AN EXPLORATORY CASE STUDY ON THE PREPARATION OF UNDERGRADUATE CIVIL ENGINEERING STUDENTS AT THE UNIVERSITY OF CAPE TOWN TO CONTRIBUTE TO AN INCLUSIVE SOCIETY FOR PEOPLE WITH DISABILITIES

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A thesis submitted in the fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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2016

PLAGIARISM DECLARATION

I declare that ‘*An exploratory case study on the preparation of undergraduate Civil Engineering students at the University of Cape Town to contribute to an inclusive society for people with disabilities*’ is my own work, except where indicated, and that it has not been submitted before for any degree or examination at any university.

Victor John McKinney

February 2016

DEDICATION

This is my biggest piece of work and academic achievement to date. It is my legacy and I dedicate it to my two boys, James Derek McKinney, who arrived about two years into the process, and Benjamin Jack McKinney, who arrived a year from the end, and whose arrival was quite a distraction from final writing up. My hope is that they will grow up to believe that they can achieve anything that they put their heart into.

ACKNOWLEDGEMENTS

First of all, I would like to thank my mother, Margaret, who has always inspired me to learn more. More than that, considering the hardships that we have been through, if it was not for her remarkable strength and courage and love, I would not be where I am today.

I would also like to thank my dear cousin Lesley Anne. My research journey made me appreciate her love and support a whole lot more, especially during the difficult years experienced soon after my accident. Unfortunately, she lives overseas and I don’t get to see her often but she is always in my thoughts.

With regard to the PhD programme in Disability Studies at UCT, there are a number of people I can always turn to in a time of academic need, whether it is for moral support or intellectual insight. With that in mind, I would like to thank Andre Gorgens, Frank Kronenberg, Prof Leslie Swartz, Dr Brian Watermeyer and Dr Theresa Lorenzo. For her special kind of insight and ability to connect everything together, and for coming on board as my co-supervisor, I would like to give a special thanks to Dr Colleen Howell. Finally, to the man whose phenomenal gift of teaching has made me realise so much. For his constant and firm guidance, as well as his huge patience, I would like to express my heartfelt gratitude to my supervisor, Professor Seyi Ladele (Dele) Amosun.

I would like to thank all my participants who gave their time willingly, with a special thanks to the staff and students at the Department of Civil Engineering, UCT, who were most accommodating of all of my requests.

I would also like to extend a big thank you to Reinette Popplestone and Nafisa Mayat of the Disability Service at UCT, for always being there when I have needed anything related to my disability.

I would like to give a special thanks to Anita Visser and all the other librarians at UCT. Their hard work so often goes unnoticed.

I express a huge thank you to The Harry Crossley Foundation for their research funding and belief in my work which enabled me to embark on this journey and pursue the dream. I also extend a special thank you to the Tshikululu Social Investments for their substantial financial support.

To Anne and Derek Coop, once again my eternal gratitude goes to them for their ongoing support. Whether it is supplying meals or helping with the final diagrams, I know I can always depend on them. Thank you very much.

Last and by no means least to my wife, Emma, whose love and support kept me going when I thought I was too tired. She has been a tower of strength and during my time spent on this doctorate and went through pregnancy and childbirth, not once but twice. My darling Emma, you make up all my reasons for being, thank you and I love you.

ABSTRACT

Based on the experiences of the researcher who is a quadriplegic, people with disabilities still encounter many challenges within the built environment. As civil engineers play a central role, this study set out to address the question – How are undergraduate Civil Engineering students at the University of Cape Town (UCT) being prepared to contribute to an inclusive society that accommodates people with disabilities? Based on a conceptual theoretical framework that draws from a broader context of the Universal Declaration of Human Rights and the United Nations Convention on the Rights of People with Disabilities, a production line analogy was adopted to explore the resources, approaches and experiences of key stakeholders involved in the preparation of the students. The adopted model recognised the students as the "raw materials", the graduates as the "products", UCT as the "factory", the Engineering Council of South Africa (ECSA) as the "quality controller", the Engineering Industry "utilised and refined" the product, while people with disabilities were the "consumers". A qualitative, exploratory, multiple case design was utilised incorporating interviews with representatives of UCT, the Engineering Industry, and people with disabilities, while the contents of the website of ECSA was reviewed.

ECSA has a transformation agenda that does not explicitly identify issues about disability. However, there were opportunities to incorporate the concept of Universal Design (UD) into the exit level outcomes of the undergraduate civil engineering programme. Furthermore, while UCT, Industry and people with disabilities identified legislation around disability as a major resource for the training of students, and UCT and Industry shared an open minded approach to the concept of UD, its inclusion in the education programme is still lacking. There was a conspicuous gap for collaboration between the stakeholders, which seem to hinder the adoption of a multidisciplinary approach in the preparation of the students. The study highlighted the need to formalise a platform that brings the key stakeholders together in the preparation of civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities.

Keywords: engineering, education, people with disabilities, inclusive society, universal design

DESCRIPTION OF TERMS

Definitions and explanations of the use of various terms are provided below.

Disability

The concept of disability for this study is taken directly from *the United Nations Convention on the Rights of People with Disabilities* (*the CRPD*). *The CRPD* does not give a precise definition for the word "disability" nor the term "persons with disabilities" as such. Instead it refers to disability as an evolving concept. This approach is an acknowledgement of the fact that society and opinions within society are in a constant state of change. It also facilitates modifications to the concept of disability over the space of time and within different socio-economic scenarios. Furthermore, *the CRPD* emphasises the importance of the full participation of people with disabilities in society. It recognises that there are attitudinal and environmental barriers that may inhibit this, and expresses the importance of changing these attitudes and environments.

Rather than providing a definition, *the CRPD* gives an indication of those who comprise people with disabilities. It states that people with disabilities "include those who have long-term physical, mental, intellectual or sensory impairments that, in the face of various negative attitudes or physical obstacles, may prevent those persons from participating fully in society" (United Nations, 2010, Article 1). *The CRPD* serves to protect these people and possibly more. This indication by *the CRPD* acknowledges that countries may "broaden the range of persons" to protect or include as they deem necessary (United Nations, 2010, Article 1).

Inclusive Society

There is much discourse on what constitutes an inclusive society but there are few definitions. This study will adopt the term inclusive society according to the following definitions. The World Summit for Social Development (Copenhagen 1995) defined an inclusive society as a "society for all in which every individual, each with rights and responsibilities, has an active role to play" (UN, 1995). The United Nations put forward that such an inclusive society must be "based on respect for all human rights and fundamental freedoms, cultural and religious diversity, social justice and the special needs of vulnerable and disadvantaged groups, democratic participation and the rule of law" (UN, 2008, p. 8).

Engineering

The study uses the term of engineering as provided by the following definitions. On its website, the Engineering Council of South Africa (ECSA) describes engineering as the following:

> Engineering is the practice of science, engineering science and technology concerned with the solution of problems of economic importance and those essential to the progress of society. Solutions are reliant on basic scientific, mathematical and engineering knowledge. Solutions rely on analysis and synthesis, underpinned by sound techno-economic analysis. Solutions must take into account the needs of society, sustainability and the protection of the physical environment. Engineering work requires management and communication, and must be conducted ethically and within the bounds of applicable legislation.
>
> (Engineering Council South Africa (ECSA), n.d.a, para. 1)

The American Engineers Council for Professional Development defines the field of engineering as “the creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes.” Sometimes the term is used more loosely. In the United Kingdom, engineering is defined as “the manufacture or assembly of engines, machine tools, and machine parts” (Encyclopaedia Britannica, 2013, para. 1).

Moreover, the Society of Professional Engineers (SPE) highlights that engineering represents “a group of related professions upon which all other professions rely and in that sense it is unique” (Society of Professional Engineers (SPE), 2013). It adds that despite the different specialisations within the related engineering professions, they all adhere to the same set of fundamental principles (SPE, 2013). The different specialised fields include mechanical engineering, chemical engineering, electrical engineering and civil engineering, to name but a few.

Civil Engineering

The study uses the term of civil engineering as provided by the Institution of Civil Engineers (ICE) in the UK. It describes civil engineering as being all about people, adding that civil engineering is about developing and improving the services and facilities that the public use (ICE, 2013). It further highlights that civil engineers design and build the infrastructure, including all the services and facilities that society needs to support and enhance everyday life. Hence, civil engineers are responsible for designing, building and maintaining towers, tunnels, bridges, dams, harbours, sports stadia, hospitals, airports, roads, railways, tall buildings and large structures all over the world (ICE, 2013).

Transformation

The Dictionary Unit for South African English defines transformation as ‘a marked change in nature, form or appearance’ (cited in Macdonald, 2010, p. 79)

Transformation in South Africa

In South Africa, transformation is a recognised process linked to the readdressing injustices of the apartheid era .Transformation promotes equity of access and the opportunity to succeed to everyone. It also therefore relates to “demographic intervention around the imbalances of race, class, gender and language” (Soudien, 2010, p. 4). Transformation promotes a culture of human rights and democratic ethos it is also about representation and increasing the numbers of Black men, women and children in all spheres of society (Soudien, 2010).

Social responsiveness

This study defines the term “social responsiveness” in accordance with the South African Department of Education. *Education White Paper 3: a Programme for the Transformation of Higher Education* (1997) identified the third role of South African higher education institutions, after teaching and research, as delivering “responsiveness to societal interests and needs” (Department of Education, 1997, p. 3). Moreover, it makes clear that this responsiveness should be fully integrated with the teaching and research programmes in the higher education institutions. The notion of social responsiveness is further articulated within *the National plan for Higher Education,* which describes the goals as follows:

- To meet national development needs through well planned teaching, learning and research programmes, including the challenges presented by a growing economy, operating in a global environment.

- To support a democratic ethos and culture of human rights through educational programmes and practices conducive to critical discourse and creative thinking.
- To contribute to the advancement of knowledge and scholarship, in particular, addressing diverse problems and demands of local, national, southern African and African contexts. (Department of Education, 2001)

Graduateness

The term "Graduateness" refers to those graduate attributes that higher education institutions want their students to have upon graduation. The Council on Higher Education in South Africa has endorsed the development of the Graduate Attribute Agenda, listing the following basic qualities for South African graduates in the new millennium: Computer literacy; knowledge configuration skills; information skills; problem solving; teamwork; networking; mediation skills; social sensitivity (Council on Higher Education, 2001).

These attributes are considered to be over and beyond the academic qualifications achieved by graduates, and in some cases, could be considered unique to a particular higher education institution. The University of Cape Town refers to an "overarching graduateness aligned to the UCT mission, vision" (UCT, 2008, p. 12). It also calls upon each faculty to develop its own set of graduate attributes in line with the mission statement of the University.

Essentially, UCT wants to produce graduates "who are lifelong learners capable of critical, creative and flexible thinking, who can contribute to economic and scientific development, meet diverse social and cultural needs, build a vibrant civil society and consolidate democracy" (UCT, 2008. p. 12).

Resource

The Merriam-Webster dictionary describes the word “resource” in the following manner:

A**:** a source of supply (such as money) or support**:** an available means — usually used in plural;

B**:** a natural source of wealth or revenue — often used in plural;

C**:** a natural feature or phenomenon that enhances the quality of human life;

D**:** computable wealth — usually used in plural; and

E**:** a source of information or expertise (Merriam-Webster, 2013).

The definitions provided in “A” and “E” above applies to the way that the term resource is used in this study. The resources of the stakeholders were viewed as anything that enabled their progress with regard to the preparation of undergraduate civil engineering students to contribute to an inclusive society. In some cases this was represented by a characteristic, such as strong leadership, or an established method or structure, such as the system of transformation committees at UCT. Other resources were simpler to identify, such as legislation or financial support.

Approach

The Merriam- Webster dictionary describes the word “approach” in the following manner:

A: a way of dealing with something: a way of doing or thinking about something;

B: the act of moving or becoming near or nearer to someone or something: the act of approaching: an act or occurrence in which something comes nearer; and

C: the act of speaking to someone for some purpose (such as to ask a question or make a request) (Merriam-Webster, 2013).

The definition provided in “A” applies to the way that the term “approach” is used in this study. It generally refers to the outlook of a stakeholder on any issue relating to the preparation of undergraduate civil engineers to contribute to an inclusive society. For example, some stakeholders were in favour of accommodating people with disabilities in the built environment through the use of Universal Design (UD). This was deemed as a positive approach towards inclusion. Other scenarios encompassed a broader perspective. An example of this was the aspect of graduateness at UCT. The desire and practice of the University to instil the attributes of social justice and global citizenship among their students was viewed as a proactive approach to creating a better, more philanthropic society.

Experience

The Merriam-Webster dictionary describes the word “experience” in the following manner:

A: the process of doing and seeing things and of having things happen to you;

B: skill or knowledge that you get by doing something; and

C: the length of time that you have spent doing something (such as a particular job) (Merriam-Webster, 2013).

All three of the above definitions apply to the term “experiences” as it is in this study. Furthermore, these experiences were generally either seen as challenges, which hindered progress, or facilitators which enhanced the progress of stakeholders in relation to the preparation of undergraduate civil engineers to contribute to an inclusive society.

Reasonable accommodation

The study adopts the definition of reasonable accommodation as described in *the CRPD*. It describes reasonable accommodation as the “necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms” (UN, 2010, Article 2).

Universal Design

The study also adopts the definition of UD as described in *the CRPD*. It describes UD as “the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. ‘Universal design’ shall not exclude assistive devices for particular groups of persons with disabilities where this is needed” (UN, 2010, Article 2).

Legislation

The Merriam-Webster dictionary describes the term legislation in the following manner:

A: a law or set of laws made by a government.

B: the action or process of making laws.

(Merriam-Webster, 2013)

The study predominantly utilises the first definition provided above. Furthermore, legislation has been described as “an institutional practice by which the legislature, as our basic policy-making body issues directives to the governmental mechanisms that implement the policy” (Rubin, 1989, p. 372).

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CHAPTER ONE

INTRODUCTION

This chapter presents the background to the study, highlighting some of the impact of the built environment on the lives of some people with disability. The chapter also includes the research question, purpose and aim, the significance of the study, and an overview of the layout of the thesis.

1.1 Background for the Study

In 2001, the national census of South Africa estimated the prevalence of disability to be 5% of the total population, representing approximately 2.24 million people (Maart, Eide, Jelsma, Loeb, & Ka Toni, 2007), although this was considered to be an underestimate (Loeb, Eide, & Mont, 2008; Mitra, 2008; Schneider, 2009; Sing, 2012). In 2007, the Council for Scientific and Industrial Research (CSIR) stated that there were approximately 4 million people with disabilities in South Africa (Macagnano & Greeff, 2007). This represented 7.54% of the population, an increase of 2.54% or 1.76 million people, from 2001.

Despite global and national programmes, people with disabilities continue to be represented amongst the poorest, least employed and least educated citizens, facing difficult challenges relating to mobility and general exclusion from society, having been marginalised historically in South Africa (Coulson, Napier, & Matsebe, 2006; Mitra, 2008; Sing, 2012). The government acknowledged their exclusion from society and in response established the Office on the Status of Disabled Persons (OSDP). This office monitored and coordinated access to fundamental rights for people with disabilities (Lomofsky & Lazarus, 2001; Mji, Maclachlani, Melling-Williams, & Gcaza, 2009; Sing, 2012). During the initial data collection period of this study, the OSDP was dismantled and in its place the government established the Department of Women, Children and People with Disabilities. This department has a mandate for the promotion, facilitation, coordination and monitoring of the realisation of the rights and empowerment of people with disabilities. Subsequently issues relating to people with disabilities have now been placed within the Department of Social Development.

With regard to integration into society, people with disabilities experience attitudinal barriers and physical barriers. Attitudinal barriers may be unintentional, generally referring to ignorance and lack of understanding, or intentional, which involves people with disabilities being isolated, physically abused or emotionally abused (Barnes, 2003; Pavri & Luftig, 2000; Pivik, McComas, & Laflamme, 2002; United Nations, 2011). Physical or practical barriers refer to the day-to-day challenges experienced by people with disabilities in association with the condition of the environment (Barnes, 2003; Pivik et al., 2002; United Nations, 2011).

The issue of universal access and inclusivity is a challenging and complex one which requires a coherent multi-disciplinary approach (Emiliani & Stephanidis, 2005; Macdonald, 2006). In 1948, *the Universal Declaration of Human Rights* was adopted by the United Nations General Assembly in Paris. It was created in reaction to the experiences of the Second World War and it represents the first international expression of rights, which apply to all people, that they are born free and equal in dignity and rights and that everyone is entitled to all these rights and freedoms "without distinction of any kind" (United Nations, 1948, Article 2).
The rationale behind this study stems from the personal experiences of the researcher who is a person with a disability. In general the built environment does not accommodate free

movement in his wheelchair. The researcher discovered that these experiences were echoed by other people with disabilities as they also battled to overcome barriers to moving around freely in society.

1.1.1 Personal Experiences

The researcher is a person with a disability, who has quadriplegia and is paralysed from the shoulders down (Appendix A). He was a very active sportsman and a first-year, fine art student before becoming a quadriplegic in an accident in 1987. He feels that it has been an incredibly difficult experience to adjust to life as a wheelchair user. One of the major obstacles to overcome that still persists after these many years, is the lack of accommodation to be a truly integrated member of society. The researcher uses a motorised wheelchair which is quite high off the ground compared to those who use smaller self-propelled wheelchairs (such as paraplegics or quadriplegics who have regained sufficient arm movement to push their own weight forward in a wheelchair). Subsequently, the researcher is challenged to use a simple regular item such as a normal desk as his knees cannot fit underneath it. When building a workstation for his computer the researcher called in the assistance of a furniture maker to make a desk that was height adjustable for his use. The researcher is also an artist who paints with his mouth. Standard size easels are not appropriate as they are too small to fit around the wheelchair and there is no provision in their design for extensions to be added. The researcher called upon the services of a young engineering student to help him design an adjustable easel that can be used by a person using a higher wheelchair.

The above examples provide occasions when the researcher has been able to control and make adaptations to suit his own environment. Unfortunately, this ability does not extend to the built environment in the mainstream world and this is where the greatest challenges lie.

The researcher has identified four of these personal experiences over the last 25 years to highlight the challenges he has faced in the built environment.

In 1990 the researcher was involved in a court case related to the accident which rendered him paralysed. When the case eventually reached court, the proceedings took place at the Cape Town High Court buildings in South Africa. At the time the buildings were highly inaccessible to people in wheelchairs and there was no consideration for the accommodation of people with disabilities whatsoever. The researcher's court case was quite a high profile one receiving a lot of media attention and very little, if anything, was done to accommodate his needs as a wheelchair user. As part of the court proceedings, all parties were requested to visit the scene of the accident, which was on a main freeway in Cape Town. The courts did not offer any appropriate transportation for the researcher. Subsequently, in order to travel anywhere, the researcher had to be transferred from his wheelchair into the front passenger seat of a car. At that stage the researcher relied on the help of his cousin and his mother to get his wheelchair in and out of his mother’s car which was an old 1971 Mercedes with four doors and a big boot. To do this the passenger door had to be opened to its fullest. The researcher, in his wheelchair, would be placed as close as possible to the passenger seat. The researcher's cousin would stand in front of him and place her arms on his knees and legs. At the same time, the researcher's mother would take a hold of the researcher’s upper body, sliding her arms under his armpits and gripping her hands on each of his arms which were folded in front of him. On a count of “one, two and three”, the researcher’s mother and cousin would move their bodies in unison towards the passenger seat, simultaneously lifting and swinging the researcher into the car, landing him as safely as possible on pillows placed on the passenger seat. Once he was inside the car, the researcher’s legs and back were then straightened to put him in a sitting position and make him as comfortable as possible.

Furthermore, the researcher's cousin would sit behind him and hold his shoulders to stabilise him and stop him falling forward or sideways. The wheelchair, which was collapsible, would be folded up and put into the boot. On arrival at a destination, the researcher was lifted out of the car into his wheelchair in similar fashion, with his cousin holding his legs and his mother holding his upper body. The whole process of getting in or out of the car would take about half an hour. Since that time the researcher has accumulated funds to purchase a VW Microbus, which can accommodate him while still sitting in a wheelchair. However, on occasions when his Microbus is not available, the researcher needs to be transferred into the passenger seat of a car in the same way as mentioned above. This is due to the lack of availability of any alternative accessible transport and it is a problem that faces all wheelchair users who do not have their own accessible vehicle, or use thereof.

The second example took place in 2006, twelve years after the change of government, when the researcher travelled by aeroplane to a conference in Grahamstown in the Eastern Cape province of South Africa. On the return journey to Cape Town, the airways happened to use a smaller aeroplane because of the relatively short distance between the two towns. On arrival at Cape Town International airport, it transpired that the passenger assistant unit (PAU), which is essentially an automobile elevator designed to facilitate the movement of wheelchair users from the aeroplane to the ground, could not fit onto the rear door of the smaller aeroplane. Subsequently, the researcher was left without any safe means of disembarking the aeroplane. The cabin crew of the aeroplane and one of the staff at the airport suggested that he use a "slipper chair" to disembark. Basically, the slipper chair is a thin chair without any arms and a high backrest that moves on casters and it is designed for use in the narrow aisle of an aeroplane. However, the researcher is not able to sit in this particular type of chair because it offers him no stability and he will fall sideways or forward. In the end, there was no choice but for the researcher's personal attendant to carry down him the steep and narrow metal stairs from the aeroplane to the ground. The researcher did not feel safe at all, it was very difficult for his personal attendant to carry him and see where he was going and it was raining as well, making the stairs slippery. The researcher asked the stewardess to take a photo of him being carried down the stairs (see Appendix B) so that he could send it to the airport authorities.

