same opportunities for promotion as a man with the equivalent training and experience?
- 6.13 Why did you choose the engineering option rather than the scientific or laboratorial work?
- 6.14 What advice would you give a sister or female friend contemplating a career in engineering?
- 6.15 Do you think the engineering faculty needs to adopt a future policy to promote engineering aimed at encouraging women to study engineering?
- 6.16 If you gave up engineering work for a period, how difficult do you think it would be for you to return to engineering?
- 6.17 Do you think you would require a refresher course after a break in engineering?

Appendix B: Letter of Entry

Sociology Department
University of Cape Town
Rondebosch
7700
email: cnrash02@southone.uct.ac.za
Tel: a/h (021) 637-4906
Fax: (021) 685-1206

Dear

Invitation To Participate In Women In Engineering Study

My name is Ashraf Conrad. I am a Sociology Masters student at the University of Cape Town and am working in collaboration with the Women in Engineering (WiE) project within the Centre for Research in Engineering Education (CREE). The WiE project was established in order to record the experiences of both women engineering students and women engineers. Recently, both in South Africa and abroad, there has been much research on women studying engineering, my project will try to supplement international research on women engineers through in-depth interviews with South African women engineers about their experiences as women in the engineering workplace. CREE's role in the above is to share the findings of this and other research with academic institutions and people in the field.

I would appreciate it greatly if you would consider being interviewed by me but I would understand if you cannot do the interview. The interview will consist of two parts. The first part will deal with your experiences as a women in the occupation of engineering. The second part will attempt to contextualise your choice through looking briefly at aspects such as home and school background and your personal interests. The method I will employ is the life story interview and for this reason I would prefer to audio-tape record the interview. All the information gathered will be dealt with in the strictest confidence and anonymity of all respondents is assured. Also, I am willing to arrange the interviews at a time and location which is convenient for you.

For the purposes of updating the Women in Engineering (WiE) Database and also providing me with a brief biography, I would appreciate it if you could complete the attached Biographical Questionnaire. I would prefer to collect the questionnaire in person and can be contacted for any queries regarding any of the above either by:-

- a) phone: after hours at 021-637-4906 or alternatively you could leave a message for me at 650-3351 from 9am till 1pm Monday to Fridays and I will get back to you as soon as possible or;
- b) fax: on 021-685-1206 or;
- c) e-mail: on cnrash02@southone.uct.ac.za.

I very much hope that you will agree to be interviewed by me as outlined above.

Thank you in anticipation.

Yours sincerely

Ashraf Conrad

Appendix C: WE Biographical Questionnaire

1. **PERSONAL DETAILS**

Name and Surname Date of Birth

Marital Status No of children.

Address.....

..... Contact Number(s)

2. **SCHOOL BACKGROUND**

Name of School..... Town..... Year Matriculated?

Tertiary Education Details:

Year	Qualification Obtained	Tertiary Institution

3. **FAMILY BACKGROUND**

Mother's principal working occupation.....

Mother's Highest Education

Father's principal working occupation

Father's Highest Education.....

4. **CURRENT EMPLOYMENT DETAILS**

Employer Name Years with firm

Your Position in Firm.....

Approximate Size of Firm (please circle) less than 10 11<20 21<40 41<100 more than 100

Employment History:

Employer Name	Location (Town/City)	Years with firm	Your highest position in firm

Thank you

Ashraf Conrad

Appendix D: WE Interview Guide

Women in Engineering Life Story Interview Guide Questions

Work Experience

Introduction

What I am interested in is your experiences as a women engineer, about how you coped with being a woman firstly studying and then working in a field that was and is predominantly male-dominated.

I would, however, first like to ask you questions about your past and see how it affected your choices.

How many years did you live in the house you were born in?

With who did you live?

How long did you live there?

Where did you move after this? (repeated for subsequent moves)

Do you have brothers and sisters?

(For each sibling)

When was he/she born?

That makes him/her how old now?

What type of work does he/she do now? Did he/she do previously?

When were your parents born?

How old were they when they got married?

How old were they when you were born?

Did they go to school?

Did they have any tertiary education?

What was the highest level of education they achieved?

What type of work do they do now?

What type of work did they do previously?

What do you remember about their work? Workplace?

Did you have to move house to accomodate your parents' occupations?

If both your parents worked, who looked after you?

I'd like to ask about your home life when you were a child.

Can you describe yor house?

How many rooms? For what were they used?

How many bedrooms?

Who shared rooms?