In 2009, the researcher, his wife, and attendant went to visit Robben Island where Nelson Mandela had been imprisoned during the apartheid regime. It had been a lifelong wish of the researcher to go there but it had been previously inaccessible. Upon enquiry, the researcher was assured that the catamaran ferry to the island was accessible for wheelchairs and that there was accessible transport to conduct the tour around the island. So after many assurances from the Robben Island tour company and a lot of organising by the researcher and his wife, they undertook a trip to the historic site.

As promised, the ferry to the island was accessible and the tour company had just received accessible buses on Robben Island which could accommodate a wheelchair. It was a wonderful experience travelling around the island and seeing the houses where the staff of the prison lived as well as the quarry where Nelson Mandela and the other political prisoners had to work during their incarceration. However a barrier arose when the tour group reached the cellblocks. They were not accessible for wheelchairs. There were stairs leading to the entrance and there was no other way to get in using a wheelchair. The researcher felt incredibly deflated as he had come so far and was now unable to see the cell where Nelson Mandela had lived for eighteen years. This was to be the highlight of the trip and the harsh irony was that everything had been accessible to this point.

There was an informal entrance at the back of the cellblocks but one had to descend from a higher level down a wall about a metre high to get level with the cellblocks. However, not to be outdone, the researcher and his personal attendant looked around and eventually found some steel girders around the back of the cellblocks. They used two of these to make impromptu ramps for the wheels of his wheelchair. It was not a very safe scenario, so they called upon the help of some of the other members of the tour group to help the researcher get down and up the ramps safely but at least they got to see the cellblocks and the place where Nelson Mandela stayed while he was a prisoner on the island - an integral part of the tour that was otherwise totally inaccessible to anyone in a wheelchair.

More recently, in 2015, a current example involves a supposedly wheelchair accessible lift that the researcher must use to frequent a restaurant on the second floor of a building. The building is old and the small elevator has been put in place specifically for wheelchair users to reach the second floor. However, the dimensions of the elevator are still too small for the slightly bigger, motorised wheelchair that the researcher uses. In order to travel to the different levels the lift requires a person to press the up or down button for the duration of the trip. Again this is not possible for the researcher as he is unable to move his arms, let alone hold down a button. Furthermore, the researcher needs assistance and there is hardly any room for another person (see Appendix C). Consequently, any wheelchair user requiring assistance will struggle to use the elevator.

These experiences highlight everyday frustrations for the researcher regarding travelling around the built environment. The researcher is not able to use any of the public transport systems in his area. He cannot get on any of the local buses and all the train stations near to his home, which is in a moderately affluent middle-class suburb, are inaccessible. Reflecting upon his experiences, the researcher wondered whether other people with disabilities had similar experiences.

1.1.2 Experiences of other People with Disabilities

Environmental barriers to living as an integrated member of society, as mentioned above, are not limited to wheelchair users but extend to all people with disabilities. The researcher came across the experience of someone who has a visual impairment. For the sake of anonymity, he shall be referred to as Mr A. Owing to his disability, Mr A does not always know what floor level he has arrived at when he uses an elevator, particularly if there are other people in the elevator who are stopping at different floors. Sometimes elevators have heat or touch sensitive buttons for the floor levels. These elevators prove to be difficult for him because as he tries to find the appropriate button for his floor level his fingers move over the other buttons as well, activating them to stop on those floors. It has been his experience that in trying to get to floor 23, for example, he has stopped on almost every floor along the way to get there. Some elevators have Braille on the floor-selection buttons to cater for people with visual impairments. However, his experience is that this can actually be a hindrance because the Braille is often too large or too faint or too small. Mr A finds it best when the floor number on the button is slightly raised. Ultimately though, the system that enables him to use an elevator efficiently is one equipped with a speaker that tells him which floor level the elevator is on. He found that the first time he could use an elevator independently and efficiently was in a new modern building that was built in Cape Town in 2003 – The Cape Town International Convention Centre (CTICC). The numbers on the button were raised and just right. They were accompanied by an excellent voice over speaking system that announced each floor level that the elevator arrived at. Mr A often jokes that he could use an elevator properly for the first time when he was 40 years old. It is unfortunate that buildings such as the CTICC that have accessible elevators for the visually impaired are few and far between. The majority of buildings in South Africa do not provide talking elevators and this makes it difficult for people with visual impairments to get around them.

In many cases organisations have claimed to be accessible but upon closer inspection they have proved to be inaccessible and not to have fully understood the concept of accommodation for people with disabilities. A wheelchair user had such an experience on the internationally renowned, five-star rated Blue Train, which travels between Pretoria and Cape Town in South Africa and is known to be one of the most luxurious trains in the word. The story was recorded in the media and Mr Davies has given his consent to the researcher to use it in this thesis (Appendix D). After being assured by the Blue Train management that the whole train was wheelchair accessible and even fitted out with its own wheelchair cabin, Mr Davies and his wife booked tickets for a train journey accompanied by some friends from Cape Town to Johannesburg. While they got a discount on the ticket prices it was still a substantial amount of around ZAR 10,000 each (approximately USD 8800 or 7850 Euros at the time of writing). Furthermore, Mr Davies had to book aeroplane tickets back from Johannesburg to Cape Town and had also arranged for his car to be at Cape Town airport so that they would be able to drive home once they had landed.

On the morning of departure Mr Davies, his wife and friends were collected by the vehicle that they had organised and driven through to Cape Town station where they were greeted by the train management and given champagne in the Blue Train lounge. They checked in and caught up with all their friends, excited about the journey ahead, before boarding time. However, things started to go wrong when it was time to board the train. Mr Davies began to suspect that something was wrong when the staff kept on asking him if they could push his wheelchair and he had to explain each time that he preferred to push himself. He was then asked if he could walk a few steps to which he replied that he could not. The train staff then got the special “train’s wheelchair”, which was narrower than his own wheelchair, and they asked him to use that to board the train. However, even that wheelchair would not get through the door onto the train. There was no ramp and there was no way on board and the train was now delayed as the departure time had passed. With no other choice, Mr Davies had to “bum shuffle” onto the train and then lifted himself into the narrow wheelchair to go and look at the accessible cabin. He rolled down the corridor, wondering why the accessible cabin was so far from the dining car and bar. Upon reaching the cabin he found that he could not manoeuvre the tiny wheelchair through the door. A train staff member who was assigned to help him as his “butler” while on board lifted the wheelchair across and into the cabin, but still he could not get in and was stuck in the doorway because of the furniture placement inside the cabin. Mr Davies soon realised that he could not get to the toilet, could not get into bed and could not get in and out of his room without assistance from the untrained staff. He realised that he could not take the journey and had to disembark the train. He had to “bum shuffle” down the corridor once again to get into his own wheelchair on the platform. By this stage his wife was crying and all his friends are concerned, many of them not knowing whether to carry on with the journey or not. The manager of the train was very angry about the late departure and Mr Davies felt very embarrassed at being the cause of the delay, despite it not being his fault, and at the unwanted attention as a big crowd had gathered around to watch the proceedings. Mr Davies convinced his wife to stay in the train and enjoy the weekend with their friends while he departed to go back home. Mr Davies departed, feeling deflated and frustrated at having gone to all the trouble and expense on the assurance that the train was accessible and the journey accommodated people with disabilities. Mr Davies happens to be a consultant on accessibility in South Africa and he was incredibly disappointed that an internationally renowned feature of South African tourism was blatantly breaking the laws and ignorant of its own responsibilities under the constitution.

A woman, who shall be referred to as Mrs B, is hard of hearing and had a challenging experienced in the built environment on a recent trip to Johannesburg. This occurred on one of the Gautrain (an express train network) stations as she was trying to get to the airport to catch a plane to Cape Town. Mrs B found it confusing when navigating her way around the multi-levelled station, trying to get to the correct platform to catch a train to the airport, as the signage was inadequate. For example, there was a sign reading "Platform A for Airport." However, it was not clear what platform she was on or how to get to Platform A. Consequently, she needed to ask for directions and turned to the security guards on the station to do so. This proved to be very difficult for a number of sequential reasons. Firstly, there was a lot of background noise from people and trains as it was a busy time at the station. Secondly, she found it difficult to hear what the security guards on the platform were saying because of the background noise. Thirdly, Mrs B is able to lip-read when she cannot hear sufficiently but she found this extremely difficult because the lighting at the station was poor. In addition, the security guards wore peaked caps and these cast a dark shadow over their mouths, making it hard for Mrs B to understand what they were saying. Moreover, English is not the first language of most of the security guards at the station, making it even harder for her to understand them correctly. In summary, the combination of inadequate signage, poor lighting and bad acoustics created a very stressful experience for Mrs B, particularly as the station was very busy and she was agitated about not getting to the airport in time to catch her flight.

Finally, another wheelchair user, who shall be referred to as Mr C, has to overcome a simple accessibility and logistical problem every working day. When going to work, Mr C catches a train from an accessible platform on the right hand side of the station near his house. However, when he returns home he cannot disembark at the same station because the platform on the left hand side is not accessible, there is no ramped subway and he would not be able to get to the other side. Subsequently, Mr C has to travel a further three stations down the track to a station where he can get off the train and get across to the other side. He then takes another train back to his home station to get off on the right hand side platform. This not only costs him an extra ticket, but is also time consuming and not pleasant in winter when it is raining. Above that, it is an indication of how his situation has not been included in the design-making processes in the built environment.

The researcher has been involved in the empowerment of people with disabilities over the past twenty years. Such involvement has ranged from grassroots, community projects to parliamentary programmes and policy covering all aspects relating to disability. He has encountered attitudinal and physical barriers to living as an integrated member of society at all levels. These personal experiences of the researcher and his peers stirred the interest of the researcher to explore the preparation of civil engineering graduates in South Africa to contribute to the development of an inclusive society that accommodates people with disabilities.

Furthermore, it became apparent that this was not just an issue regarding disability, but a human rights issue as well. The experiences described above provide examples of discrimination against people with disabilities where they have been excluded from their right to full participation within society (Schulze, 2010). Furthermore, the above experiences suggest a shortcoming on the part of the professionals involved in the built environment regarding their understanding of the full requirements necessary in accommodating **all** wheelchair users and other people with disabilities.

1.2 Disability and Human Rights

The United Nations (UN) *Declaration of Human Rights* proclaims itself as a "common standard of achievement" for "all peoples and all nations", so that "all individuals" and "all organs of society" should promote and secure effective recognition and observance of these rights through teaching and education (UN, 1948, para. 8). With regard to this education, point 2 of Article 26 of the human rights states:

> Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms. (UN, 1948, Article 26, p. 2).

Furthermore, the declaration sets the standard for an inclusive and socially just society in Articles 27 and 28 where: "everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits" (UN, 1948, Article 27, p. 1), and are entitled to a "social and international order in which the rights and freedoms set forth in this *Declaration* can be fully realized" (UN, 1948, Article 28).

South Africa's transition to democracy in 1994 held up the promise of a better life for all South Africans. This has been supported by legislation regarding disability rights at the highest international levels, most notably the *United Nations Standard Rules on the Equalisation of Opportunities for People with Disabilities* and more recently the *United Nations Convention on the Rights of People with Disabilities* (*the CRPD)* (Kayess & French, 2008; McKinney, 2013; Metts, 2000; Oliver, 1996). Moreover, this legislation is promoted and supported by bodies such as the World Health Organization (WHO) and the African Decade for People with Disabilities (ADPD) which have challenged the status quo and motivated for a paradigm shift from the medical to social model of disability (WHO, 2011). This legislation is human rights based in the quest for achieving social justice. At the heart of this is the fundamental belief in the individuality of human beings and their inherent capacity to be in charge of their own destiny (Metts, 2000; Oliver, 1996).

The *White Paper on an Integrated National Disability Strategy* (INDS) was introduced by the South African government in November 1997. This is firmly based within a human rights framework of *The Constitution of RSA* (1996) that recognises the equality of all citizens (Howell, 2005; Howell, Chalklen, & Alberts, 2006; Sing, 2012; Watermeyer, Swartz, Lorenzo, Schneider, & Priestley, 2006). The *INDS* provides guidelines on: prevention; public education and awareness raising; health care; rehabilitation; barrier free access; transport; communications; data; information and research; education; employment; human resources development; social welfare and community development; housing; and finally, sport and recreation (ODP, 1997). The *INDS* represented the government's thinking and commitment "on what it can contribute to the development of disabled people and to the promotion and protection of their rights" (ODP, 1997, Foreword). No less than ten of the fifteen policy guidelines outline the specific strategy of education and training of society towards understanding disability and embracing it in all spheres of life. Unfortunately, people with disabilities still encounter environmental and attitudinal barriers in striving for an inclusive society (Amosun & Taukobong, 2010; Amosun, Volmink, & Rosin, 2005; Mayat & Amosun, 2011; Schneidert, Hurst, & Miller, 2003; Yeo & Moore, 2003). Full participation in society requires one to be mobile in that society. The experiences of people with disabilities described above however, suggest that, in a society in which mobility is a prerequisite of living inclusively, people with disabilities have been forced either to move around less or depend on others for mobility.

1.3 Arguments for an Inclusive Society: Rationale for Civil Engineering

The built environment is recognised as a multi-dimensional concept and its design, construction and maintenance is a multi-professional endeavour, involving the collaboration and joint responsibility of architects, engineers, occupational therapists and city planners, to name but a few (Gray, Gould, & Bickenbach, 2003; Hartenberger, Lorenz, & Lützkendorf , 2013). Within urban planning, there has been a recognised link between the built environment and the physical activity of the community (Frank, Engelke, & Schmid, 2003; Handy, Boarnet, Ewing, & Killingsworth, 2002; McCormack, Giles-Corti, Lange, Smith, Martin, & Pikora, 2004). Furthermore, there has been increasing awareness of the built environment on the health and well-being of the community (Srinivasan, O'Fallon, & Dearry, 2003; Villanueva, 2013; Wright, McGorry, Harris, Jorm, & Pennell, 2006). It comprises of "urban design, land use and the transportation system, and encompasses patterns of human activity within the physical environment" (Handy, Xinyu, & Mokhtarian, 2006, p. 64). Moreover, the profession responsible for getting members of the society from point A to point B, as well as public health and safety within infrastructure, is the civil engineering profession.

On their website, the Institute of Civil Engineers (ICE) define civil engineering as "the practice of improving and maintaining the built environment to enhance the quality of life for the present and future generations" (ICE in Wits, 2015). Civil engineers are also responsible for the design and building of bridges, roads, and railways, as well as the design and building of tall structures and large buildings such as multi-storey car parks, train stations, and stadia. Hence, civil engineers are at the heart of all collaboration and development of the built environment (Lawless, 2008). Referring back to the participation of the whole community, the design of the built environment is viewed as a critical factor (Frank et al., 2003; Hitch, Larkin, Watchorn, & Ang, 2012). If the accommodation of people with disabilities is not taken into account at the design stage, it may become very difficult, costly and time-consuming to make the necessary adaptations to the built environment to make it accessible to people with (Maynard, 2009). Moreover, an inclusive society demands an inclusive design (Herriott & Jensen, 2013; Persad, Langdon, & Clarkson, 2007). As described above, civil engineers are central to the design of the built environment. Therefore, it is crucial that they gain an understanding of the needs of people with disability in society in order to accommodate them within the built environment towards developing an inclusive society.

1.4 The Process of Becoming a Professional Civil Engineer

From information obtained on the website of the Engineering Council of South Africa (ECSA), becoming a Professional Civil Engineer in South Africa is essentially a two phase process. The first phase occurs at university, or a higher education institution (HEI), where an undergraduate learns the foundations of civil engineering and meets the academic requirements necessary to graduate with a tertiary level degree qualification in Civil Engineering (e.g. Bachelor of Science, Bachelor of Technology). Once the student has graduated, he/she enters Phase 2 when the civil engineering graduate goes to work in the civil engineering industry as a candidate civil engineer to develop the skills and competencies necessary in order to become a professional civil engineer. This period normally lasts three to five years. Sometimes the period is a bit longer but it is never less than 3 years. It is similar to an apprenticeship in that the candidate civil engineer is often mentored by an experienced professional civil engineer within the workplace. When it is felt that the candidate civil engineer is ready to become a professional civil engineer, he or she undertakes written and oral exams. Once these exams are passed, the candidate civil engineer is viewed as having achieved all the competencies necessary to become a professional civil engineer and may begin practising as such. From the above, it became evident that becoming and being a professional civil engineer entails a lifelong learning journey that extends from the HEI into the civil engineering industry.

1.5 Social Responsiveness in Engineering Education Internationally

Alice Pawley, an assistant professor of engineering education at Purdue University, Indiana, reported that many engineers, engineering educators, as well as engineering studies researchers have been exploring the relationship between engineering and social justice by way of recent publications and workshops (Pawley, 2009). She postulated that the arena of social justice presents the opportunity for educating future “global” engineers (Pawley, 2009). Baillie and Catalano (2009) stated that, to make appropriate decisions, engineers needed to realise the consequences that their work would have on people with disability. This would require engineers to take responsibility to a much deeper level. Furthermore, their ability to respond to the rising needs of all people across all cultures must be developed by engineers (Baillie & Catalano, 2009; Gary, Lucena, Moskal, & Parkhurst, 2006; Kotta, 2011). This is linked to a new awareness within the international engineering fraternity that the issue of social justice needs to be addressed in order to develop an inclusive society. The ICE explored this when it posed the question to the engineering fraternity, asking, “How comprehensively do we consider the social impacts of what we design and construct?” (Nicholson, 2009, para. 6). Recognising the integral role of civil engineers as described above, they explained that the vision of the ICE was to put engineers "at the heart of society, delivering sustainable development through knowledge, skills and professional expertise" (*Nicholson, 2009*, para. 6*)*. They recognised that there were many tools available that could assist civil engineers to minimise the adverse and maximise the positive environmental impacts and effects of their projects. However, the ICE further identified that "there are few tools available to help civil engineers identify all of the social issues and then assist in delivering high quality solutions to them" (*Nicholson, 2009*, para. 9).

It was also highlighted that while the world community had been faced with new problems over the course of time, the education of engineers had not been keeping up with these trends (Mills & Treagust, 2003; Wulf, 2000; Wulf & Fisher, in Owens & Fortenberry, 2007). On the African continent, the African Union (AU) and the New Partnership for Africa's Development (NEPAD) developed a consolidated plan of action to enhance economic development and industrial transformation on the continent (NEPAD, 2008). The consolidated plan has two main objectives – firstly, to revitalize engineering training in African HEIs in order to increase the number and quality of engineers; and secondly, to promote university-industry partnerships to ensure that engineering training is relevant to economic production and industrialisation priorities (ibid).

In the new millennium, the American engineering fraternity came together to address this issue and overhaul the curriculum for undergraduate engineers. They realised that as a profession dedicated to promoting the well-being of everyone in the community, engineering needs to include all stakeholders and participants within society in its design and practice. Based on the views expressed by SAICE (Lawless, 2008) and NEPAD (2008), key stakeholders would include the academic institutions or universities responsible for the training of the engineers, the industries that employ the engineers after successful completion of their training, and the professional bodies that set the requirements for the training and practice of the engineering profession. The consumers of the services provided by the engineers would also be a major interest group among the stakeholders.

Furthermore, the American engineering fraternity realised the need to re-evaluate and redesign the engineering education within the country in order to meet the combined aims of engineering, social justice and sustainable community development. They wanted future engineer graduates to have a broader perspective of real-world problems relating to social justice and global citizenship, beyond the technical parameters of their engineering degree (National Academy of Engineering (NAE), 2005). Many universities have formulated courses within the undergraduate programme that incorporate aspects of social justice and sustainable development, some of them involving a direct interaction between students and people with disabilities, for example. This trend of incorporating social justice and global citizenship into undergraduate degrees has since spread across the globe to Europe and the rest of the westernised world. It has also been incorporated in many developing countries including South Africa, as described below.

1.6 Social Responsiveness within South Africa and the Higher Education Institutions

In striving for an inclusive society and social justice for all, it is necessary to develop context-appropriate strategies that assess the appropriateness of existing interventions that govern the integration of people with disabilities into communities and the workplace (Gray, Hollingsworth, Stark & Morgan, 2008; Shaw, Hong, Pransky, & Loisel, 2008; Slee, 2001). Reviewing existing interventions in the South African context, the researcher is of the opinion that the integration of disability concretisation within delivery systems of government, like HEIs and the operation of civil society, is generally still in its initial stages. In line with the recommendations of NEPAD for transformation in the practice and education of engineering in Africa (NEPAD, 2008), the South African government also launched the National Infrastructural Plan (Presidential Infrastructure Coordinating Committee (PICC), 2012) in 2012, which supports the National Development Plan 2030 (National Planning Committee (NPC), 2012) in realising its goals of developing an inclusive and equitable society.

Van Zyl (2008) documents that until students in higher education are trained to be better service deliverers, services will not improve for people with disabilities. There are currently six HEIs which offer civil engineering as an undergraduate degree. Furthermore, all of them are committed to transformation through South African legislation (Badat, 2007; Department of Education (DoE), 1997, 2001).

1.7 Research Problem

1.7.1 Research Question

There are six tertiary level institutions in South Africa accredited for the training of civil engineers in the country. One of the accredited training institutions is the University of Cape Town. The researcher therefore sought to address the question:

- How are the undergraduate Civil Engineering students in South Africa being prepared to contribute to an inclusive society that accommodates people with disabilities?

1.7.2 Aim of Study

The overall aim of this exploratory process is to obtain an overview of current experiences in the preparation of civil engineering students at UCT to contribute to an inclusive society that accommodates people with disabilities. In addition, the research aims to identify key issues of interest from the interviews of the stakeholders which will inform the future preparation of undergraduate civil engineering students in UCT. This study will provide an opportunity for key stakeholders of the undergraduate civil engineering programme at UCT to reflect jointly on the preparation of the students to contribute to an inclusive society that accommodates people with disabilities. For the purpose of this study, the other stakeholders apart from UCT include ECSA, the civil engineering industry, and finally, people with disabilities.

The specific objectives are:

- To gain an insight into the vision, practice and operations of the Engineering Council of South Africa (ECSA)
- To identify the resources available to UCT, people with disabilities, and the Industry (henceforth referred to as the stakeholders) for the preparation of civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities.
- To identify the approaches utilised by the stakeholders regarding the preparation of civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities.
- To identify the experiences of the stakeholders in the preparation of civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities.

- To explore available documents on transformation and social responsiveness of the stakeholders for the preparation of civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities.
- To explore the outlines of the courses of the undergraduate civil engineering programme at UCT to identify which of them may influence the preparation of civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities.
- To identify key issues of interest from the interviews of the stakeholders towards the development of a conceptual framework for the preparation of undergraduate civil engineering students to contribute to an inclusive society that accommodates people with disabilities.

1.8 Conclusion of Chapter One: Introduction

This chapter provided the background to the study. It described the experiences of people with disabilities, including the researcher, and explained how they are perceived to be excluded from society by inaccessible built environments. The built environment was identified as requiring the collaboration of many different stakeholders and professions, with civil engineers being central to all aspects of infrastructural development. It was highlighted that, at international, continental, and national levels, issues about social responsiveness in engineering are being addressed, having a direct impact on the education of future engineers at tertiary education institutions across the globe. The overall objectives were then described and these were followed by the specific objectives of the study.

The following chapter presents the conceptual framework of the thesis.

CHAPTER TWO

THE CONCEPTUAL FRAMEWORK OF THE STUDY

2.1 Introduction

This chapter outlines the conceptual framework that informs the primary research aim of the study, namely, to explore the preparation of undergraduate civil engineering students at UCT to contribute to an inclusive society that accommodates people with disabilities. The process of formulating the conceptual framework was influenced by a number of factors, which are described in this chapter.

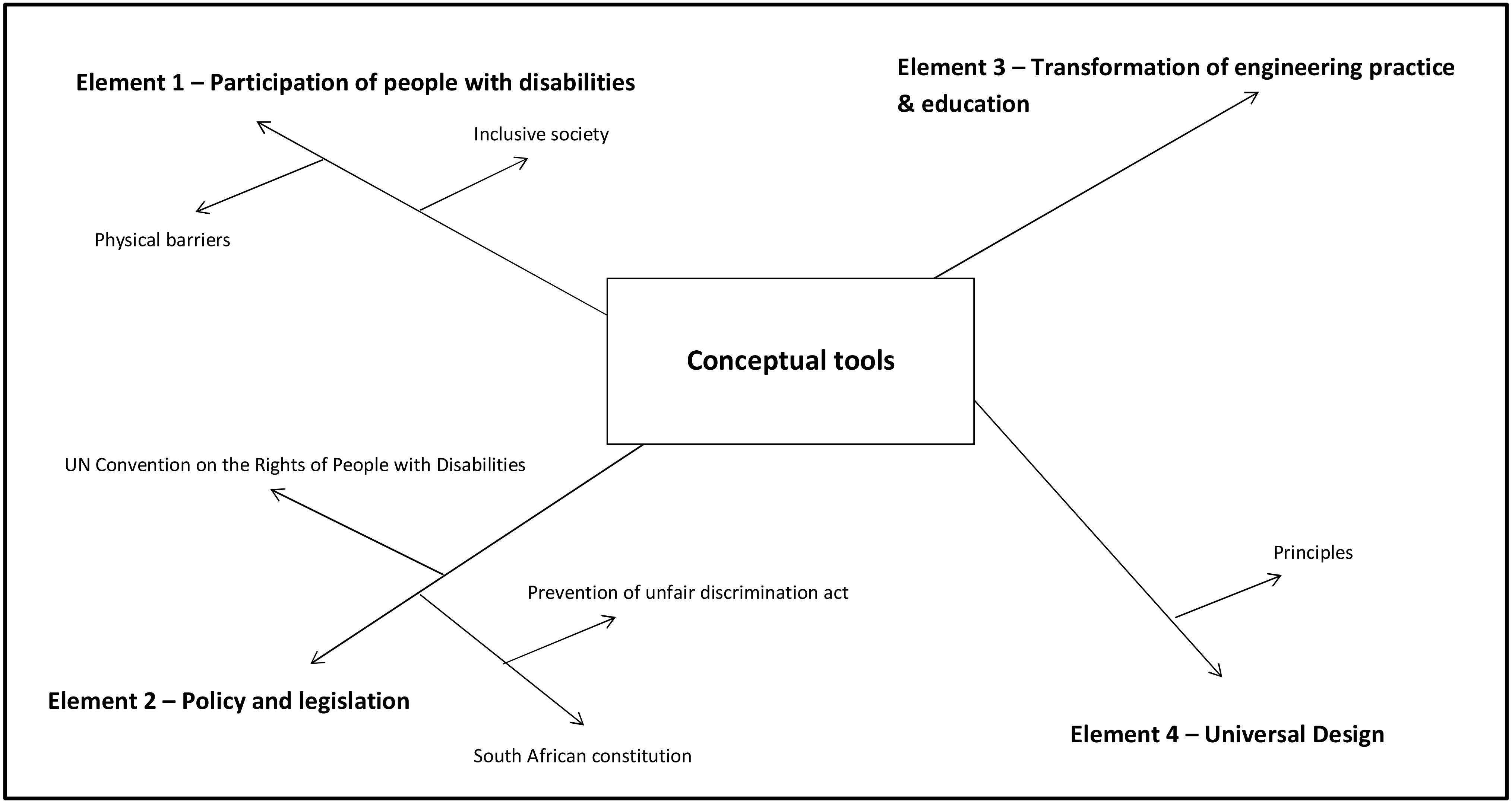
2.2 The Development of the Conceptual Framework

The conceptual framework of a study incorporates the "system of concepts, assumptions, expectations, beliefs, and theories that supports and informs your research" (Maxwell, 1998, p. 222). Furthermore, the framework establishes "the main things to be studied – the key factors, concepts, or variables — and the presumed relationships among them" (Miles and Huberman, 1994, p. 18). It takes the various factors and concepts from the relevant knowledge domains and uses them to formulate a new presentation (Reichel & Ramey, 1987).

Smyth (2004) explains that, as a tool, his conceptual framework created an organised approach that helped to communicate the findings of a study. Moreover, in her doctoral thesis examining how South African universities are accommodating students with disabilities, Howell (2006) refers to the elements of her conceptual framework as providing a "new set of tools" to assist in gaining an understanding of the research topic (2006, p. 292). Once established, the conceptual framework is seen to create a structure of the relevant elements of the study that provides connections between the aims of the research and the literature, as well as clear links to the discussion of the findings (Smyth, 2004; Goetz & LeCompte, 1984).

For the researcher, the process of formulating the conceptual framework was influenced by one main factor – the personal experiences of people with disabilities in a country whose constitution, written in the aftermath of Apartheid, promises to protect the equality of all its citizens. This influenced the researcher's selection of a set of conceptual tools, in the development of the conceptual framework, to address the research question. The elements of the framework were drawn from four knowledge areas within the broader context of the Universal Declaration of Human Rights, and *the CRPD.* The knowledge areas are: the participation of people with disabilities, the policy and legislative framework surrounding disability (national and international), the current changing landscape within engineering practice and education, and finally, the concept of UD (Figure 2.1). These four knowledge areas are seen to relate directly to the preparation of civil engineering students at UCT to contribute to an inclusive society that accommodates people with disabilities. When put together, it is the opinion of the researcher that all of these elements create a structure that facilitates the links in ensuring the participation of people with disabilities in an inclusive society. Being an exploratory study, the researcher will use the framework to gain some understanding and awareness of the situation that is being examined (Smyth, 2004).

Figure 2.1 Diagram of the conceptual framework



2.3 Element 1: The Participation of People with Disabilities

The first element of the conceptual framework relates to the participation of people with disabilities in the built environment. Based on the experiences of people with disabilities narrated in sections 1.1.1 and 1.1.2, there are two key factors which impact the participation of people with disabilities, namely, physical barriers within the built environment and the development of an inclusive society.

2.3.1 Physical Barriers

The experiences of the researcher and others with disabilities reflected that they face many challenges when trying to participate in society, particularly with regard to physical barriers within the built environment. The *World Report on Disability 2011* (*WRD*) documents that physical barriers have a significant and negative impact on the participation of people with disabilities in society (Bickenbach, 2011; WHO, 2011). Moreover, obstacles within the built environment may exacerbate the disabling process when they prevent people with impairments from conducting their daily activities and participating in society (Bickenbach, 2011). The lack of access to and within the built environment serves to deny people with disabilities many of their rights as described in *the CRPD*. Hence, the researcher is of the viewpoint that the removal of physical barriers within the built environment will greatly enhance and increase the participation of people with disabilities within the built environment and society in general.

2.3.2. Inclusive Society

The second key factor relates to the vision of an inclusive society; one in which the human rights of people with disabilities are acknowledged as the society makes provision for their accommodation through an accessible physical environment. In developing the conceptual framework for this study, the researcher draws predominantly on the literature of Ruth Lister for the description of an inclusive society. Deriving from a series of case studies conducted in the global South, and predominantly among those who are regarded as excluded, Lister (2007) identifies four values of inclusive citizenship. The first value is that of justice, which refers to "when it is fair for people to be treated the same and when it is fair that they should be treated differently" (Kabeer in Lister, 2007, p. 50). The second value is that of recognition, referring to the "intrinsic worth of all human beings" as well as the recognition of their differences and respect thereof (Kabeer in Lister, 2007, p. 50). The third value relates to self-determination, or the ability of people to have a degree of autonomy over their lives and future (Lister, 2007). The fourth and final value is that of solidarity, or the ability to identify with others and join them in the quest for recognition and justice. Lister (2007) suggests that this value relates to a horizontal view of citizenship, "which accords as much significance to the relations between citizens, as well as to the vertical relationship between the state and the individual" (Lister, 2007, p. 51).

People with disabilities are often excluded from formal rights and responsibilities, as well as of enjoying full cultural citizenship (Marks in Lister, 2007). This exacerbates the exclusion processes because "representation cannot be separated from structural issues" (Marks in Lister, 2007, p. 53). If people with disabilities are to experience equal opportunities and full participation, it will need to be in a society where being different does not equate to not belonging, but rather to a state where "our common humanity is recognised and valued" (Morris in Lister, 2007, p. 53). Hence, the study subscribes to the concept of an inclusive society which embraces the celebration of difference as well as the right of people with disabilities to full participation within society, particularly the built environment, as established in disability policy, and this is discussed in the following section.

2.4 Element 2: Disability Policy and Legislation Framework

The recognition of the experiences of people with disabilities, particularly from a human rights perspective, has evolved over the last century and there is now a comprehensive international legislation framework regarding the rights of people with disabilities. Furthermore, this international policy links with many national policies around the world. Currently, most developed countries have extensive and established disability policy. Many developing countries have disability policies as well, however, many of them experience challenges in implementing their national policies.

The study is concerned with the development of an inclusive society within South Africa, specifically the participation of people with disabilities. Hence, the policies that the conceptual framework draws from, at a national level, are the South African *Constitution* and the *Promotion of Equality and Prevention of Unfair Discrimination Act.* At an international level, the conceptual framework draws from the *CRPD*, predominantly Article 9, which focuses on accessibility.

2.4.1 The South African Constitution

The *New Constitution of South Africa* (*The Constitution*) (Act No. 108 of 1996) provides the underlying foundation to the conceptual framework. *The Constitution* is the cornerstone of the development of an inclusive and democratic South African society. Its adoption on 8 May 1996 championed a new era of fundamental rights and freedom from discrimination of all kind for South African citizens. Chapter 2 of *The Constitution* contains a *Bill of Rights* which enshrines the notion of equality for all South African citizens. Section 9 of the *Bill of Rights* opens with “everyone is equal before the law and has the right to equal protection and benefit of the law” (Section 9(1)). Equality includes the full and equal enjoyment of “all rights and freedoms” (Section 9(1)). The *Bill of Rights* follows on to prohibit all discrimination. This anti-discriminatory stance is enshrined in the *Promotion of Equality and Prevention of Unfair Discrimination Act* (Act 4 of 2000), which is described next.

2.4.2 The Promotion of Equality and Prevention of Unfair Discrimination Act (Act 4 of 2000)

The *Promotion of Equality and Prevention of Unfair Discrimination Act* (Act 4 of 2000) was essentially formulated to give effect to Section 9 of *The Constitution* described above (Republic of South Africa, 2000). One of the key objects of the Act is “to provide for measures to facilitate the eradication of unfair discrimination, hate speech and harassment, particularly on the grounds of race, gender and disability” (Section 2(c)).

The Act describes discrimination as “any act or omission, including a policy, law, rule, conditional situation which directly or indirectly –

a) imposes burdens, obligations or disadvantage on; or
b) withholds benefits, opportunities or advantages from,

any person on one or more of the prohibited grounds” (Republic of South Africa, 2000, p. 4).

These prohibited grounds include; “race, gender, sex, pregnancy, marital status, ethnic or social origin, colour, sexual orientation age, disability, religion, conscience, belief, culture, language and birth” (Republic of South Africa, 2000, p. 5). Furthermore, the guiding principles of the Act recognise the “existence of systemic discrimination and equalities, particularly in respect of race, gender and disability in all spheres of life as a result of past and present unfair discrimination” (Section 4, (2) a, p. 7).

Section 9 (of the Act) deals directly with the prohibition of unfair discrimination on the ground of disability. It stipulates that “no person may unfairly discriminate against any person on the grounds of disability, including:

a) denying or removing from any person who has a disability, any supporting or enabling facility necessary for their functioning in society;
b) contravening the code of practice or regulations of the South African Bureau of Standards (SABS) that govern environmental accessibility;
c) failing to eliminate obstacles that unfairly limit or restrict persons with disabilities from enjoying equal opportunities or failing to take steps to reasonably accommodate the needs of such persons” (Section 9, pp. 8-9).

With regard to professional civil engineers developing the built environment, Section 26 of the Act identifies the responsibility of persons operating in the public domain to promote equality (Republic of South Africa, 2000). It categorically states that “it is the responsibility of any person directly or indirectly contracting with the state or exercising public power to promote equality by:

a) adopting appropriate equality plans, codes, regulatory mechanisms and other appropriate measures for the effective promotion of equality in the spheres of their operation;
b) enforcing and monitoring the enforcement of the equality plans, codes and regulatory mechanisms developed by them; and
c) making regular reports to the relevant monitoring authorities or institutions as may be provided in regulations, where appropriate” (Republic of South Africa, 2000, Section 26).

Moreover, Section 28 of the Act relates directly to special measures to promote equality with regard to race, gender and disability. Point three of the section states that is incumbent upon the State, institutions performing public functions and juristic and non-juristic entities to

(i) "audit laws, policies and practices with a view to eliminating all discriminatory aspects thereof;

(ii) enact appropriate laws, develop progressive policies and initiate codes of practice in order to eliminate discrimination on the grounds of race, gender and disability;

(iii) adopt viable action plans for the promotion and achievement of equality in society;

(iv) give priority to the elimination of unfair discrimination and the promotion of equality in respect of race, gender and disability" (Section 28, 3 (b), p. 19).

Hence, the Act is a comprehensive policy aimed at protecting the rights of all South African citizens, with clear and specific instructions regarding the protection of the rights of people with disabilities.

2.4.3 International Policy: *The CRPD* - Article 9: Accessibility

With regard to legislation that is specific to disability, South Africa was the second country to ratify *the CRPD*. In doing so, it committed to improving the quality of life of all its citizens by protecting and promoting their rights. With regard to participation of people with disabilities in the built environment, this study draws directly from *the CRPD*, more specifically the right to accessibility of people with disabilities as described in Article 9 (UN, 2006). Article 9 instructs member states to implement measures to ensure that people with disabilities have "access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communication technologies and systems, and to other facilities and services open to, or provided to the public, both in urban and in rural areas" (UN, 2006, Article 9). *The CRPD* further identifies areas where barriers to accessibility may exist, including "buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces" (UN, 2006, Article 9). Essentially, the right to access is enshrined in Article 9 (Schulze, 2010). It is also mentioned directly in Article 5, which refers to equality and non-discrimination, and which indicates that people with disabilities have "the right of access to any place or services intended for use by the general public, such as transport, hotels, restaurants, cafes, theatres and parks" (Schulze, 2010; UN, 2006, Article 5).

Approaching the challenges of accessibility from a human rights point of view provides a framework to ensure the removal of any barriers to the full enjoyment of all human rights by people with disabilities. It also serves a greater purpose, in that it tackles the existing social constructs which perpetuate the exclusion of people with disabilities and lead to the denial of their rights (Schulze, 2010). This is an underlying factor of *the CRPD*, and while it does not formulate any new disability rights, it does "highlight the accessibility and inclusion angle of all human rights" (Schulze, 2010:7). Other articles in *the CRPD* that propose the provision of "reasonable accommodation" to ensure the participation of people with disabilities within the built environment include, but are not limited to, the following:

- Article 13 Access To Justice;
- Article 18 Liberty Of Movement And Nationality;
- Article 19 Living Independently And Being Included In The Community;
- Article 20 Personal Mobility;
- Article 24 Education;
- Article 26 Habilitation And Rehabilitation;

- Article 27 Work And Employment;
- Article 29 Participation In Political And Public Life; and
- Article 30 Recreation, Leisure and Sport.

Under Article 30 on Recreation, Leisure and Sport, *the CRPD* specifically mentions tourism in paragraph 5. Schulze (2010) points out that it was felt that this was an area that was worth mentioning on its own.

2.5 Element 3: Transformation within Engineering Practice and Education

This section of the conceptual framework focuses on the environment that current and future engineering students will be working in once they graduate as engineers. Since the new millennium there has been an increasing awareness amongst the engineering fraternity at international and national levels that changes are needed within the profession regarding its practice and its education (National Academy of Engineering (NAE), 2005; Wulf & Fisher, 2002). In their publication, *The Engineer of 2020: Adapting Engineering Education to the New Century,* the National Academy of Engineering (NAE) of America address the "societal, geopolitical and professional context within which engineering and its new technologies will exist" (NAE, 2005, p. 3). It identifies the challenges that current and future professional engineers will experience and looks at how the education of engineers needs to improve.

2.5.1 Transformation in Engineering Practice

Current and future challenges to engineers include an increase in population, a subsequent strain on water resources and food shortages as well as new and complex developments in the built environment within a sustainable development approach (NAE, 2005). Baillie and Catalano (2009) add that modern engineers will also need to develop a social responsibility as they work in “an increasingly complex entanglement of ideas, people, cultures, technology, systems and environments” (2009, p. 1). The professional engineer of the future needs to be prepared “to conceive and direct projects of enormous complexity that require a highly integrative view of engineering systems” (Vest, 2006, p. 41). Furthermore, they will need to operate within a sustainable development framework, as well as to “be creative and innovative, understand business and organizations, and be prepared to live and work as global citizens” (Vest, 2006, p. 41).

The approach of the modern professional engineer requires collaboration between multi-disciplinary teams of experts with different engineering technical backgrounds as well as different professions involved in the built environment. Consequently, modern engineers will need to develop the attributes of communication, flexibility and teamwork within their profession (Baillie & Catalano 2009; Coyle, Jamieson, & Oakes, 2005; Hartenberger, et al., 2013; NAE, 2005; Wulf & Fisher, 2002). The NAE (2005) suggests that student engineers may also need to develop “excellence in communication (with technical and public audiences), an ability to communicate using technology, and an understanding of the complexities associated with a global market and social context” (NAE, 2005, p. 10). Hence, to achieve their goals effectively, modern engineers will need to develop attributes of social responsibility, effective communication and flexibility, while maintaining the standard of technical excellence required of professional engineers (Baillie & Catalano, 2009; Vest, 2006; NAE, 2005; Wulf & Fisher, 2002).