Who was responsible for the housework?

Was anyone, other than your nuclear family, living with you?

where did they sleep? what did they do for a living?

Did you have a best friend while at school?What sort of things did you do together?Are you still in touch with him/her? What does he/she do now?

Who prepared the meals?

Where did the family have meals? breakfast lunch and supper?

Who was present at meals? What do you remember about these occassions?

Were there occassions that you ate in other rooms?

Did you have anything different on special days? Maybe Sundays?
Can you describe the atmosphere around the table during meals?

General relationships with parents:

While you were still at school:

Can you describe your relationship with your mother (father)?

Did your relationship change later on?

Was it different with the relationship with your siblings? Why do you think so?

How did you feel about your parents?

How did they expect you to behave towards them?

During this period was there any adult that you related to well? Could you tell me some more about this person?

What do you think your parents regarded as being important?

Did you agree with them? Do you still think so now?

What parent did you feel closer to? Why do you think so?

What sort of relationship did you have with your brothers and sisters?

School

How old were you when you first went to school?

What type of school did you attend? Boarding/private/church/public

What did you think of the school? How did you feel about the teachers?

Was there any teacher that made a particularly positive impression on you?

Was there any teacher that made a particularly negative impression on you?

What was the most important life lesson that your teachers taught you/

Were you very involved with school activities?

What was your parents attitude to school?

Was there ever a time when your schooling was interrupted? Why was that?

What was your favourite subject at school? why was this so?

What did you do during school holidays?

If you worked, what did you do? Where did you work? Why did you work? Did you get paid?

Did you get to keep the money? If you kept it what did you do with the money?

How old were you when you left school?

What is your overall impression of your school career?

Did you have any special achievements at school that you are especially proud of?

Was there any happening at school that you feel made a special impact on your life?

What did you do after you left school? Why did you do this?

If you worked directly after school what type of work did you do?

Interaction with engineers?

Was there anyone in your family that was an engineer?

What was your relationship with that person?

What was your impression of him/her?

Was there any friends of the family that were engineers?

Did you interact with these people?

Was there any other engineers that you came into contact with during your school going years?

Why Engineering

(I would like to take you back, to when you, as a woman, made the decision to do engineering.) A lot has been written about the reasons for doing engineering. They range from parental pressure to an interest in scientific application, from a desire to help one's community to a need to assert one's independence. What were your reasons for doing engineering, which was and still is a male dominated career path?

How old were you when you decided that you were going to apply to study engineering?

How were you perceived by your family when you made this choice?

Were there any expectations placed on you by people outside your immediate family?

What is your perception of engineering?

University Experiences

Over the last 10 years there has been an increased emphasis at universities on increasing the number of women doing engineering. Also, there have been attempts to make the engineering faculty more women-friendly. When you were studying were there any other women doing engineering at the same time? Roughly what was the sex-ratio in lectures. For practicals and projects, how were groups divided? What characteristics did you look for in lab partners? How did you get on with the other women? How did you get on with the men? Are there any specific circumstances that you recall where gender was an issue? Do you feel that there was a significant difference between your study experience and your male classmates' experience?

In previous research women students mentioned that access to resources was a problem for them. Finding help after hours was especially difficult because the numbers of women engineering students were so small that it was nearly impossible to find a tutor and they had to go to men's residences. How did you find help after hours?

Were there any women lecturers? Did they lecture you? Were you treated differently by your lecturers? Do you feel that you would have felt more comfortable doing engineering knowing that there were more women doing it? Do you think that your classmates treated you differently? Why do you think so? Do you think that students from other faculties treated you differently because you were doing engineering?

How was your studies funded? Was there a gender dimension to you being chosen? What is your impression of your sponsor? Do you think that women are discriminated against when it comes to funding?

Did you tutor at any time during your time at university? How did the students respond to you as a woman?

(worked during vacations? while at university ... How did your vacation work colleagues treat you? do you think it was because you were young or because you were a woman?)

Tertiary level Expectations of Engineering

When you left university, what was your expectations of the workplace? Did you feel that you had extra pressure on you as a woman to succeed? Did you feel intimidated that you had to go into such a male-dominated field?

Do you feel that your expectations were justified?

Brief Job Description

First I would like you to give me a brief description of your day to day activities. What does an average day consist of?

Career Path/Development (for each job)

Are you pleased with how your career has developed?
(has there been hiccups along the way?)

You indicated that your first (second) job was at How did it come about that you secured this job? What was your job description. How was this job different from the one that you have now? What were the reasons that you left that job?