2.5.2 Transformation in Engineering Education

Along with the recognition of the changes necessary within engineering to meet the demands of the modern globalised world, was the awareness that the education of engineers would need to change accordingly (NAE, 2005; Wulf & Fisher, 2002). Wulf and Fisher (2002) also highlighted that engineering education has been lagging behind and needs to be redesigned and improved to meet the future needs of society. Current and future students will need to develop the "ability to respond" to the challenges of the modern world described above (Baillie and Catalano, 2009, p. 1; Wulf and Fisher, 2002). This involves developing various attributes, including effective communication, teamwork and leadership skills within society, over and above the technical knowledge they gain (Baillie and Catalano, 2009; Mills, 2013; NAE, 2005; Royal Academy of Engineering, 2011; Vest, 2006; Wulf & Fisher, 2002).

In order to develop these skills and attributes, the NAE (2005) recommend that higher education institutions introduce an interdisciplinary learning approach into their engineering training programmes. Furthermore, undergraduate engineering programmes are encouraged to have a component dedicated to working within communities, so that students gain experience in working with real life problems (NAE, 2005). The NAE also motivates for a stronger working relationship between academic institutions and industry (NAE, 2005). From the standpoint of this study, it would be viewed as advantageous for civil engineering undergraduates to be involved in interdisciplinary approaches to learning, community projects as well as comprehensive programmes resulting from developed academy-industry ties.

2.6. Element 4: Universal Design

For people with disabilities, like other marginalised groups of people, having access to the built environment is a requirement for the development of an inclusive society. Specifically, it should be a society where being different represents something to be celebrated, as opposed to leading to exclusion, which is the current experience of many people with disabilities

(Morris in Lister, 2007). It is the researcher’s view that this process will be made easier by the incorporation of the concept of UD in the built environment.

The fundamental principle of UD is the “avoidance of discriminatory design” (Imrie, 2012, p. 874). It stems from a social movement dedicated to creating spaces and utilities that can be used by everyone, regardless of their impairment or any activity limitations (Imrie, 2012, p. 874). It recognises that many environments, including houses, places of work and recreation spaces such as public parks, may contain physical characteristics such as steps or kerbs which present barriers to people with mobility and sensory difficulties, thereby infringing upon their rights to participation and accessibility (Imrie, 2012). Advocates of UD stipulate that “usable design” should extend beyond the use of architectural areas and spaces into the realm of everyday products such as “taps, door handles, telephones and computers” (Imrie, 2012, p. 874). The Center for Universal Design at North Carolina State University in the United States, defined UD as follows: “Universal Design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design” (Center for Universal Design, 1998). The centre further described the aim of UD as “to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost”. With regard to people with disabilities and the incorporation of UD, Imrie (2004) explains that impairment is not something that belongs to a particular group of people, but rather something that is a natural and inherent part of the human condition. In that sense, it is just another natural characteristic among many, within a diverse human society and therefore something that needs to be incorporated into any and all design (Imrie, 2004). In terms of being a social movement, UD promotes the recognition of human diversity in its approach to the development of environments and products (Connell & Sandford, 1999; Imrie, 2004).

In practice and in theory, UD is guided by seven foundational principles in the quest for inclusive use of all environments and products, without anyone experiencing segregation or being stigmatised. These principles are: “equitable use; flexibility in use; simple and intuitive to use; perceptible information – easy to understand; has tolerance for error; requires low physical effort; and has sufficient size and space for approach and use” (Burke, 2013, p. 87). Furthermore, the concept of UD is not disability-specific, but is dedicated to accommodating all groups of people with special needs within the built environment and society as a whole. Imrie (2004) points out that everyone should benefit from UD, not only those who have disabilities. He states that “Universal Design . . . seeks to integrate the accommodation of disability with the basic concept of the design by sensitising the environment to the broadest possible range of body shapes, dimensions and movements” (Imrie, 2004, p. 280). Connell and Sandford (1999) enhance this, stipulating that UD will also benefit children, parents pushing strollers, people with large luggage or shopping, individuals temporarily disabled due to a broken limb, and individuals who are aged (1999, p. 36). The overall goal of UD is “to recognise human diversity” as well as discover ways to enable everybody “to access and use environments and objects in inclusive ways” (Burke, 2013, p. 87).

2.7 Consolidation of the Four Elements

The four elements of the conceptual framework are the participation of people with disabilities; the policy and legislative framework surrounding disability; the changing landscape within engineering practice and education; and finally, the concept of UD. Each of these elements plays a vital role in the conceptual framework, in isolation and in relation to each other. They speak to creating an environment that people with disabilities strive towards, namely, an inclusive society where they do not experience any discrimination whatsoever and where their rights are fully respected.

In the context of an inclusive society, people with disabilities want to be able to move within a built environment that is devoid of physical structures that impede their freedom of movement. This would require the built environment to be conceived, planned and developed according to the principles of UD. In turn, this calls for a working knowledge and understanding of the rights and needs of people with disabilities amongst the professionals involved with the multi-dimensional process of developing the built environment. Civil engineering is seen to be at the heart of developing such infrastructure, and there is evidence of on-going transformation in engineering practice and education to ensure that engineering students develop the skills required to contribute to the development of an inclusive infrastructure. Consequently civil engineering education is being explored within this study (Lawless, 2008). This is how the elements relate to each other and strengthen one another, within the conceptual framework.

2.8 Conclusion of Chapter Two: Conceptual Framework

This chapter gave a detailed description of the conceptual framework of the study. It described the development of the framework, as well as the four elements that comprise the structure of the framework, namely, the participation of people with disabilities; the policy framework surrounding disability; the changing landscape within engineering practice and education; and finally, the concept of UD. It was intended that these pivotal components would provide a thread between the research aims, literature review and discussion in order to strengthen the cohesion of the study. The consolidation of the four elements described their importance and how they contributed to the conceptual framework on their own as well as in relation to each other. The following chapter provides a literature review of current research relating to the various aspects that influence the participation of people with disabilities in society, more specifically, the built environment.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This chapter sets out to explore the literature relevant to the study. It is divided into seven sections which are guided by the elements described in the conceptual framework. The first section examines the prevalence of disability to help gain insight into the magnitude of the problem. This is followed by how disability is being addressed. This section gives an indication as to what is being done to ensure the health and welfare of people with disabilities, as well as protect and promote their basic human rights. The next section examines the experiences of people with disabilities to get an idea of their everyday challenges as well. The chapter then moves on to describe the built environment to learn about the factors that influence its development. This is followed by a description of the current transformation taking place within engineering practice and engineering education. This gives an idea of the environment in which civil engineering undergraduates are being trained. Finally, the chapter closes with a description of the engineering landscape of South Africa which includes a description of the EBE Faculty and the Department of Civil Engineering at UCT.

3.2 Prevalence of Disability

3.2.1 Introduction

The following section explores the prevalence of disability. To gain an understanding of the magnitude of the challenge associated with accommodating people with disabilities in the built environment it is important to have a sense of how many people with disabilities there are living in the world. To begin with, the situation is looked at from a global perspective. Thereafter, the prevalence of people with disabilities living in South Africa is explored.

3.2.2 Global Scenario

The *World Report on Disability (WRD)* released in 2011 puts forward that more than 1 billion of the world's population live with some form of disability (WHO, 2011). This constitutes approximately 15 % of all people living in the world. According to the International Labour Organization (ILO), this makes people with disabilities the largest and most neglected minority group in the word (ILO, 2012). The *WRD* further indicates that this figure is higher than the previous estimate of 10 % of the world population and adds that the prevalence of disability is on the rise due to various contributing factors including poverty, ageing populations, armed conflict, and AIDS (Durocher, Lord, & Defranco, 2012; WHO, 2011). Studies have shown an increased prevalence rate of severe disability, coupled with various chronic diseases, amongst working age populations (Bhattacharya, Choudhry, & Lakdawalla, 2008). Moreover, countries which have experienced armed conflict often have an increased amount of people with disabilities as a result. In the global landscape, people with disabilities constitute a large portion of the population in many countries, however, they continue to endure severe discrimination and segregation (Durocher et al., 2012; WHO, 2011).

The *WRD* was the result of a partnership between the World Health Organization (WHO) and the World Bank and involved the collaboration of many disability stakeholders, including disabled people's organisations, academics, health professionals and policy makers. It has been hailed as a remarkable achievement, setting the benchmark "for disability studies research for evidence-informed policy for years to come" (Bickenbach, 2011, p. 655). There are two factors which have influenced the significance of the report. The first is the inclusion of people with disabilities, and disability organisations, at every stage of the development of the report. Secondly, the report is meticulous about the accuracy of information it represents, particularly the reliability of it. In short, the *WDR* has gathered all the best available information on disability throughout the world and assembled it into one comprehensive document for stakeholders in government and civil society to use in addressing the needs of people with disabilities in developing programmes towards their inclusion in society (Bickenbach, 2011; Durocher et al., 2012; WHO, 2011). The report has been warmly received by stakeholders because, over the years, it has been very difficult to arrive at disability prevalence rates that are internationally comparable, particularly regarding poverty and conflict affected regions where environmental factors make data collection very difficult (Durocher et al., 2012; Madans, Loeb, & Altman, 2011; Mitra, Posarac, & Vick, 2013; WHO, 2011). The situation is exacerbated by the fact that there is no single correct definition for disability. Hence, the varying factors that may influence measuring disability include the concept of disability, impairments, activity limitations, participation restrictions, related health conditions, environmental factors, data collection methods, question design and definition of disability (Madans et al., 2011; WHO, 2011). In 2001 the United Nations founded the Washington Group (WG), whose purpose it was to standardise disability definitions and measurements in a way that is culturally neutral amongst all the UN member states (Madans et al., 2011). Via international agreement, the Washington Group approach has since been adopted by most countries around the world (Madans et al., 2011).

The *WRD* describes disability as “a complex, dynamic, multidimensional concept that engages both intrinsic features of human physiology and functioning – the domain of health – and features of the physical, human-built, social, and attitudinal environment” (Bickenbach, 2011, p. 656). In that sense, the report utilises the *International Classification of Functioning,* *Disability and Health* (ICF) which is integral to the concept of disability throughout the document. This is because the *ICF* explains disability as the interaction between the biological features of the individual and the features of the environment that may prevent that individual's ability to participate or be included (Bickenbach, 2011; WHO, 2011). Furthermore, the report is explicit that people with disabilities represent a diverse group and this is often difficult when set against the stereotypical notions of society which often link disability to wheelchair users and other obvious groups such as the blind and the deaf (Bickenbach, 2011; WHO, 2011). The *WRD* submits that vulnerable populations are disproportionately affected by disability; their social exclusion and poverty may lead to further disadvantages and various forms of discrimination including employment, housing and general participation in society (Durocher, 2012; Filmer, 2008; Mitra et al., 2013).

3.2.3 Disability Prevalence in South Africa

In working towards developing an inclusive society in South Africa that accommodates people with disabilities we need to get an idea of how many people with disabilities there are in the country. South Africa has a poor history when it comes to recording the prevalence of disability (Mitra, 2008; Sing, 2012). Over the last two decades since South Africa became a democracy, there have been many surveys and censuses, however, there has been a severe lack of consistency in the results, particularly regarding the majority of people with disabilities who live in poverty (Loeb, Eide, Jelsma, Toni, & Maart, 2008; Loeb, Eide, & Mont, 2008; Mitra, 2008). Collecting data on disability has been difficult in South Africa due to the absence of a definition of disability, similar to international experience (Schneider, 2009; Sing, 2012).

3.2.3.1 Census 2011

In an attempt to obtain more realistic estimates of disability prevalence, the Census 2011 used questions formulated by the Washington Group (WG). Disability was defined as "difficulties encountered in functioning due to body impairments or activity limitation, with or without the use of assistive devices" (StatSA, 2011). Furthermore, functioning questions relating to the activities of seeing, hearing, walking, communicating, and self-care, remembering and concentrating, replaced questions on disability (StatSA, 2011).

Census 2011 did not report a single figure on disability prevalence as such because of the use of the Washington Group Short Set of Questions on Disability. Instead, it provided information relating to what functions the population had difficulty in carrying out, and what level of difficulty they experienced when undertaking these functions. The results indicate that the vast majority, more than 90 % of the population, had no level of difficulty preventing them from carrying out certain functions. It is important to note, however, that the questions used did not provide for any difficulties experienced resulting from psychosocial, neurological or emotional impairments (Department of Women Children and People with Disabilities (DWCPD), 2013; StatSA, 2011).

3.2.3.2 Current Views on Statistics and Disability Prevalence in South Africa

In their *Baseline Country Report* to the United Nations regarding the implementation of *the CRPD* 2008-2012, the DWCPD report that the "lack of adequate, reliable, relevant and recent information on the nature and prevalence of disability in South Africa remains a challenge" (DWCPD, 2013, p. vi). They stipulate that the constant fluctuation in figures makes it "very difficult to identify enduring patterns and inter-provincial differences, thus rendering analysis of probable reasons impossible” (DWCPD, 2013, p. viii). With regard to the 2011 Census, the DWCPD referred to the fact that over 90 % of the population had no functional difficulty relating to the Washington Group questions. They did however, state that the census gives an impairment prevalence of 10.3 %, or 5 334 905 people, in South Africa (DWCPD, 2013, p. vii). The literature suggests that this could be the most accurate South African disability prevalence estimate to date, particularly when considering that the UN estimate that between 10% and 15 % of the population in developing countries comprise people with disabilities (UN, 2010).

3.2.3.3 Value of Census 2011 statistics

While census 2011 did not provide a single estimate for disability prevalence in South Africa, the breakdown of the various levels of functioning of members of the population could be helpful to several stakeholders (StatsSA, 2011a). For example, *Figure 3.1* below gives an indication of the percentage of population (aged five years and older) that use assistive devices. A focus on mobility would determine that 5.5 % of the population have some degree of difficulty in the activity of walking and use some kind of assistive device, whether it is a wheelchair or a walking frame. This percentage of the population currently represents approximately 2.9 million people in South Africa taking into account that as of May 2013 the population of South Africa stood at approximately 52.98 million people (StatsSA, 2013). Such an amount could provide valuable information to urban and transport planners with regard to how many people would require special needs accommodation within the built environment.

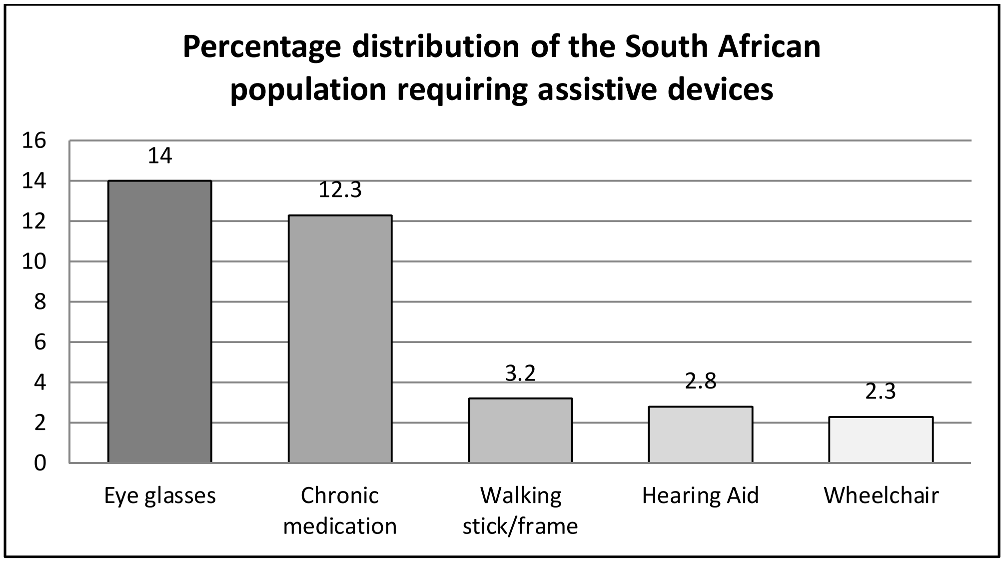


*Figure 3.1.*Percentage distribution of South African population requiring assistive devices (StatsSA, 2011b, p. 46)

3.2.4 Summary of Prevalence of Disability

There are still challenges surrounding collecting data on people with disabilities despite the formulation of the Washington Group and a lack of information and awareness on disability issues remain (Mitra et al., 2013; WHO, 2011). While there have been many surveys and three censuses since South Africa became a democracy, adequate estimates of the prevalence of people with disabilities remains elusive. However, disability prevalence estimates that relate to a level of difficulty of functioning, recorded in Census 2011, appear to be more realistic and potentially provide valuable information to various stakeholders concerned with the needs of people with disabilities in South African society. This would suggest that the incorporation of the *ICF* framework through the Washington Group set of questions on disability can lead to the provision of useful information on people with disabilities within developing countries (Madans, 2013; Schneider, 2009). However, what may still be lacking in the South African context is an understanding of the impact of disability on the living conditions of people living in poverty stricken areas (Schneider, 2009).

3.3 How Disability is Being Addressed

3.3.1 Introduction

This section provides a description of international policy and programmes regarding the needs of people with disabilities and their participation in society. Beginning with the *Universal Declaration of Human Rights,* the section describes the slow rise and recognition of disability rights through the human rights agenda. Landmark international legislation is mentioned along with the attention given to creating a built environment accessible to people with disabilities. The section concludes with the situation in South Africa.

3.3.2 The emergence of Human Rights and a Rights-Based Approach to Disability

In December 1948 the *Universal Declaration of Human Rights* (*The Declaration*) was adopted by the United Nations (UN) in Paris. Comprising of 30 Articles, the declaration establishes the birth-right of all people are human rights and fundamental freedoms (UN, 1948). Despite the fact that people with disabilities are not referred to specifically, O'Reilly (2003) puts forward that they are accommodated under the terms of "everybody" and "all". Article 1 of the declaration states that "*all* human beings are born free and equal in dignity and rights" (UN, 1948) and Article 2 follows on, stating that "*everyone* is entitled to all the rights and freedoms as set out in (the) Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status" (Article 2). Protection from discrimination is soon introduced where "all are entitled to equal protection against any discrimination in violation of *the Declaration* and against any incitement to such discrimination" (Article 7). *The Declaration* goes on to include articles establishing rights regarding nationality, freedom of movement, education and employment before declaring that "everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits" (Article 27).

Hence, the first substantial move towards the establishment of a United Nations human rights system was taken by *The Declaration*, through the protection of specific civil, political, developmental and cultural rights (Rioux & Carbert, 2003). From this human rights point of view, any impairment an individual may have would be regarded as inherent to the human condition and consequently represent something diverse. In that sense, any impairment would not diminish the individuals' potential ability to contribute and participate in society but rather "diversify the range of potential contributions and the range of mechanisms to ensure individual potential is realized" (Rioux & Carbert, 2003, p. 2).

Baylies (2002, p.728) points out that the one direct reference to disability in Article 25 "locates it alongside unemployment, sickness, widowhood and old age, as a factor beyond one's control that, because potentially leading to a lack of livelihood, warrants a right to security." This categorised people with disabilities as being dependent and unable to sustain their own livelihoods (Baylies, 2010). This view of disability would endure for most of the ensuing 20th century until the disability movement of the 1980s and the arrival of the social model of disability (Barnes & Mercer, 2005; Lunt & Thornton, 1994).

Moving forward with regard to further legislation for people with disabilities, there were a few notable policies in the 1970s. In 1971, the UN's *Declaration on the Rights of Mentally Retarded Persons* was adopted, and soon thereafter the *Declaration on the Rights of Disabled Persons* adopted in 1975. This policy was notable in that it first introduced the notion of equalisation of opportunities for people with disabilities (Metts, 2000; Oliver, 1996). The

International Labour Organization's resolution (also adopted in 1975) regarding the *Vocational Rehabilitation and Social Reintegration of Disabled or Handicapped Persons* (ILO, 1975) is also of note. It is suggested that this resolution fuelled a campaign which eventually led to the UN declaring 1981 as *The International Year of Disabled Persons* (UN, 1981). The UN's 1982 *World Programme of Action concerning Disabled Persons* (*WPA*) soon followed (O'Reilly, 2003; UN, 1983b).

The *WPA* was part of a growing disability movement that witnessed the introduction of the social model of disability and, for the first time, the role of the environment as a potential disabling factor was recognised within the official definition of handicap (Rioux & Carbert, 2003). The *WPA* called for the full participation of people with disabilities by the elimination of all barriers. They encouraged countries to establish legal frameworks for the implementation of its objectives. The *WPA* identified the need for a disability to be incorporated into the international development agenda and it had something of a domino effect on disability policy. The United Nations declared 1983 to 1992 as the UN Decade of Disabled Persons (UN, 1983a) as a timeframe for governments to put the *WPA* into action. This was soon followed in 1993 by the *Standard Rules on the Equalisation of Opportunities for Persons with Disabilities* (UN, 1993) (Metts, 2000; Quinn & Degener, 2002; Rioux & Carbert, 2003). The *Standard Rules* set a global standard regarding inclusive and anti-discriminatory policy and essentially signified the endorsement of the United Nations of the human rights approach to disability (Quinn & Degener, 2002).

3.3.3 *The CRPD* on the Rights of Persons with Disabilities

The CRPD and its *Optional Protocol* (UN, 2006) was adopted by the United Nations General assembly on 13 December 2006. *The CRPD* is seen as the reaction of the international community to the long history of exclusion of and discrimination against people with disabilities. It has been hailed as a pioneering policy “in the struggle to reframe the needs and concerns of persons with disability in terms of human rights” (Kayess & French, 2008, p. 2). *The CRPD* comprises of 50 articles which address the full range of social, economic, cultural, civil and political rights (Guernsey et al., 2007). The *Optional Protocol* that joins *the CRPD* enhances a monitoring process and it is ratified separately by a state and this enables the committee to monitor operations. *The CRPD* represents “the first comprehensive international legal instrument specifically for persons with disabilities” and as such its guidelines reflect global consensus and are respectfully regarded as the correct way whereby countries should fulfil their obligations towards their citizens with disabilities (Guernsey, Nicoli, & Ninio, 2007, p. 5). Furthermore, when developing policy and implementation programmes for *the CRPD*, countries are called upon to consult with people with disabilities as well as disability organisations (Kayess & French, 2008). It encourages collaboration amongst all stakeholders in the development and participation of people with disabilities (UN, 2006).

3.3.4 Challenges Facing the Implementation of *the CRPD*

A key challenge to the implementation of *the CRPD* is that it does not offer a definition of disability. It chooses instead to identify people with disabilities rather than defining them, with the intention that all are included and none become excluded (Schulze, 2010). The preamble refers to disability as “an evolving concept and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others” (UN, 2006, preamble). Here, *the CRPD* acknowledges that the state of society and its opinions are not static and therefore provides a perspective of disability that allows for adaptations over a period of time and that is applicable to different social economic scenarios (Kanter, 2006; Kayess & French, 2008; UN, 2010). However, as expressed in the previous section on prevalence of disability, the lack of a concise definition of disability is problematic and controversial (Filmer, 2008; Grech, 2009; Kayess & French, 2008). With regard to the general obligations of countries that ratify *the CRPD*, Lang, Kett, Groce, and Trani (2011) identified three challenges which pertain specifically to developing countries. These challenges refer to the possible lack of effective national disability policy, the potential disconnect between policy and practice that arises out of inadequate, or incapacitated, government practices, and finally a lack of will of implementation from governments and civil society alike (Kanter, 2006, 2008; Kayess & French, 2008; Lang, Kett, Groce, & Trani, 2011).

3.3.5 The South African Context

As described in Chapter 2: The Conceptual Framework (section 2.4.1), the adoption of the new *Constitution* in 1996 brought with it the promise of a new era of freedom and equality for all South African citizens. It should be noted that during the apartheid era, people with disabilities shared the experiences of “a deeply divided people living in a profoundly unequal society” (Howell et al., 2006, p. 48). Furthermore, the experiences of Black and White people with disabilities were very different, and were reflective of the broader inequalities between Black and White people within South African society at that time. Life was a constant struggle for the majority of Black people with disabilities, who had to cope with the daily challenges related to violence and extreme poverty under the apartheid regime (Howell et al., 2006).

However, both Black and White people with disabilities experienced discrimination and marginalisation because of their disabilities and their access to the basic socio-economic rights of education, employment and required health care was limited. This discrimination was due to the fact that people with disabilities were regarded as those who were “sick or in need of care, rather than as equal citizens with equal rights and responsibilities” (Howell et al., 2006, p. 48).

Hence, the change in government brought with it the promise of a better life and the *Constitution* was particularly important as it extended basic human rights to South Africans with disabilities for the first time. Moreover, the fact that *The Constitution* recognised that people with disabilities in particular were discriminated against, marked an historic moment in the disability struggle of South Africa (Howell et al., 2006; Mitra, 2008).

3.3.5.1 Integrated National Disability Strategy (INDS)

Following on from *The Constitution,* a disability desk was set up to deal with matters concerning people with disabilities. The disability desk was incorporated into the Office on the Status of Disabled Persons (OSDP) which was established in 1997. The establishment of the OSDP, which was staffed entirely by people with disabilities, was significant because it ensured that the disability agenda in South Africa had a substantial parliamentary presence (Barnes, 2003; Baylies, 2002; Loeb et al., 2008).

The OSDP began working with all stakeholders in drawing up a new policy document for people with disabilities in South Africa. This document, formulated within the human rights framework and reflective of the country’s new constitution, grew to be the *White Paper on an Integrated National Disability Strategy* (INDS) which was adopted by the government in

November 1997. Furthermore, it was seen to represent the disability perspective of the government, which had incorporated the social model of disability into its policy-making processes (Hay, Smit, & Paulsen, 2006; Howell, 2005; Howell et al., 2006). The *INDS* provided solid guidelines for all stakeholders to follow to increase the participation of people with disabilities in South African society and enable them to access their basic rights and responsibilities (Hay et al., 2006; Howell, 2005; Howell et al., 2006; Loeb et al., 2008). These guidelines are made explicit within 15 designated sectors concerning the participation of people with disabilities in various aspects of life; they include: prevention; public education and awareness raising; health care; rehabilitation; barrier free access; transport; communications; data; information and research; education; employment; human resources development; social welfare and community development; housing; sport and recreation (OSDP, 1997, p. iii). With regard to the built environment, the *INDS* promotes accessibility to enable the participation of people with disabilities. Furthermore, it recognises that beyond the physical environment, it is society that needs to undergo a paradigm shift and become understanding and aware of people with disabilities in order to facilitate their full participation in South African society (Hay et al., 2006; Howell, 2005; Howell et al., 2006).

While the *INDS* described above represents a relatively comprehensive document regarding the implementation of disability rights and practices in South Africa, it has remained a White Paper. In other words it is a full government policy document but it has not been adopted as an Act of parliament, and therefore is not legally binding. In that sense, South Africa does not have a dedicated disability policy such as the *American Disability Act (ADA)* in America (Sherman & Sherman, 2012) or the *Dedicated Disability Act (DDA)* in the United Kingdom (Barnes; 2011). However, although there is no dedicated policy, the current system contains generic policy that applies to certain areas of life (Van Reenen & Combrink, 2012).

The legislation referred to by Van Reenen and Combrink (2012) above, includes the following:

- The *Employment Equity Act* (Act no 55 of 1998) – protects various designated groups from discrimination in the workplace.
- The *Skills Development Act* (No. 97 of 1998) – formulated to improve the overall skills of the national workforce to promote national economic growth and social development.
- The *Code of Good Practise on the Employment of People with Disabilities* (2002) – essentially an implementation guide for employers to facilitate the employment of people with disabilities.

It should be noted that all these South African policies described above (and below) are strengthened by one particular policy not yet mentioned, namely, the *Promotion of Equality and Prevention of Unfair Discrimination Act* (No. 4 of 2000), which extends from the *Bill of Rights* and prohibits the discrimination of individuals by others, including the state, on the grounds of race, gender and disability (Baylies, 2002; Howell et al., 2006).

There is also specific legislation that pertains to the built environment and the accommodation and participation of people with disabilities within it; this legislation includes:

- *SANS 10400: The application of the National Building Regulations, Part S: Facilities for persons with disabilities* (1987). Compliance with the requirements of this document is deemed to be compliant with the requirements of the *National Building - Regulations and Building Standards Act, 1977* (Act No. 103 of 1977).

- *Pedestrian and Bicycle Facility Guidelines* (August 2003) as published by the Department of Transport.
- *SANS 784:2008, Design for Access and Mobility. Part 4: Tactile indicators* (adopted 2008).
- *The National Land Transport Act 2009 (Functions of Minister, 5(4) and 8.*
- *The Public Transport Strategy* 2007.
- *The Accessible Public Transport Strategy* 2011 (Draft).

Hence with regard to the built environment, there are quite a number of policies relating to the accommodation of people with disabilities in South Africa. The next section covering the experiences of people with disabilities will provide an indication of how successful the implementation of these policies has been

3.3.6 Summary of How Disability Is Being Addressed

This section looks briefly at how disability has been addressed internationally since the adoption of the *Universal Declaration of Human Rights,* which initiated the development of the human rights framework of the United Nations. However, people with disabilities only began to be part of that framework during the 1980s with the adoption of the *WPA* (UN, 1983b). This period also witnessed the emergence of the social model of disability. The *Standard Rules on the Equalisation of Opportunities for Persons with Disabilities* (UN, 1993) raised the level of inclusive and anti-discriminatory policy regarding people with disability policy and called for the built environment to be accessible to people with disabilities to enhance their inclusion in society. However, The *Standard Rules* were only a set of guidelines and are not legally binding. The adoption of *The CRPD* and its *Optional Protocol* marked a huge milestone in the establishment and development of the rights of people with disabilities. This comprehensive, legally binding document calls for the full participation of people with disabilities and furthermore, provides governments and all stakeholders with a working framework to address the needs of people with disabilities worldwide. Finally, a brief description of policy in South Africa was provided. Extending from *The Constitution* and *Bill of Rights*, South African disability policy is embedded within the human rights framework and is underpinned by the social model of disability, with various policies pertaining to the rights of people with disabilities.

The following section describes the built environment.

3.4 Describing the Built Environment

3.4.1 Introduction

This section explores what constitutes the built environment as well as the role it plays in the disabling process. There is also a focus on the professionals who work within the built environment, and how they operate together in developing new infrastructure. The challenges involved in creating an inclusive built environment are explored, and finally, the case for incorporating UD is examined.

3.4.2 What is the built environment?

Handy, Boarnet, Ewing, and Killingsworth (2002) describe the built environment as a multi-dimensional concept comprising of "urban design, land use, and the transportation system, and encompasses patterns of human activity within the physical environment" (2002, p. 64). Hartenberger et al. (2013) add that the built environment is "a broad and interdisciplinary field, with many subject disciplines including design, construction, management, economics, law and technology" (p. 61).

The built environment also incorporates the urban landscape and the use of public services as well as the activities related to all the types of land uses (Handy et al., 2002). The term *urban design* is used to describe the layout of a city as well as the arrangement and appearance of the physical elements within it, and is concerned with “the function and appeal of public spaces” (Handy et al., 2002, p. 65). The term *land use* relates to the “distribution of activities across space” and also includes the density and location of different activities (Handy et al., 2002, p. 65). These activities are often further categorised as residential industrial, commercial, etc. (Handy et al., 2002).

A transportation system incorporates the physical infrastructure of roads and sidewalks as well as bicycle paths, railroad tracks, bridges, etc. It is also concerned with the services provided with regard to the modes of transport, level of traffic, bus frequencies and so on (Handy et al., 2002). Urban planners may also look at the travel behaviour of the population in order to plan for transport systems (Handy et al., 2002). Their ability to comprehend the connections between the built environment and human behaviour is the challenge “in the design and management of the built environment so as to promote physical activity” (Handy et al., 2002, p. 73).

3.4.3 Understanding the Role of the Environment in the Disabling Process

For people with disabilities, having access to the built environment is a requirement for the development of an inclusive society (Schulze, 2010; UN, 2006), specifically if it is to be a society where being different represents something to be celebrated, as opposed to being excluded, as is the experience of many people with disabilities currently (Morris in Lister, 2007). There is a growing awareness of the importance of the role of the built environment in the participation of people with disabilities and that many characteristics such as uneven sidewalks, poor road conditions and sidewalk obstacles present barriers to many people with mobility impairments (Clarke, Ailshire, Nieuwenhuijsen, de Kleijn, & de Vrankrijker, 2011). The relationship between people with disabilities, or even people with impairments, and the environment can be explained effectively by the use of the *International Classification of Functioning, Disability and Health (ICF)* (WHO, 2001). The ICF stipulates that functioning, or level of disability, is an interaction between the built environment and the health condition of a person, as well as their personal circumstances as reflected in *Figure 3.2* (Clarke et al., 2011). The following example which compares two individuals who have suffered a stroke further elucidates how this interaction with the built environment works. Clarke et al. (2011) explain that while both individuals are not able to drive any more due to a severe right hemiparesis, they may experience different levels of participation and independence. One of the individuals may live near an accessible public transport system which connects them to their neighbourhood as well as shopping malls, thus enabling them to complete their daily tasks of shopping and banking and visiting friends. On the other hand, the other individual may live far from a bus stop or may even live in a rural area and thus have very little opportunity to travel outside the house to complete various daily activities, a situation which could well lead to social isolation (Clarke et al., 2011). Hence, the example highlights the fact that although these two individuals share the same impairment, it is the built environment that has the most impact on their daily activities, more specifically their ability to participate in society. The barriers that exist in the built environment can have a negative impact on the participation of people with impairments who may be scared or unable to manage on their own (Clarke et al., 2011).

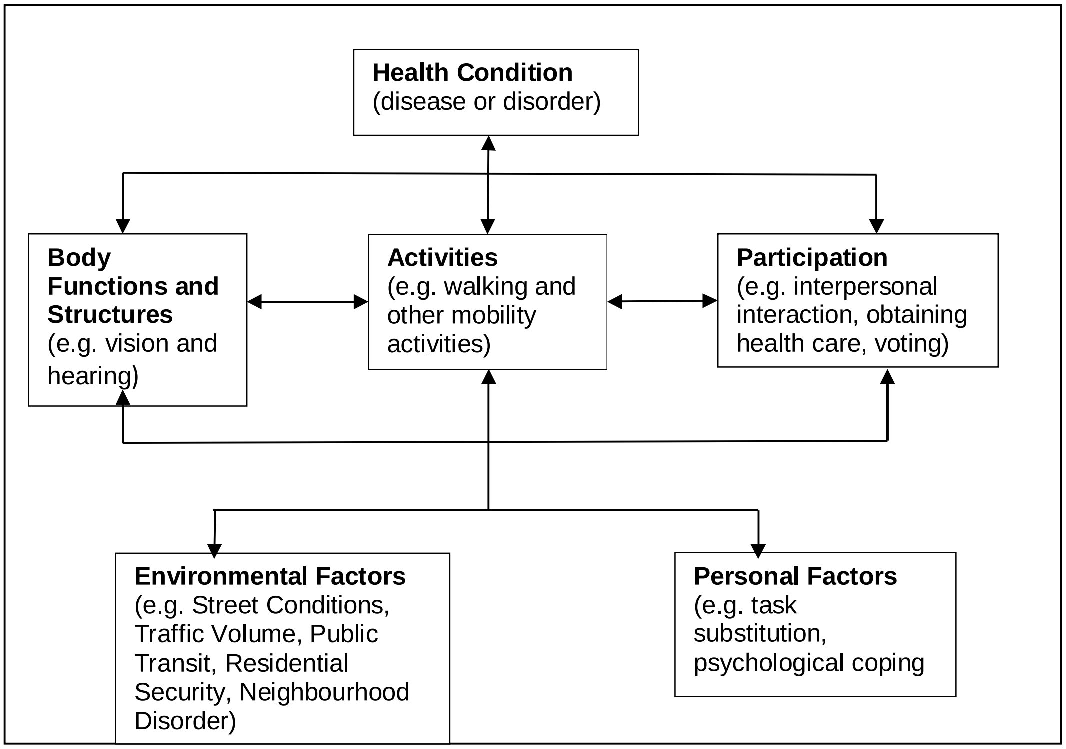


Figure 3.2 Interactions between the components of the ICF model (Clarke et al., 2011, p. 1675).

Hence, with regard to participation of people with disabilities, the built environment has a direct impact at the societal level of impairment (Clarke et al., 2011). Moreover, the participation of people with disabilities is enhanced by the concept of UD, as is discussed later in this section. However, before this can be implemented there are a number of challenges to the inclusive approach.

3.4.4 The Challenge of Inclusion

The literature above has highlighted two important connections when dealing with the built environment. These are firstly, the link between the built environment and human behaviour, and secondly, that the built environment is a multidisciplinary enterprise (Handy et al., 2002; Hartenberger et al., 2013). With regard to developing an inclusive society, Hitch et al. (2012)

stipulate that the design phase of built environments plays a vital role in "the facilitation of people's participation within their respective communities, regardless of individual age, gender, abilities, or capacities" (p. 375). They further identify that the processes relating to the design, construct and modification of these environments "fall under the remit of many disciplines" (Hitch et al., 2012, p. 375).

Hartenberger et al. (2013) describe built environment professionals as "all groups of stakeholders and professions that are directly and indirectly (or in a narrower and wider sense respectively) involved in the design, operation, preservation and development of the built environment" (p. 61). They further add that the complexity of the built environment sector is "reflected in the multitude of stakeholders who shape it, operate within it and use it" (Hartenberger et al., 2013, p. 71). They identified a possible list of stakeholders, in a narrow sense, as the following:

- Architects/designers.
- Landscape architects/town planners.
- Construction engineers (these include civil engineers).
- Construction managers/project managers (these include civil engineers).
- Specialist consultants (e.g., sustainability assessors/auditors).
- Quantity surveyors.
- Facility managers.
- Construction product engineers (these include civil engineers).
- Construction process technicians.
- Mechanical engineers (e.g., for heating, ventilation and air conditioning).
- Plant, energy and waste technicians (Hartenberger et al., 2013, p. 62).

Hence, while the role of civil engineers may be central to the development of infrastructure, the successful development of the built environment requires a large range of professionals (Handy et al., 2002; Hartenberger et al., 2013; Lawless, 2008). Moreover, the awareness of the concept and principles of UD are integral to the development of an inclusive and accessible built environment that strives to facilitate an inclusive society (Hitch et al, 2012). It was established at the introduction of the thesis that an inclusive society requires an inclusive design (Herriot & Jensen, 2013; Persad et al., 2007; WHO, 2011). However, research suggests that a lack of collaboration between stakeholders has presented a major barrier to the broad incorporation and practice of UD and the lack of accommodation for people with disabilities (Afacan & Erbug, 2009; Hitch et al., 2012).

The literature indicates that the majority of built environment professionals do not regard themselves as being part of a larger professional network, tending to remain focused on their specific field of specialisation (Hartenberger et al., 2013). In addition, territorial thinking and competition is prevalent within the built environment arena and there is no sense of common understanding shared among the different professions (Hartenberger et al., 2013). Hartenberger et al. (2013) also stipulate that professionals involved with the built environment do not share any common identity, ideals or professional values like the medical profession do through the Hippocratic Oath.

The Royal Academy of Engineering (in Hartenberger et al., 2013) indicate that the construction supply chain is highly fragmented and that many professions span across the design and development of building projects without any one of them being concerned with the overall sustainable performance of the final structure (2013). Bordass (in Hartenberger et al., 2013) adds that, within the construction industry, “designers design and constructors build and everybody usually disappears as soon as a building is handed over” (2013, p. 63).

Other identified barriers to collaboration between built environment professionals include but are not limited to, the following:

- Lack of understanding of one individual’s role in relation to that of others.
- Ineffective communication, documentation and flow of information between stakeholders.
- Limited understanding of the information needs of third parties (e.g., banks and insurers) (Hartenberger et al., 2013, p. 62-63).

Without a common understanding and responsibility towards the built environment, including incorporation and management of the concept of UD, the implementation of accommodations for people with disabilities may not be carried out effectively, or at all. This scenario lends itself to the need for retrofitting after construction is complete to make the environment accessible. Retrofitting is an undertaking which generally proves to be very expensive and time-consuming (Abraham & James, 2013; Maynard, 2009).

With regards to transport, Maynard (2009) refers to the “journey chain”, explaining that every aspect of a journey, from point A to point B, must be accessible in order for a person with a disability to be able to use it (2009 p. 24). If there is one obstacle at any stage of the journey, it could even be a single step stopping a person in a wheelchair from moving forward, then that travel route becomes inaccessible. In the design of transport infrastructure, the land boundaries generally guide the design and this is where “the devil is in the detail” (Maynard, 2009, p. 23). The challenge is that many of these physical details, and the potential barrier they may present, are not considered with the focus staying on the upgrade of the transport system (Maynard, 2009). The difficulty is that those developing the transport system are not necessarily responsible for determining that the surrounding environment is accessible. Maynard (2009) goes on to describe that issues relating to the transport system and issues related to the physical environment are often dealt with by different internal departments. This often results in “a lack of integrated thinking” which consequently prevents a picture of the entire route and leads to inaccessibility (Maynard, 2009, p. 23). The consequent lack of ability to be mobile within the built environment and/or transport services leads to people with disabilities experiencing “considerable problems with daily activities and social isolation” (Clark, et al., 2011, p. 1684).