Effect of Gender (for each job)

When you spoke about your day-to-day activities you mentioned
either
working with men
physically demanding labour

Do you feel that your gender has affected your work?
(How others perceive you?)

When did you get married? How old were you? How old was he?
What does your husband do?
Can you describe your relationship with your husband?
What is your husband's impression of the work you do?
How old were you when your children were born?
What is your relationship with your children?
Did the birth of your children affect your studies/ career development? How so?
How old were they when you went back to work? Who looked after them while you were at work? How did this make you feel?

Closing

How do you feel about a man interviewing women about being women?

Is there anything you wish to clarify or do you wish to say something that you feel we haven't covered?

Appendix E: WE Occupation Categories Qualification Guide

WE Occupation Categories Qualification Guide

Occupation Category	Qualification
Upper Management	Advanced Degree + Promotion
Elite Professionals	Advanced Degree
Middle Management	Basic Degree + Promotion
Degree Occupation	Basic Degree
Technical Degree Occupation	Technical Degree
Non-Manual Skilled	Matric + Technical Certificate
Manual Skilled	Matric + Technical Certificate
Manual Unskilled	Below Standard 8 (Grade 10)
Self Employed	N/A
Housewife	N/A
Unemployed	N/A
Unspecified	N/A

Appendix F: Reasons for Doing Engineering Of Women Engineering Students

Reasons for doing Engineering of Women Engineering Students

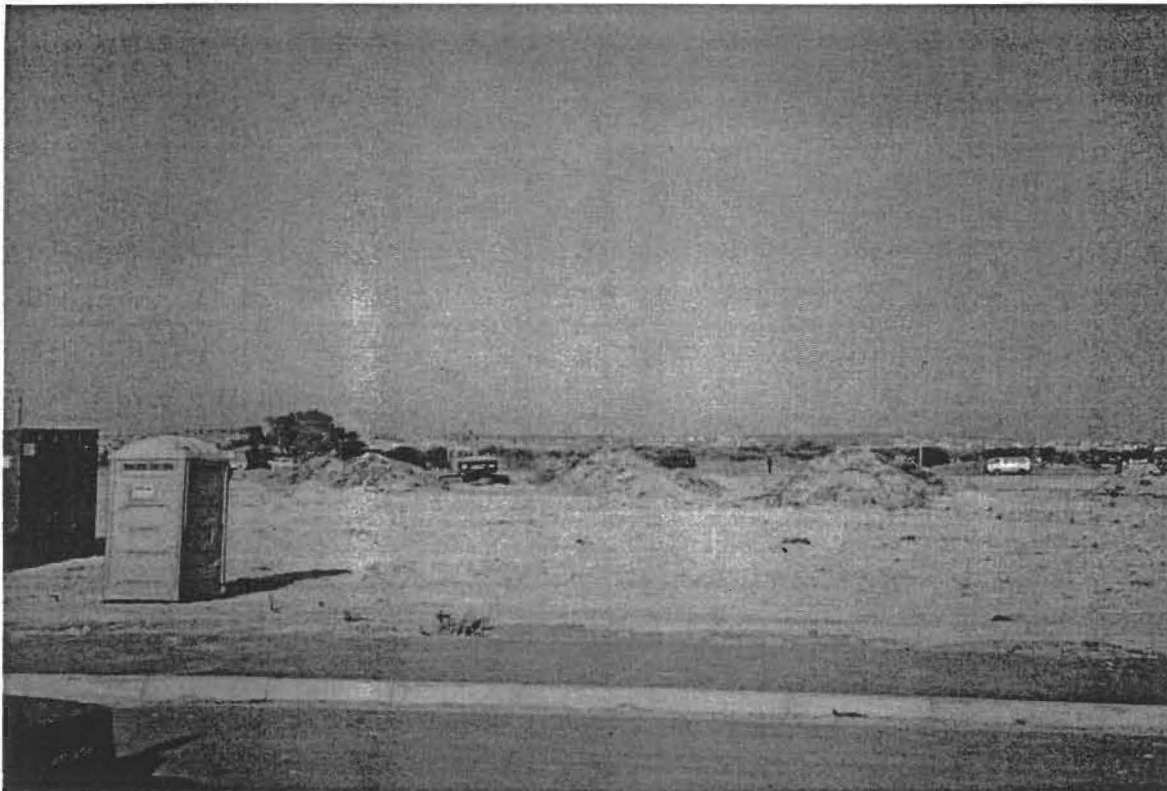
	Reasons for doing Engineering	Undergraduate frequency (%)		Postgraduate frequency (%)	
SOC	Science/ Maths Teacher recommended	1	(1.3%)	1	(7.1%)
SOC	Guidance Teacher recommended	1	(1.3%)	0	(0.0%)
SOC	Was recommended after an aptitude test/ consulted educational psychologist	6	(7.7%)	0	(0.0%)
SOC	Relatives or friends who are engineers/ engineering students/ technicians	4	(5.1%)	2	(14.3%)
SOC	Recommended by parents or close family (not necessarily engineers)	3	(3.8%)	0	(0.0%)
SOC	Father is an engineer	11	(14.1%)	0	(0.0%)
SOC	Brother is an engineer	8	(10.3%)	1	(7.1%)
SOC	Sister is an engineer	3	(3.8%)	1	(7.1%)
CAR	Career Activities – Organized by School	4	(5.1%)	0	(0.0%)
CAR	Career Activities – Organized by tertiary institution	8	(10.3%)	1	(7.1%)
CAR	Career Activities – Organized by an organization	3	(3.8%)	1	(7.1%)
CAR	Career Activities – Media : Leaflets/ Books/ Magazines/ TV	3	(3.8%)	0	(0.0%)
CAR	Contact with Engineers – Have worked in industry/ engineering company	1	(1.3%)	0	(0.0%)
REW	Money/ Status	2	(2.6%)	1	(7.1%)
REW	Awarded a bursary/ scholarship to study engineering	3	(3.8%)	0	(0.0%)
SCH	Particularly enjoyed Chemistry	0	(0.0%)	0	(0.0%)
SCH	Enjoyed (did well) – Mathematics/ Science	8	(10.3%)	4	(28.6%)
SCH	Enjoyed (did well) – All Subjects	5	(6.4%)	0	(0.0%)
MAN	Solving real problems/ Want to apply scientific principles to real life situations	2	(2.6%)	0	(0.0%)
MEN	Interested in how things work/ engineering things/ curious/ technological developments	1	(1.3%)	0	(0.0%)
MEN	Enjoy problem solving/ thinking logically	0	(0.0%)	1	(7.1%)
SID	Want to prove that I can do it/ not enough female engineers	1	(1.3%)	0	(0.0%)
SID	Make a contribution to the development of the community/ country	0	(0.0%)	1	(7.1%)
	Grand Total	78	(100.0%)	14	(100.0%)