3.4.5 The case for Universal Design in the Built Environment

The concept of UD was described in Chapter 2, arguing that the incorporation of the concept of UD should be seen as non-discriminatory in nature and fundamental to the accommodation of people with disabilities in the built environment, as well as in the development of an inclusive society (Imrie, 2004; Larkin, Hitch, Watchorn, & Ang, 2015; UN, 2006). It is important to note that the concept of UD is not only concerned with accessibility for people with disabilities. Rather, the incorporation of UD will be beneficial to the majority of people, enabling the movement within the built environment by many special needs groups such as the elderly, people using wheelchairs, people with mobility challenges, people pushing prams, people with heavy luggage, shoppers with trolleys, as well as employees in general (Burke, 2013; Connell & Sandford, 1999; Darcy & Dickson 2009; Hitch et al., 2012; Imrie, 2004). This is just one of the positives regarding the incorporation of UD.

The concept of UD is recognised as a usable method without adaptation or stigma and one that addresses the requirements of everyone throughout their life course (Hitch et al., 2012). Hitch et al. (2012) declare that these modern attributes need to be incorporated into the concept of community mobility. This sentiment is echoed by the *WRD* which calls for the removal of barriers with an enabled environment in order to develop a "culture of accessibility" (WHO, 2011, p. 170). Hence, it is important to note that the call for the concept of UD to be incorporated into the built environment is not solely a disability agenda. Indeed, many who have little to do with disability feel strongly about the business case of UD. Waller, Bradley, Hosking, and Clarkson (2013) indicate that while every design has the potential to include or exclude customers, the success criteria for businesses include "factors related to people, profit and planet" (Waller et al., 2013, p. 1). Furthermore, there are three aspects related to people. These are the utility, usability and desirability of the product which refers to its functionality, efficiency and the extent to which it motivates a purchase (Waller et al., 2013). Aspects related to profit include commercial viability, technical viability and compatibility with other devices as well as legal and cultural conforms. Finally, aspects related to the planet refer to the product's resource consumption, waste control and energy efficiency (Waller et al., 2013).

Some of these aspects are interrelated and can even be conflicting. For example, if more features are added to a product to increase its utility, there is a possibility that it may become too complicated which would compromise its usability. Hence, thoughtful development and managing is required at all stages of the product so that it is successful in meeting the requirements of the user, the business and the planet (Maynard, 2009; Waller et al., 2013).

Waller et al. (2013) point out that there are three key messages behind the business case for UD. These are:

1. Ageing populations lead to growing opportunities for inclusive products.
2. Inclusive design mitigates business risk.
3. Simplicity can offer competitive advantage (Waller et al., 2013, p. 4).

They further stress that the concept of UD must be incorporated at every stage of development in order to be successful, stipulating the importance of getting the design right at the concept phase and conducting “early-stage user involvement and successive improvement cycles” (Wright in Waller et al., 2013, p. 7). Finally, in establishing their case for UD, Waller et al. (2013) conclude that: “Products that are more inclusive can reach a wider market, improve customer satisfaction and drive business success, especially given the ageing population” (2013, p. 7).

Perhaps the strongest case for UD comes from the tourism industry. It exemplifies the need for people with disabilities to be part of society, and in this particular case, expresses their desire and willingness to travel. Darcy and Dickson (2009) stipulate that just about everybody will need access requirement at some point in their lives, whether this is due to a permanent or temporary injury. Using the example of the Australian population they indicate further that approximately 31% of the population have particular access requirements, as shown in *Figure 3.3* (Dickson in Darcy & Dickson, 2009). While acquiring a disability might be a challenging experience overall it should not reduce the capacity to travel (Darcy & Dickson 2009; UN, 2006). The area of tourism falls under Article 30 of *the CRPD* which relates to cultural industries and ratifying states are legally bound to ensure the right of access to people with disabilities to travel as they please (Small, Darcy, & Packer, 2012).

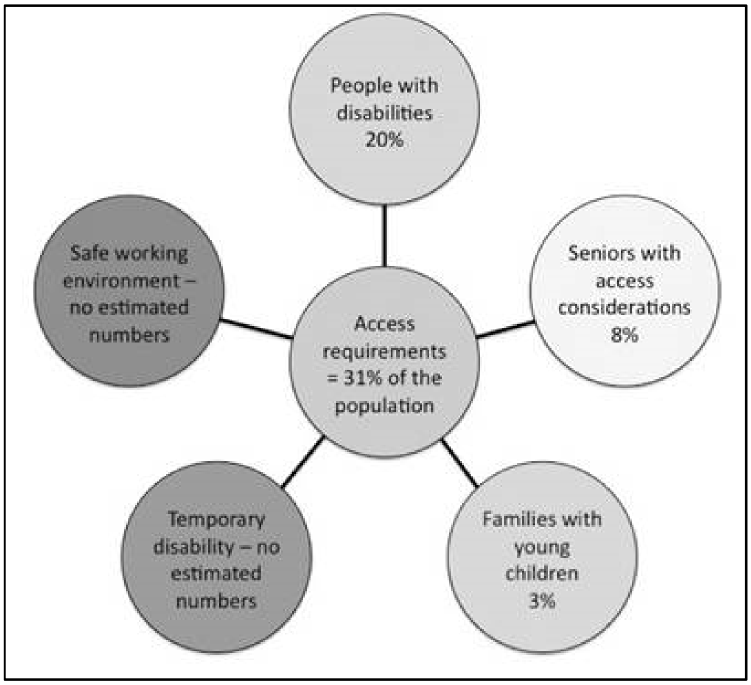


Figure 3.3 Universal Design beneficiaries and proportion of Australians (Darcy & Dickson, 2009, p. 33).

3.4.6 Summary of Describing the Built Environment

This section began by giving a description of the modern built environment, presented as a multidimensional concept related to patterns of human activity within a physical space. Furthermore the various disciplines and stakeholders associated with the environment were described. The role of the built environment in the disabling process was explained. Thereafter, the challenges in ensuring the needed collaboration are described. Finally, the case for inclusion was presented using examples of current legislation, the business case as described by Waller et al. (2013) as well as the benefits associated with accessible tourism for people with disabilities. The following section explores the experiences of people with disabilities.

3.5 Experiences of People with Disabilities

3.5.1 Introduction

This section explores the experiences of people with disabilities in the world today, first focusing on America and Britain before attention is paid to experiences within the South African context.

3.5.2 World Overview

Despite the multitude of policies and legislation on disability as described above, people with disabilities still suffer the same experiences of exclusion and poverty on a regular basis. Globally, people with disabilities experience poorer health, lower educational standards and diminished economic participation, along with the highest rates of poverty in society (Bickenbach, 2011; Durocher et al., 2012; Lang et al., 2011; Meekosha & Soldatic, 2011; Mitra, 2008). Much of this is a result of the barriers that people with disabilities face when trying to access everyday services "that many of us have long taken for granted, including health, education, employment, and transport as well as information. These difficulties are exacerbated in less advantaged communities" (WHO, 2011, p. xi). There is also a historical nature as to how people with disabilities have been treated in the past. In line with the medical model, they were provided for through practices that kept them segregated from general society. For example, in developed countries this involved housing people with disabilities in special residential homes and sending children with disabilities to special schools (Engelbrecht, 2006; Skiba et al., 2008; Swain, French, Barnes, & Thomas, 2013; WHO, 2011). Since the adoption of international policy, such as the United Nations *Standard Rules on the Equalization of Opportunities of Persons with Disabilities* and *the CRPD,* there has been an increased recognition that people are disabled through barriers in the environment as well as their impairments, and traditional solutions have been replaced by more inclusive approaches. In relation to this, implementation of policy and practice of *the CRPD*'s provisions has proved difficult, and its adoption has generally led to greater awareness of the human rights aspect concerning people with disabilities. This in turn has led to the incorporation of disability programmes within national initiatives (Barnes & Mercer, 2005; Gartrell, 2010; WHO, 2011).

Despite this progression of the basic rights of people with disabilities, unfortunately, "national disability legal frameworks remain underdeveloped throughout the world" (Durocher et al., 2012, p. 133). Indeed the domestic law of many countries still carry "blatant discriminatory provisions for people with disabilities" which usurp the goals of access to justice and the full participation in society of people with disabilities (Durocher et al., 2012, p. 133). These provisions include the exclusion of people with disabilities from electoral codes, execution of guardianship laws without associated due process protections, exclusionary banking processes as well as inaccessible judicial systems (Durocher et al., 2012). The persistent poverty and general social exclusion of people with disabilities has resulted in their on-going experience of a range of disadvantages and discrimination including education, employment and participation in the community (Durocher et al., 2012; Filmer, 2008). These same obstacles preclude them from decision making processes regarding their social and economic development, as well as their overall inclusion in the community (Betts & Flower, 2001; Durocher et al., 2012). Moreover, this preclusion from decision making processes and general exclusion from community life is worse for people with disabilities living within developing countries (Durocher et al., 2012).

3.5.3 Attitudes Towards Disability

Attitudes towards people with disabilities are often very negative and often this results in their exclusion from society (Goreczny, Bender, Caruso, & Feinstein, 2011). Negative attitudes may be regarded as "invisible barriers" to the integration of people with disabilities and these perceptions may have a damaging impact on their self-concept and self-esteem. They may also negatively affect a person's perception of their disability as well as their use of vocational rehabilitation services (Hergenrather, Rhodes, & McDaniel, 2005).

Attitudes towards disability are seen to be influenced by a variety of factors including gender, age, race, marital status, level of education, socio-economic status and place of residence (urban versus rural) (Tervo, Azuma, Palmer, & Redinius, 2002). There are two key types of attitudes towards people with disabilities, these are personal and societal (Daruwalla & Darcy, 2005). At a fundamental level personal attitudes are described as beliefs and opinions which are held by an individual about a referent object. Societal attitudes, however, refer to existing beliefs perpetuated by cultural framework, historical background and other prevailing factors. Daruwalla and Darcy (2005) suggest that societal attitudes are the most important and that they are generally more remote and not necessarily congruent with personal attitudes.

It is regarded that the negative attitudes of ignorance, stigmatisation and stereotypes are the predominant cause of barriers to the participation of people with disabilities in society (Boyle, 1997; Minton, 1992; Stone & Colella, 1996; Wordsworth, 2003). They lead to generalisations of disability which are negative and generally untrue and they range from unintentional activities such as forgetting to involve people with disabilities in decision-making processes, to more harmful actions such as intimidation or abuse of people with disabilities (Barnes, 2003).

Within the context of the study it is pertinent to explore student's attitudes towards disability, particularly in those professions that may be directly involved with the rehabilitation of people with disabilities. There have been a number of studies which have looked into various aspects regarding students' attitudes towards people with disabilities (Amosun & Taukobong, 2010; Bizjak et al., 2011; Brown, Peyton, Rodger, Stagnitti, Hutton, & Wu, 2009; Symons, Morley, McGuigan, & Akl, 2014; Vincent-Onabajo & Samson, 2014). Vincent-Onabajo and Samson (2014) stated that the negative attitudes of the students, if retained after qualification, would potentially serve as a barrier to effective healthcare for people with disabilities. They called for "the urgent need to integrate core courses on disability into the undergraduate physiotherapy training curricula in Nigeria that will among other things emphasize the social model of disability" (Vincent-Onabajo & Samson, 2014, p. 15). They also called for the necessity of students to see people with disabilities in their natural environment as opposed to a purely clinical environment. This sentiment was echoed by Amosun and Taukobong (2010), who identified that the exposure to disability of undergraduate medical students is very often focussed on impairment. They recognised the need for medical students to get a perspective of people with disabilities beyond the clinical environment in order to acquire "the specific knowledge, skills, and attitudes required to provide effective service to people with disabilities" (Amosun & Taukobong, 2010, p. 45). Symons et al. (2014) revealed that the exposure of medical students to a curriculum focused on caring for people with disabilities lead to a substantial improvement in factors related to their comfort level around, and attitudes towards, people with disabilities. These findings were enhanced by Daruwalla and Darcy (2005), whose study with tourism employees and students, provided evidence that their attitudes could be positively transformed through an intervention programme with people with disabilities. Such practice is endorsed by the *WRD* (WHO, 2011) which calls academic institutions to “integrate disability education into undergraduate and continuing education for all healthcare professionals” (p. 79).

3.5.4 People with Disabilities and the Built Environment

It is recognised that the built environment plays a crucial role regarding the participation of people with disabilities (Clarke et al., 2011; Barnes, 2011; Darcy, 2003; Frattari, Dalprà, & Bernardi, 2013; Gray et al., 2008; Hammel, Magasi, Heinemann, Whiteneck, Bogner, & Rodriguez, 2008; Imrie, 2012; Shakespeare, 2006). This section expands on that drawing from matters relating to the development of the built environment as well as actual experiences of people with disabilities within the built environment itself.

The *WRD* stipulates that environments “can either disable people with impairments or foster their participation and inclusion” (WHO, 2011, p. 169). Imrie and Thomas (2008) put forward that socio-cultural and environmental challenges hinder the participation of people with disabilities, denying an integral part of their lives relating to movement around and within their environments, both rural and urban. They further identify that these barriers are everywhere, from steps in the pavement that affect wheelchair users to pathways that have no signage in Braille, rendering it difficult for people with visual impairments (Imrie & Thomas, 2008; Packer, Mckercher, & Yau, 2007). Maynard (2009) reiterates this, revealing that the built environment, including its transport systems, is organised in such a way as to create a number of obstacles for people with disabilities, comprising a wide variety of impairments. Furthermore, weak colour contrasting within signage at places like bus stations and train stations hinders the progress of many with visual impairments (Gray et al., 2008; Maynard, 2009; Shakespeare, 2006; Standen & Brown, 2005). Very often this lack of access to the built environment resulted in many people with disabilities being denied many other basic human rights (Clarke et al., 2011; Shakespeare, 2006).

Accessible transport is a key component to participation within society and community life as it provides participation through independent access to areas of life such as healthcare, education and employment, etc. (Hammel et al., 2008; Packer et al., 2007; Shakespeare, 2006). People with disabilities who do not have accessible transport available to them are most probable to be excluded from social interaction (Darcy, 2003; Gray et al., 2008; Hammel et al., 2008). The *World Report on Disability* (WHO, 2011) documents that even in developed countries the lack of accessible public transport remains a problem, denying people with disabilities the ability to move around freely as well as access to services and the community (Darcy, 2003; Gray et al., 2008; Hammel et al., 2008). For example, American citizens with disability cited the lack of accessible transport as the second most frequent reason for not attempting to find employment (Rimmer, Barth, Wang, Rauworth, & Jurkowski, 2004; WHO, 2011). Moreover, accessible railway stations in the UK, by definition, should provide step-free access to each platform from street level (Harrison, Grant, & Conway, 2004).

3.5.5 People with Disabilities and Tourism

Theory on disability tourism has garnered a lot of interest over the last decade, receiving increasing attention across the globe from the academy and government alike (Bizjak, Knezevic & Cvetreznik, 2011; Kim & Lehto, 2012). This is largely due to the fact that people with disabilities have become a large consumer group within the tourist industry. Bizjak, Knezevic and Cvetreznik (2011) report that as far back as 1999, the Wall Street Journal identified people with disabilities as becoming the next consumer niche. They also reported that the European accessible travelling industry catered for 127 million people, which equates to 27% of the European population. More importantly though, is that this represents a market share of approximately USD $117 billion every year. The number of people with disabilities who travel is increasing and it is now acknowledged that the potential wealth they bring is growing as well (Bizjak et al., 2011; Lovelock, 2010). In the United States alone, people with disabilities comprise 51.2 million, or 18.1% of the population and by the year 2030 that number is expected to double to 100 million (Ozturk et al. in Kim & Lehto, 2012). With that, the economic benefit of catering for people with disabilities has been recognised by the hospitality and tourism industry. In order to reap the economic benefits of accommodating people with disabilities, Darcy and Dickson (2009) reiterate that, "understanding and developing a foundation for accessible tourism can be found through the concept of universal design" (2009, p. 34). Improvements in accessibility in various locations around the world have been accompanied by the increase of tourists with disabilities and this is a positive reflection of what can be achieved when people with disabilities are accommodated within the built environment.

Despite this, there are still a lot of challenges to resolve. A study on the experiences of hotel guests with disabilities by Kim, Stonesifer, and Han (2012) revealed that manoeuvrability was still a prevalent difficulty. People with mobility disabilities were concerned about the hotel swimming pool as it did not have special hoists to help them in and out of the pool. They also complained about the lack of handrails and points of transfer within the pool itself (Kim, Stonesifer, & Han, 2012). The main physical environmental barrier for people with visual impairments was lighting and colour contrast, referring to bad lighting in the hallways and near the room doors (Kim, et al., 2012).

A study by Poria, Reichel, and Brandt (2010) looked at the flight experiences of two groups of disability, people who are blind and people with mobility impairments, including wheelchair users and those who use crutches. Many of those using crutches explained that they requested an aisle seat so as not to disturb others when they need to get up. However, some in wheelchairs preferred to sit by the window in order to avoid any contact with other people, particularly if they were nursing a pressure sore (Poria, Reichel, & Brandt, 2010). The key issue for wheelchair users, however, was using the restroom, “which they described as painful and humiliating” (Poria et al., 2010, p. 221). They explained that in order to get to the toilet, they had to be carried by a companion or a flight attendant because the restroom was generally too small for wheelchair use. In order to avoid this scenario wheelchair users had come up with a few strategies. Some would try breaking up the journey into several flights while others would use a catheter or fast before travelling. Others would use a diaper or a bottle while some chose to use a hygroscopic bag (Poria et al., 2010). Some of them related the unfortunate experience of accidentally defecating on board the plane because it proved too difficult to get to the restroom. They describe this experience as both humiliating and painful, particularly because of the unpleasant smell and awkward looks from fellow passengers (Poria et al., 2010). The participants who were blind shared different challenges. They reported being scared of missing information regarding flight schedules and changes of gates for departures and were not always confident that they had heard public announcements properly due to the noise at the airport or the unfamiliarity of a different accent (Poria et al., 2010).

As has been described, travel experiences of people with disabilities generally entail social difficulties besides the physical challenges encountered (Chan & Chen, 2010; Darcy & Dickson, 2009; Kim & Lehto, 2012; Lovelock, 2010; Poria et al., 2010; Small et al., 2012). Hence, many research studies recommend disability sensitivity training for staff and managers within the tourism industry (Kim & Lehto, 2012; Lovelock, 2010; Poria, et al., 2010; Small, et al., 2012).

3.5.6 Inclusive Playgrounds for Children with Disabilities

Burke (2013) indicates that in the quest for developing an inclusive society, internationally there is a growing interest in erecting inclusive public playgrounds that accommodate children with disabilities. The literature has recorded this trend from developing countries such as Egypt and Malaysia, to developed countries including Australia, America and United Kingdom (Burke 2013; Jeanes & Magee, 2012; King, Petrenchik, Law, & Hurley, 2009; Soltani, Abbas, & Bin Awang, 2011).

Jeanes and Magee (2012) report that the importance of play regarding children's development and well-being has been well established. They develop a sense of belonging and acceptance by their fellow peers which leads to the acquisition of social skills and making friends, generally accompanied by a positive improvement on their health (King, Law, King, Rosenbaum, Kertoy, & Young, 2003; King et al., 2009).

In developing these playgrounds, it is important to not only address the potential physical challenges, but moreover, to create an environment "where disabilities are viewed positively" (Jeanes & Magee, 2012, p. 193). It was also stressed that, integral to the process, is working with the children with disabilities and their families (Burke, 2013; Jeanes & Magee, 2012; King, et al., 2009; Woolley, 2013). Legislation throughout Australia, Canada, America and the United Kingdom calls for the development of inclusive playgrounds (Burke, 2013; Jeanes, & Magee, 2012; King, et al., 2009; Woolley, 2013). However despite this legislation, one of the challenges discovered was that there were few designers who knew how to develop these playgrounds for a range of impairments and there was no common understanding amongst designers of what accessibility actually meant (Burke, 2013). As a consequence, some "inclusive" playgrounds were accessible to children in wheelchairs but not to those with other impairments (Burke, 2013).

3.5.7 Attitudes Towards Disability Revisited: the Professional Challenge

Sherman and Sherman (2012) remind us that while it is important to incorporate the principles of UD into education programmes, it is also vital for students and practitioners to understand why they are doing it. The *ADA* has promoted the level of awareness of interior designers with regards the needs of people with disabilities, calling for the profession to incorporate the concept of UD in its practices (Sherman & Sherman, 2012). There are even questions on the needs of people with disabilities within their qualification exams and knowledge of UD and accommodations of people with disabilities as required by the National Council for Interior Design Qualification, in order to qualify for state licensure. Literature reveals that despite this, many interior designers hold negative attitudes towards the *ADA* standards (Sherman & Sherman, 2012; Gray et al, 2003). It is important to understand the reasons behind the perceptions of interior designers. Being able to identify attitude gaps will assist in dealing with the issue of potential discrimination within the interior design industry. If the interior design industry regard the *ADA* as a conduit for effective social change, then interior design professionals have a real opportunity to "make long-lasting inroads to the bias against accepting persons with disabilities into society" (Wehman in Sherman & Sherman, 2012, p. 52).

The research discovered that many interior designers felt that the *ADA* regulations hampered creativity (Gray et al., 2003). Referring to the *ADA*, Designer 8 in the study expressed that "it restricts your design," while Designer 5 declared, "just [do] enough to get it past the city" (Sherman & Sherman, 2012, p. 60). Another participant, Designer 6, was dismissive of people with disabilities, stating that "we have wheelchairs that can [allow a person with a disability to] do almost anything a person with two good legs can do. If you stop to think about that, from just a cost . . . standpoint, it might have been more prudent to give everyone with a disability a free wheelchair [rather] than spend all this money on architecture" (Sherman & Sherman, 2012, p. 60).

Hence, the results highlight a "disconnect between how designers comply with the *ADA* Standards and their understanding of the intent and spirit of the mandate" (Sherman & Sherman, 2012, p. 61). The designers complied with the legislation but regarded it more as punishment than constructive guideline. They did not seem sensitive to the accessibility needs of people with disabilities at all (Sherman & Sherman, 2012). This would suggest that their knowledge about the purpose and potential benefits of universal access is limited (Sherman & Sherman, 2012). While the accreditation standards of the National Council for Interior Design require that interior designers demonstrate an ability to apply the *ADA* standards, there is no call for designers to comprehend the full spirit and intent of the legislation.

Sherman and Sherman (2012) stipulate that since adoption of the *ADA*, "the point has been repeatedly made that laws alone will not bring about attitudinal changes" (2012, p 54.). The ideal that the built environment should "respond to peoples' needs, that it should not diminish, humiliate, or unnecessarily reduce a persons' capacity for living in the world," does not seem to be grasped (Eisenberg, Griggins, & Duval in Sherman & Sherman, 2012, p. 54). It was concluded that, for the concept of inclusive environments to be fully understood and carried out, the designer's awareness of people with disabilities needs to be expanded through an increase in knowledge and dedicated training and education (Sherman & Sherman, 2012).

3.5.8 Experiences of People with Disabilities in South Africa

3.5.8.1 Basic Policy

South Africa ratified *the CRPD* in 2007 and as for most developing nations the ratification of the treaty brought with it the promise of a huge step towards realising the rights of South African citizens with disabilities. Unfortunately, however, progress has been slow.

Ataguba, Akazili, and McIntyre (2011) reveal that the poor in South Africa consistently suffer more disability when compared to the wealthier socio-economic groups. Just over 50% of people with physical disabilities are represented by the poorest 40% of the population (Ataguba, Akazili, & McIntyre, 2011).

The goal of *the CRPD* is to embed people with disabilities within their communities (Guernsey et al., 2007; UN, 2010; Van Reenen & Combrink, 2011). The evidence so far suggests that this is a great challenge. The Department of Woman, Children and People with Disabilities (DWCPD), in their first, country report to United Nations (2008 – 2012) since the ratification of *the CRPD*, declared that "South African society in general, unless directly affected by disability, remains largely ignorant of the rights of persons with disabilities, and in particular of the reasonable accommodation" (DWCPD, 2013, p. 6). They revealed that although awareness-raising of the rights of people with disabilities was high on the agenda of the government, particularly since the ratification of *the CRPD* in 2007, its impact has been weak due to ineffective coordination and implementation, as well as monitoring and evaluation of the initiative.

Moving on to the other two key areas for potential participation of people with disabilities in society, namely, education and employment, things have not progressed very well in South Africa either (DWCPD, 2013; McKinney, 2012). The DWCPD (2013) acknowledge that while policy framework exists concerning the inclusion of children with disabilities into mainstream schools, there have been problems with implementation of the policy and accessibility. As a result, there is a large percentage of children with disabilities who have been completely excluded from the compulsory education system, and in many instances there simply has been no accessible transport to take them to schools, many of which were also inaccessible (DWCPD, 2013; McKinney, 2012).

Turning to the employment of people with disabilities in South Africa, the DWCPD (2013) report recognises that despite enabling legislation such as *the Employment Equity Act* and its *Code of Good Practice* and *Technical Assistance Guidelines* (Department of Labour, 2002, 2007) there has not been much progress in creating economic independence. This is put down to "the lack of access to the built environment and public transport, the interrelatedness between poverty and disability, as well as persistent attitudinal and communication barriers" (DWCPD, 2013, p. 33). Hence, the overall implementation of *the CRPD* in South Africa has not been that effective. Van Reenen and Combrink (2011) felt that South Africa had yet to fully incorporate *the CRPD* into its domestic law, suggesting that the formulation of a comprehensive disability would be the obvious solution in doing so (Van Reenen & Combrink, 2011).

3.5.8.2 The South African Built Environment

This section will focus on the experiences of South Africans with disabilities in the built environment, predominantly through the report back to the United Nations by the DWCPD. As the report is examined, experiences and studies will be highlighted and expanded upon, giving an idea of the current context of the participation of people with disabilities in the South African built environment.

3.5.8.2.1 Slow Progress

The DWCPD (2013) report states that South Africa currently "does not have a regulatory framework that governs universal access and design" (2013, p. 8). They make clear that in their current form, the National Building Regulations and Building Standards Act, 1977, along with the National Guidelines for Accessibility that currently make up the legislative framework of standards and measures contained in the SANS 10400-S document, published in 2011, do not meet the requirements necessary regarding incorporating the universal access principles (DWCPD, 2013). The report adds that the review of government legislation relating to access in the built environment has been an open-ended process and very slow going (DWCPD, 2013).

3.5.8.2.2 Challenges with Informal Settlements

Coulson, Napier and Matsebe (2006) discovered that, for those who live on plots in informal settlements, a common challenge revolves around the use of outside toilets as well as the lack of access to sanitation (Coulson, Napier, & Matsebe, 2006). People with physical and visual impairments in particular, find it very difficult to use deep pit latrines, which are used by 30% of the population of South Africa (StatsSA, 2002). The layout of toilets on the plots renders them inaccessible for many people with mobility impairments. Person with a visual impairment spoke of his embarrassment at having to dig a hole somewhere on his plot in order to defecate in the ground (Coulson et al., 2006). The roads and pavements in the informal settlements also represented a huge challenge to people with disabilities. People with mobility disabilities as well as visual impairments complained about the roads being uneven, rocky and muddy (Coulson et al., 2006). Some wheelchair users could not travel much further than the confines of their plot. While acknowledging that informal settlements, by their nature, would present challenges to the inclusion of people with disabilities, the researchers still felt that there had been a distinct lack of attention given to "integrating barrier free design features" in the development of these settlement (Coulson et al., 2006, p. 337).

3.5.8.2.3 Public Buildings

In terms of public and commercial buildings, Coulson et al. (2006) discovered that people with disabilities in South Africa struggled with a lack of accessible toilets as well. They discovered that access to other service buildings such as railway stations, schools and banks was denied to many people with mobility disabilities because they only had stairs at the entrance (Coulson et al., 2006). This was supported by another study of adults with disabilities which uncovered that escalators, stairs, curbs and uneven terrains present obstacles to people with disabilities within the urban environment (Shumway-Cook, Patla, Stewart, Ferrucci, Ciol, & Guralnik in Maart et al., 2007). Furthermore, the study reported that more than 50% of the sample experienced these barriers relating to public buildings and the researchers expressed their concern that so little had been done regarding making the built environment more accessible, particularly in light of the fact that the study was conducted approximately seven years after the *INDS* was published (Maart, et al., 2007).

3.5.8.2.4 Transport

Moving onto transport systems within South Africa, the DWCPD (2013) documented that in general public transport is not well developed in the country and "remains largely inaccessible and unaffordable to the majority of persons with disabilities" (2013, p. 9). People with disabilities in rural areas (Venter, 2011) and urban areas suffer difficulties with public transport with accessibility and affordability being the two main issues (Lucas, 2011). Overall, the South African transport systems do not adhere to the principles of UD and continue to exclude people with disabilities (DWCPD, 2014; Lucas, 2011, 2012). Maart et al. (2007) point out that for people with disabilities, access to services, employment and education is heavily dependent on the availability of accessible transport. Consequently, given the lack of accessible public transport, all factors relating to education, employment and housing represent major challenges to people with disabilities in South Africa (Maart et al., 2007).

Lucas (2011) suggested that the new Bus Rapid Transport (BRT) systems that were being planned for 12 major urban areas offered the hope of accessible public transport to many previously disadvantaged South African passengers. She does warn, however, that the problem of social exclusion will never be solved by transport-focused policy alone (Lucas, 2011, 2012). The planning for accessibility must incorporate all of the built environment as well as aspects linked to full participation in society such as housing, education, health, responsible land use and welfare programmes (Lucas, 2012).

Research on the BRT systems has produced mixed results. The systems for both Port Elizabeth and Cape Town are reported to provide "convenient and secure access to the facility for the physically challenged and abled commuters" (Adewumi & Allopi, 2014, p. 5). The system in Johannesburg however, was found to be short of expected standards of accessibility. Problems included an unacceptably wide gap between the platform and the bus entrance and ramps that were too steep (Abraham & James, 2013). To make the system accessible now requires retrofitting solutions that will prove very costly (Abraham & James, 2013).

3.5.9 Summary of Experiences of People with Disabilities

The section explained that despite international legislation, the majority of people with disabilities still experience many challenges on a day-to-day basis, especially those who live in developing countries. The predominantly negative attitudes that people have towards disabilities was then described. These attitudes ultimately have a huge impact on the decisions made about the lives of people with disabilities. However, education can play a role in influencing these attitudes positively. Thereafter, the positive aspect of the growing market of tourists with disability was explored. An increase in the number of the number of inclusive playgrounds highlighted another positive factor. However, the lack of expertise in this area of the built environment highlighted a gap in the education of designers. Thereafter, the attitude of interior designers in America was looked into, revealing that legislation alone does not lead to automatic and successful implementation. Finally, the South African context was described highlighting the overall lack of implementation of policy, inaccessible built environment and transport systems. The following section explores the current transformation that is happening within the engineering profession.

3.6 Changes in the Global Engineering Landscape

3.6.1 Introduction

The following section explores transformation that is currently happening within the engineering fraternity worldwide. It explores the new challenges of the modern world that face engineering today, with particular reference to issues of globalisation and social justice.

Moreover, it looks at the modern attributes that modern engineers need to possess, beyond their technical ability, in order to respond to modern demands.

3.6.2 Challenges of a Modern World

In its publication, *The Engineer of 2020: Adapting Engineering Education to the New Century*, the National Academy of Engineering (NAE) of America address the "societal, geopolitical, and professional context within which engineering and its new technologies will exist" (NAE, 2005, p. 3). It recognises that the demand placed upon the engineering profession by America during the twentieth century has moved on somewhat from developing its industrial capabilities and protecting it from the Soviet threat during the Cold War (NAE, 2005). It is felt that engineering, along with engineering education, has lagged behind in addressing the problems of the modern world and the challenges that current and future professional engineers will experience (NAE, 2005; Wulf & Fisher, 2002).

The American Society of Civil Engineers (ASCE) published its revised edition of *Civil Engineering Book of Knowledge for the 21st Century: Preparing the Civil Engineer for the future* (BOK) in 2008. In it is envisioned the global challenges that practising civil engineers would face in the year 2025. It identified a growing "global population that is shifting even more towards urban areas" that would bring with it the new challenge of a much-needed sustainability plan (ASCE, 2008, p. 6). Moreover, these urban environments will be in developing countries that lack the physical, social and economic infrastructure to support a growing population (NAE, 2005). Furthermore, it highlighted issues relating to environmental protection as well as a development of infrastructure related to an increasing demand for clean air, drinking water, energy sources, transportation systems and sanitation systems (ASCE, 2008).

The challenges facing the modern world have been a recognised phenomenon amongst engineers across the globe. In the United Kingdom, the Royal Academy of Engineering (RAE) addressed the situation in their report entitled *Educating Engineers for the 21st Century* in 2007. More recently, the "Global Grand Challenges Summit" was held in London in March 2013.It was a significant and historic event in that it was a collaboration of the three most important national engineering academies, namely, The National Academy of Engineering of the United States, The Royal Academy of Engineering of the United Kingdom, and the Chinese Academy of Engineering (Regli & Heisserman, 2013). The aim of the summit was to gather a multinational engineering community and to harness their expertise for a status report relating to "the challenges common to our global society" (Regli & Heisserman, 2013, p. 1485). There were five key points that emerged from the summit. The first was that the growing global population was going to place a heavy strain on the ability to provide energy, food and water. Second, the need to provide water would exacerbate the difficult challenge of public health care, particularly in developing counties. Third, the role of education was identified as being increasingly important in that it could potentially positively influence cultural changes regarding the use of resources and population growth. Fourth, through the development of new tools and technologies, engineering holds the promise of addressing and resolving the challenges of the modern world. Finally, the summit concluded that it is crucial that the education of future engineers is improved so as to advance engineering practice; it was felt that the public image of engineering needs to be elevated as well (Regli & Heisserman, 2013).

3.6.2.1 Social Responsibility

Baillie and Catalano (2009) explain that in the changing engineering landscape, modern engineers need to develop a social responsibility as they work in "an increasingly complex entanglement of ideas, people, cultures, technology, systems and environments” (2009, p. 1). It is no longer enough for engineers to be technicians. This is because their actions and decisions may have serious consequences for society, as well as the natural environment, and could impact significantly on differing cultures and delicate ecosystems (Baillie & Catalano, 2009; Nieusma & Riley, 2010). They add that modern engineers need to regain their “place as professionals”, appreciate the significance of their work and, furthermore, “take responsibility in a much deeper sense” (Baillie & Catalano, 2009, p. 1; Nieusma & Riley, 2010). Moreover, they stress that engineers need to develop and possess the “ability to respond” to the ever-increasing demands of the world population” (Baillie & Catalano, 2009, p. 1). These demands have precipitated an increasing interest in “engineering for development” programmes amongst engineering communities in North American and across the globe (Nieusma & Riley, 2010, p. 29). There are many projects which are sponsored by educational institutions that run entire courses on sustainable development in these areas. Many of these projects link up with the rising number of non-government organisations which are dedicated to meeting basic human needs in the social justice driven goal to “end poverty through the implementation of technology in poverty” (Nieusma & Riley, 2010, p. 30). Hence these development projects generally have a strong educational focus and their operations rely on a large contingent of engineering students as well as young professionals (Nieusma & Riley, 2010). The idea is that many of these working students will develop the skills, knowledge and insights related to the social and political sciences that all modern engineers need to address the challenges of the modern world (ASCE, 2011; Baillie & Catalano, 2009; NAE, 2005; Nieusma & Riley, 2010; Royal Academy of Engineering (RAE), 2011; Wulf & Fisher, 2002).

3.6.2.3 The Need to Increase Diversity amongst Future Engineers

Approximately 50% of the population in the United States of America will be non-White by the year 2050 (NAE, 2005). Consequently, the engineering profession will need to develop strategies in order to serve a diverse community that is ever-increasing. Furthermore, they should strive to draw students from the communities that have not been, traditionally well-represented within the engineering profession by the year 2050. In both America and United Kingdom, stakeholders have recognised the need to increase representation in future engineers to include racial minorities and women. This is to increase the overall diversity within the engineering fraternity in order to appropriately meet challenges in different cultural environments and societies (NAE, 2005; RAE, 2011; Wulf & Fisher 2002). Furthermore, Wulf and Fisher (2002) point out that it is not only an equity issue, but a workforce and a quality issues as well, expressing that currently the "creative field is deprived of a broad spectrum of life experiences that bear directly on good engineering design" (2002, para. 11).

3.6.3 Future Professional Context of Engineering

Given the challenges of the modern world described above, future practising engineers will find themselves in a difficult professional context. Historically, an expanding knowledge-base has given rise to areas of speciality within engineering, such as biomechanics, microelectronics, photonics, etc. However, in the current and future context, larger and complex development challenges "increasingly require a systems perspective" (NAE, 2005, p. 10).

This approach involves a greater requirement for collaboration between multidisciplinary teams of experts representing different technical backgrounds. For these collaborations to be successful, teams of engineers will need to develop the attributes of “excellence in communication (with technical and public audiences), an ability to communicate using technology, and an understanding of the complexities associated with a global market and social context” (NAE, 2005, p. 10). The multidisciplinary approach will also require engineers to become more flexible, to be receptive to change and to develop a mutual respect for engineers and professionals from other disciplines (NAE, 2005).

The collaboration with other professionals and stakeholders that needs to take place reiterates the necessity to go beyond science and engineering and into the humanities and social sciences (Baillie & Catalano, 2009; Mills, 2011; NAE, 2005; RAE, 2011; Vest, 2006). The development of new paradigms will be essential, as well as an increase in the global talent pool, to address the increasing need for multidisciplinary and system-based approaches (NAE, 2005).

3.6.3.1 Required Attribute of the Modern-Day Professional Civil Engineer

In response to the changing landscape and responsibilities within engineering, ASCE (2008) declare that “the manner in which civil engineering is practised must change”, adding that this change is necessitated by “such forces as globalization, sustainability requirements, emerging technology, and increased complexity with the corresponding need to identify, define, and solve problems at the boundaries of traditional disciplines” (2008, p.1). They also recognise that “as always within the civil engineering profession, change must be accomplished mindful of the profession’s primary concern for protecting public safety, health, and welfare” (ASCE, 2008, p.1).

Hence, it is not enough for engineers to be technicians anymore; they need to develop their abilities beyond technical knowledge (Wulf & Fischer, 2002). The 2025 vision of ASCE regards civil engineers as the future leaders in society, improving quality of life and creating sustainability across the globe. According to them, civil engineers will “serve competently, collaboratively, and ethically as master:

- planners, designers, constructors, and operators of society’s economic and social engine, the built environment;
- stewards of the natural environment and its resources;
- innovators and integrators of ideas and technology across the public, private, and academic sectors;
- managers of risk and uncertainty caused by natural events, accidents, and other threats; and
- leaders in discussions and decisions shaping public environmental and infrastructure policy” (ASCE, 2008, p. 7).

ASCE (2008) established that while professional civil engineers must possess the necessary technical knowledge and skills, they must also have the ability to help society understand “the complex nature of building a safe and sustainable physical environment that supports the needs of the community” (2008, p. 168). Viessman (Viessman in ACSE, 2008) enhances this, indicating that, “engineers must be society wise as well as technology wise” (2008, p. 12). To that end, ASCE (2008) have stipulated a number of professional outcomes that relate not to the technical knowledge required, but rather to the added knowledge and skills they will need in order to have the “ability to respond” to an increasingly demanding society and global challenge (Baillie & Catalano, 2009). These non-technical professional attributes expected of future engineers include effective knowledge relating to the humanities, social sciences, communication, public policy, globalisation, leadership, teamwork, attitudes, lifelong learning and finally professional and ethical responsibility. By and large, modern professional civil engineers are expected to possess a sense of social justice and global citizenship, as well as effective communication skills and the ability to work in a team with a multi-disciplinary approach (ASCE, 2011; Baillie & Catalano, 2009; NAE, 2005; RAE, 2011; Wulf & Fisher, 2002).

3.6.4 Summary of Transformation in Engineering Practice

The section above described how the modern professional engineer needs to have a developed sense of social justice as well as a range of attributes to be able to respond to the challenges of the modern world. Furthermore, it explained how these attributes extend to working in teams, leadership and being an effective communicator with a multidisciplinary approach. This is over and above the technical skills required to be a modern day professional civil engineer. The key challenge that emerges from these new expectations is to readdress and develop the education and training of current and future engineering students to help them develop the attributes required and this is explored in the following section (Baillie & Catalano, 2009; Mills, 2011; NAE, 2005; RAE, 2011; Vest, 2006; Wulf & Fisher, 2002).

3.7 Responses in Engineering Education

3.7.1 Introduction

Following the need for transformation within engineering practice, this section begins by identifying the need for transformation in engineering education and the graduate attributes required of modern students. Thereafter, it explores the methods of teaching deemed necessary to help student engineers develop the attributes they will need in the current engineering profession. In order to do so, it provides a description of the different engineering education systems in use around the world, along with the accreditation processes that have been developed to increase the quality of these systems and the associated challenges in introducing new skills and competencies for modern day engineering graduates. The section then focuses on the prevailing need for a multidisciplinary approach and problem-based learning, as well as incorporating the concept of UD and working in the community, into training programmes.

3.7.2 A Change Required

As referred to in the previous section, "the globalisation of engineering practice is in effect" (King, 2012, p. 1). Currently, large corporations look towards an international pool for the recruitment of engineers. Consequently, there is an increased mobility of engineers across the globe. With that, country-based engineering education systems need to ensure their graduates possess the minimum competencies required to keep them in demand in the international arena (Lucena, Downey, Jesiek & Elber, 2008, p.433). However, it is recognised that historically, engineering practice and education has lagged behind and that current new students need to develop a sense of social justice and global citizenship as well as the attributes of effective communication and being able to work in a team (Borrego & Cutler, 2010; NAE,2005; RAE, 2011).