Appendix G: Photographs of a Building Site

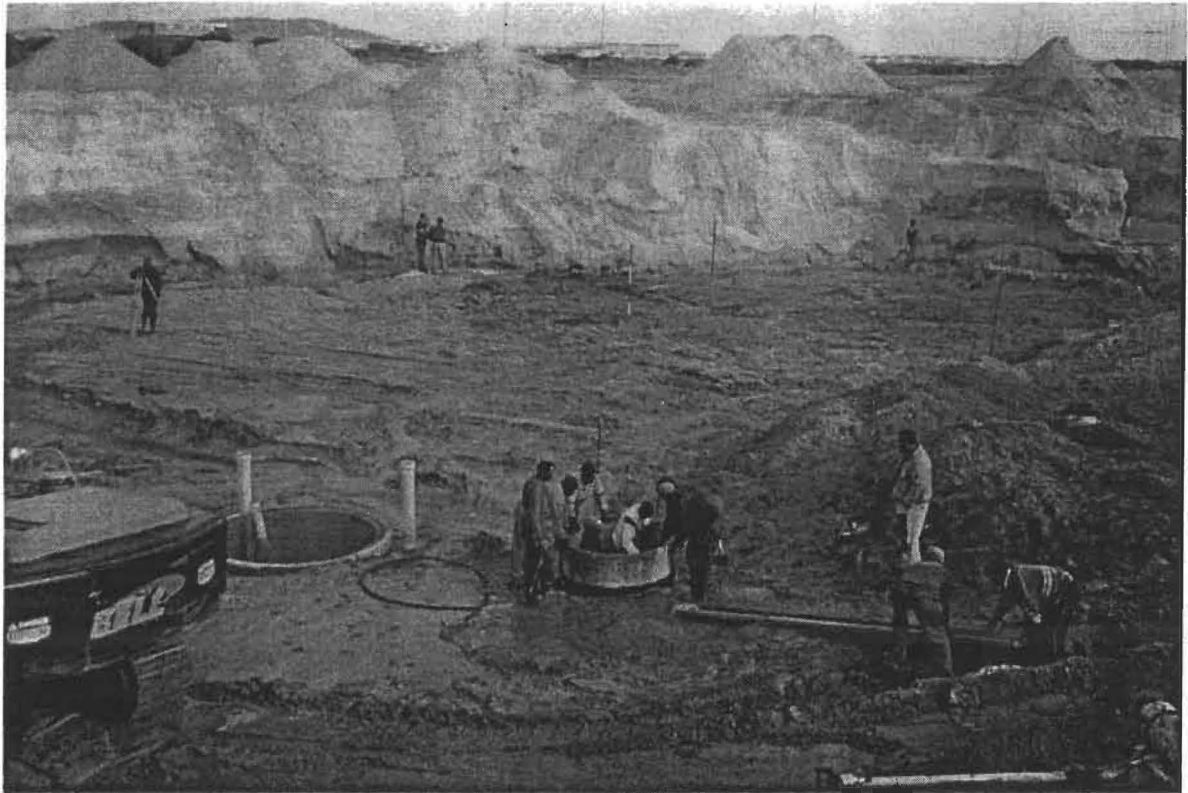
Photographs from a building site similar to the one described by Sarah



Certain building sites are located in under-developed areas.



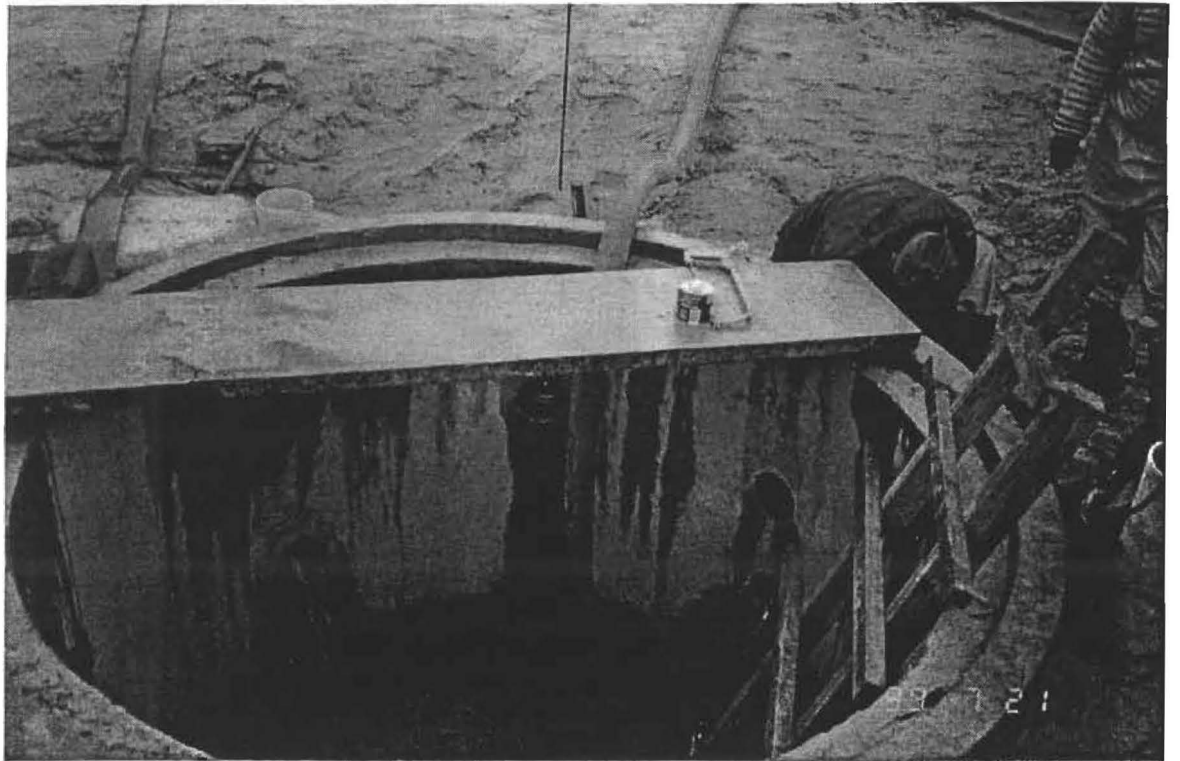
Note the solitary toilet, a sight commented on by Hannah.



The nature of building sites 1.



The nature of building sites 2.



The nature of building sites 3.