The education of engineers however, is not consistent and is taking place at various HEIs at various rates, and with a range of methods and pedagogical approaches (Gavin, 2010; Heitmann, 2005; Lucena et al., 2008; Ramos, Afonso, Cruchinho, Delgado, Ramos & Sapeta, 2013; Patil & Codner, 2007). Despite efforts to increase their efficiency and capacity, Engineering education systems are behind the pace of the modern world as they are bureaucratic structures and generally only react and adapt to the needs of their own region, outside of global demands (King, 2012). A possible reason for this is the inherent and extraordinary challenge of "adopting general education principles for all regions or countries that challenge contextualised cultural norms" (King, 2012, p. 2). Furthermore, worldwide the degree remains predominantly technical, one-dimensional and rigorous in nature (ibid). Hence, a change is required; a development of new methods, in the education of student civil engineers (Borrego & Cutler, 2010; NAE, 2005; RAE, 2011).

3.7.3 Graduate Attributes

In recognition that modern companies demanded “broadly-trained employees with cross-functional competencies to compete in highly dynamic markets,” as far back as 2000, Meier, Williams and Humphreys (2000) expressed that the 21st-century workers needed to have “cross-functional inter-disciplinary knowledge, skills, and attitudes which extend well beyond the traditional scope of technological training” (2000, p. 377).

In a study aimed at identifying needs for change in advanced technological education, they discovered that SMET (science, math, engineering, and technology) programmes need to break from tradition and increase their curricula to include the following competencies;

- customer expectations and satisfaction;
- commitment to doing one’s best;
- listening skills;
- sharing information and cooperating with co-workers;
- team working skills;
- adapting to changing work environments;
- customer orientation and focus; and
- ethical decision making and behaviour (Meier Williams & Humphreys, 2000, p. 377).

The need for SMET workers to have developed communication and management skills exposed a gap in general engineering education as depicted in *Table 3.1* below (Meier et al., 2000).

Table 3.1

Current Research: Business & industry perceptions of needed educational competencies for SMET employees (Meier et al., 2000, p. 379).

Areas of greatest curricular strengths	**Areas of greatest curricular gaps**
Advanced technological knowledge and skills	**People and communication skills** **Business management skills**
The ideal SMET worker	

Meier et al. (2000) suggested that the competency gaps are a result of three key curricular factors. Firstly, the traditional engineering accreditation requirements are very prescriptive and allow little time for students to engage in non-technical courses. Secondly, engineering faculties sometimes use the accreditation standards as a reason for not introducing new material into their courses. Thirdly, many lecturers struggle to incorporate non-technical engineering concepts into their courses (Meier et al., 2000). The prevalence of these factors called for a change in the curricular and accreditation process related to engineering education (ibid).

3.7.4 Engineering Education Accreditation

The purpose of accreditation is to set the standard, or the qualification criteria, of a training programme. The key purpose of accreditation is to assure all stakeholders that an accredited training programme (or education institution) has reached a minimum level of competence regarding "their chosen fields of study, thus serving as a form of consumer protection" (Prados et al., 2005, p. 165). The accreditation process may also be used as a means of evaluating and improving the quality of a training programme, as well as providing a platform for international recognition for qualified graduates (Patil & Codner, 2007). There are a number of key stakeholders involved with the accreditation process, these include, inter alia;

- government bodies;
- employees;
- universities;
- students; and
- professional institutions.

Accreditation within engineering education is important for the following key issues:

(a) public accountability;

(b) guarantee for quality;

(c) academic reputation (local and international);

(d) professional recognition and registration;

(e) international mobility;

(f) academic improvement;

(g) educational marketing and competitiveness. (Patil & Codner, 2007, p. 638).

Hence, accreditation may facilitate the improvement of classroom facilities, as well as enhance the reputation of HEIs (ibid). There are two main types of accreditation, namely, progamme accreditation and institutional accreditation and they are undertaken on a voluntary or compulsory basis. The design outline of most engineering education accreditation processes adhere to the following framework;

(a) application (identify needs);

(b) self-assessment (self-evaluation or testing needs);

(c) site visits (cross-checking);

(d) reports (documentation);

(e) results (outcomes) (Patil & Codner, 2007, p. 640 - 641).

The majority of accreditation processes used for engineering education are similar to, or inspired by, the guidelines and procedures of the Accreditation Board for Engineering and Technology (ABET) system (Patil & Codner, 2007; Prados, Peterson & Lattuca, 2005), which is described in the following section.

3.7.5 Abet and the Development of Different Regional Education Systems

As described above, new educational methods in engineering education had to be established in order to increase the skill set of graduates to enable them to address the new engineering challenges of globalization. In response, America and Europe developed new engineering dictation accreditation systems around the beginning of the new millennium to facilitate the introduction, and sustainability of the new educational methods. These accreditation systems were ABET (America), and the Bologna process (Europe). These systems are important as they determine the curricula and the pedagogical approaches utilised (Ramos et al., 2013). The accreditation processes serve to provide a guide as to the quality of the education given and received. It is also important to be cognisant of what should be included in the new training programmes for engineering students (Gavin, 2010; King, 2012).

3.7.5.1 ABET

By the 1980's, the accreditation criteria for engineering education had become overly prescriptive and began hindering the progress of innovative programmes that addressed the needs of a changing industry. To rectify the situation, ABET, along with a full range of stakeholders of engineering education in the USA, developed the Engineering Criteria 2000 (EC2000) which promoted learning outcomes, assessment, and continuous improvement rather than detailed curricular specifications (Patil & Codner, 2007; Prados et al., 2005).

One of the considered strengths of the ABET system was Criterion 3 which refers to the specific graduate attributes required of the modern engineering graduate and includes the following technical and transferable attributes:

(a) an ability to apply knowledge of mathematics, science, and engineering;

(b) an ability to design and conduct experiments as well as to analyse and interpret data;

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;

(d) an ability to function on multi-disciplinary teams;

(e) an ability to identify, formulate, and solve engineering problems;

(f) an understanding of professional and ethical responsibility;

(g) an ability to communicate effectively;

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;

(i) a recognition of the need for, and an ability to engage in life-long learning;

(j) a knowledge of contemporary issues;

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (ABET in Patil & Codner, 2007, p. 641).

Furthermore, ABET utilised outcomes-based criteria and predominantly concentrates on programme accreditation as opposed to institutional or departmental accreditation (Patil & Codner, 2007).

3.7.5.2 Accreditation in Europe: the Bologna Process

In Bologna, Italy in June 1999, the Summit of Ministers of Education of Europe produced the Bologna Declaration towards developing a European Higher Education Area (EHEA) by 2010, also referred to as the Bologna Process (Duran, Moon & Giraldo, 2009; Llamas-Nistal, Caeiro, Castro, Plaza & Tovar, 2013; Patil & Codner, 2007; Ramos et al., 2015). The general aim of the process was to increase employability and the ability of graduates throughout Europe, as well as increase the appeal and competitiveness of higher education systems in and outside of Europe (Duran et al., 2009; Llamas-Nistal et al., 2013; Patil & Codner, 2007; Ramos et al., 2015). A set of objectives was outlined to achieve this aim, they comprised of;

1. the adoption of a system of easily understandable and comparable degrees;
2. the adoption of a system essentially based on two cycles, including a first cycle relevant to the European labour market and a second cycle aimed at specific skills requirements from the industry;
3. the establishment of a system (of accumulation and transfer) of credits;

4. the encouragement of students', teachers', researchers' and other personnel's mobility; cooperation in quality assessment and the European competitive dimension regarding higher education (Ramos et al., 2013, p. 68).

To expand on the second point above, the Bologna process essentially consists of a two tier system involving an initial three-year process to complete an undergraduate engineering degree (first cycle) with an added two year process to complete a postgraduate Master's degree (second cycle) (Llamas-Nistal et al., 2013; Patil & Codner, 2007; Ramos et al., 2015). Prior to the Bologna process a bachelor's degree programme in continental Europe was generally a minimum of five years (Heitmann, 2005).

3.7.5.3 Accreditation Initiatives Elsewhere in the World

Two other regions worth noting are the Asia-Pacific region and Latin America. The swiftly expanding Asia-Pacific region represents the fastest internationally developing engineering education system (Patil & Codner, 2007). Australia was a founder signatory for the Washington Accord and has the most advanced engineering education system. Other countries are at different stages. Korea, Malaysia and Taiwan have recently been made provisional members of the Washington accord, while the Institute of Engineers Singapore and the Japan Accreditation Board of Engineering have already received full signatory status (ibid). The ambition to be a member of the Washington Accord generally indicates an alignment with the ABET education system.

Latin America is strongly influenced by two opposing dynamics America (Lucena et al., 2008). There is tension between the rise of a USA-influenced approach to engineering education as well as the growth of private higher education, and the resurgence of traditional colonial relationships which has witnessed the emergence of the Ibero-American Society for Engineering Education (ASIBEI). ASIBEI has grown large enough to try and establish the accreditation and competencies of Ibero-American engineers. However, this has remained a difficult challenge to overcome, as there remains an ongoing dilemma between "serving national governments and societies and serving multinational industry" (Lucena, 2008, p. 441).

3.7.6 Challenges to the Accreditation Systems

The implementation of the accreditation systems proved to be a challenging experience, both from an organisational and institutional point of view, as well as from the stance of faculty and staff. Organizationally, many HEIs have felt they have lacked support from authorities in incorporating the new accreditation systems. This factor was linked to financial cutbacks in certain areas that many HEIs experienced (Ramos et al., 2013). Furthermore, some have cited a lack of common, regional understanding and approach between them as a hindrance to the process (Llamas-Nistal et al. 2013; Ramos et al., 2013).Another major concern was the lack of consistency among programme evaluators, especially when it came to the "objectives and outcomes components of the ABET accreditation criteria" (Patil & Codner, 2007, p. 642). Furthermore, the ABET system places a great deal of pressure on HEIs to incorporate assessment processes for the engineering training programmes (ibid).

There was scepticism of the new system from some sectors of the engineering industry; this was specific to the Bologna process which called for a reformulation of the civil engineering degree to fit a shorter time frame (Heitmann, 2005). In connection to this, Ramos et al. (2013) indicated that there was also concern amongst academic staff as to the future role of internships, particularly in a discipline which relies on achieving technical competencies.

More specific challenges faced by faculty staff included to the following:

- dealing with a greater workload;
- enormous pressure on HEIs regarding the ongoing assessment of programmes;
- the need for more resources, particularly due to the resource intensive nature of problem-based learning (PBL);
- greater difficulty in evaluating learning – PBL is not reliant on hours spent teaching, but rather on learning outcomes of students which is hard to measure.;
- lecturers were affected by bad planning by universities (Heitmann, 2005; Llamas-Nistal et al. 2013; Patil & Codner, 2007; Prados et al., 2005; Ramos et al., 2013).

In general, many lecturers felt underprepared and unsupported regarding the implementation of the new system (Llamas-Nistal et al. 2013; Patil & Codner, 2007).

3.7.7 Impact of the New Accreditation Systems

By and large, the new accreditation systems were not as effective as anticipated and came under criticism. Despite the significant national and global impact of ABET, the National Science Foundation (NSF) reported in 2008 that changes to engineering education in the USA “have not resulted in major systemic change within engineering education” (National Science Foundation in Borrego, Froyd & Hall, 2010, p. 185). Furthermore, Patil & Codner (2007) complained that most accreditation systems are "non-uniform, too complex, non-transparent and, moreover, non-precise"(2007, p. 639), leading to confusion and about the mutual recognition and global mobility of the engineering profession. Zandvoort, Børsen, Deneke and Bird (2013) supported this and further highlighted the issue of social justice. They indicated that the social responsibility of engineers calls upon their “duty to safeguard or promote a peaceful, just and sustainable world society” (Zandvoort, Børsen, Deneke &

Bird, 2013, p. 1413). In light of that, it has become imperative that engineering education empowers their students to fulfil that responsibility (Zandvoort et al., 2013). However, current engineering education is severely limited in preparing future engineers, particularly in the face of enormous social problems connected to science and technology (ibid). The accreditation and evaluation mechanisms in use today "do not guarantee appropriate attention to teaching for social responsibility" as they "provide no guarantee that the curricula pay sufficient attention to teaching goals that are desirable for society as a whole (Zandvoort et al., 2013, p. 1414).

Shaaban (2014) adds that students would benefit greatly from teachers who have real-world experience. This is in order to improve their engineering judgement, which is integral to becoming a practising professional civil engineer (Shaaban, 2014). Shaaban (2014) further emphasises the need for students to begin thinking independently, to ask why, in order to develop their creativity and innovation. These are skills that they need as future engineers (ibid). This argument is further supported by Meier et al.(2000), who declared that the curricula should be defined by the community and industry and be based on competencies that "prepare students for the demands of the global economic society of the 21st century" (Meier et al.,2000, p. 383).

Despite the shortcomings of ABET and accreditation systems, as well as the slow process of transformation of engineering education, there were signs of significant progress.
Beginning with the USA, ABET authorised a study titled *Engineering Change: A Study of the Impact of EC2000*, to ascertain whether EC2000 influenced student learning outcomes in a representative sample of engineering programmes. The research was conducted in order to answer the question "Are engineers who graduated from programmes since implementation

of the EC2000 standards better prepared for careers in engineering than their counterparts who graduated before introduction of the criteria?" (Prados et al., 2005, p. 170).
The data strongly suggests that the introduction of the EC2000 criteria was changing the face of engineering education. The more striking findings in the Engineering Change Study indicated that:

- 70% (197 in number) of programme chairs report high levels of faculty support for continuous improvement efforts;
- 88% of faculty members report at least some personal effort in programme assessment;
- 95% of programme chairs report ABET is an important source of the increase in their programme's use of assessment;
- about 25%of faculty members report increases in professional development to improve undergraduate engineering education;
- more than 75% of programme chairs report greater curricular emphasis on knowledge and skills central to EC2000 (Prados et al., 2005, p. 171).

With regard to the European context, despite the slow progress and many practical problems and challenges described, there was also recognition of the Bologna process creating an opportunity to improve the previous education system and many teachers had embraced new methodologies (Heitmann, 2005; Llamas-Nistal et al., 2013; Ramos et al., 2013). Indeed, Llamas-Nistal et al. (2013) reported it as "exciting" that 56% of the teachers in their study had changed their approach towards student centred learning process (2013, p. 570). Therefore, while both ABET and the Bologna process were not as successful as hoped and /or anticipated, the road towards the transformation of engineering education had begun on a global basis (Prados et al., 2006; Borrego et al, 2010). More to the point, and of relevance to this thesis, are the transformation steps towards integrating a multidisciplinary approach towards learning in the quest to develop the required graduate attributes of the modern engineer.

Further to that, there were a number of notable initiatives that emerged in response to ABET and the need improve graduate attributes (Borrego et al., 2010). These initiatives were successful in adopting a multidisciplinary approach, as well as incorporating PBL method of teaching (ibid), and they are described below.

3.7.8 Initiatives Emerging from the Accreditation Systems

Despite the lack of the full adoption of ABET and the Bologna Process and the resulting slow transformation process of engineering education, there were a number of significantly successful and ongoing initiatives that incorporate a multidisciplinary approach towards improving graduate attributes (Borrego et al., 2010).

Engineering initiatives across USA include the following;

1. Student-Active Pedagogies: the lecturer utilises a student-active pedagogy that involves regular interaction from students other than taking lecture notes.
2. Engineering Learning Communities and Integrated Curricula: these are designed to assist students in developing socially conceptual connections through a set of multiple courses with the same group of fellow students multiple courses;
3. Design Projects in First-Year Engineering Courses: these were funded by the National Science Foundation (NSF) and involve developing teamwork and the multidisciplinary approach through engineering design projects;

4. Interdisciplinary Capstone Design Projects: these are Capstone design projects where teams of students from multiple disciplines or form to work on projects together; and
5. Curriculum-based Engineering Service-Learning Projects: these projects involve undergraduates linking and working with not-for-profit community organisations to design and develop structures that are beneficial to the community. A prominent one is the EPICS project, which is described in more detail below (Borrego et al., 2010).

With regard to the European context, there is one particular initiative that stands out. Majewski (Majewski in Gavin, 2010) submitted that the civil engineering core curriculum should be redesigned to incorporate outcomes determined by the European Civil Engineering Education and Training (EUCEET) working group and also consider the following;

- what should be taught;
- how should it be taught and learned; and
- who should teach and learn it (2010, p. 177).

With regards to incorporating this ‘core curriculum’ mentioned above, a revised two-tier civil engineering study programme that met the requirements of the Bologna process was achieved with some success by two universities in Poland. These were the Civil Engineering Faculty staff at the Bialystok University of Technology (BUT) and the Wrocław University of Technology (WUT) (Kosior-Kazberuk & Berkowski, 2011). Kosior-Kazberuk & Berkowski (2011) explain that, cognisant of the upcoming changes necessary to the education system, both BUT and WUT had been part of the Socrates and LLL programme of the EUCEET since its inception. They further describe “the elaboration of the core curriculum for studies in civil engineering” as one of the working groups “greatest achievements” Kosior-Kazberuk

& Berkowski, 2011, p. 2). The new programme was based on various education systems to include the “recommended common subjects” that must be acquired by every European civil engineer (ibid). It was also felt that the most valuable factor of the new programme was the incorporation of the relevant competence and skills that students acquire during the teaching/learning process (Kosior-Kazberuk & Berkowski, 2011).

3.7.9 Incorporating Sustainable Development and the Need for Collaboration amongst Built Environment Professionals

Linking back to the issue of the social justice obligation of engineers (Zandvoort et al., 2013), Hartenberger et al. (2013) also identified the need for a new approach in engineering education in relation to the United Nations Decade of Education for Sustainable Development (DESD) 2005 to 2014. As the lead agency for this decade, the United Nations Educational, Scientific and Cultural Organization (UNESCO) declared that “education for sustainable development aims to help people to develop the attitudes, skills, perspectives and knowledge to make informed decisions and act upon them for the benefit of themselves and others, now and in the future” (UNESCO, 2009, para. 3). The “Education for Sustainable Development” (ESD) agenda establishes a framework for many forms of existing educational approaches and new ones that may still need to be created (Hartenberger et al., 2013, p. 61). Furthermore, the primary aim of ESD is to identify whether areas of traditional teaching methods and educational programmes are actually obstacles to sustainable development, and to encourage educational institutions to re-examine their methods (Hartenberger et al., 2013). It has been identified that there is no common identity amongst professionals within the built environment and this may be linked back to the education that these professionals had received (Afacan & Erbug, 2009; Chapman, 2009; Hartenberger et al., 2013).

It is also recognised that while over the last 10 years many courses and electives have dealt with issues of globalisation, most of these initiatives "neglect the complexities of organizational change and its impact on engineering work" (Lucena, 2006, p. 323). Moreover, whether students choose these electives relied on chance or convenience and were not undertaken in a structurally organised manner (Lucena, 2006).

Hence, a paradigms shift is required regarding the higher education of built environment professionals (Hartenberger et al., 2013; Wulf & Fisher, 2002). Chapman (2009) enhances this paradigm shift, stipulating that:

> the challenge for education in the built environment is to prepare our students by developing curricula and learning activities that enable them to develop this new knowledge through active learning and shared explorations: between disciplines, and in the context of the wider environmental and socio-economic interests. (Chapman, 2009, p. 13).

Moreover, he concluded that the crucial first step towards collaborative decision-making amongst built environment professionals was the "integration of analysis and problem-framing between disciplines" (Chapman, 2009, p. 24). He identifies this integration as having the "most transformative potential in interdisciplinary built environment education" (Chapman, 2009, p. 24).

Research suggests there are many benefits of an interdisciplinary education and Gammal (2009) identified the following:

- It is reflective of life, which is not segmented into discrete disciplines;
- it allows for the use of multiple approaches and applications of skills for problem solving;

- it can provide a broader context for new information;
- it allows for a broad use of diverse experiences and knowledge bases;
- it encourages creativity and creative thinking;
- it provides a good introduction and foundation for various disciplines;
- it allows for the use of diverse perspectives; and
- it can enhance the ability to synthesise and integrate information (cited in Wilson & Zamberlan, 2012; p. 333).

The modern-day challenges faced by engineering have encouraged many engineering academies to scrutinise their current engineering education programmes in their respective countries as discussed above (NAE, 2005; RAE, 2011). These academies have met and work-shopped with various stakeholders, including representatives from industry and the academy, to determine the best way forward regarding the future education of engineers (NAE, 2005). From these stakeholder collaborations, many recommendations have been made and in terms of this study, it is pertinent to focus on two particular recommendations and the various challenges associated with them.

As highlighted above, the first recommendation is for tertiary educational institutions to adopt a multidisciplinary approach within the training and education of engineering students (ASCE, 2008; Chapman, 2009; Dong, 2009; Hartenberger et al., 2013; Hitch et al., 2012; NAE, 2005; RAE, 2011; Vest, 2006). The second recommendation is the incorporation of the concept of UD into the training programme of engineering students (Afacan & Erbug, 2009; Dong 2009; Frattari et al., 2013; Hartenberger et al., 2013; Hitch et al., 2012). However, these recommendations are not without their challenges, as described below.

3.7.10 Challenges of the Multidisciplinary Approach

The literature suggests that many of the challenges experienced by engineers in professional practice do not reveal themselves within the discipline-based approach during tertiary education and that interdisciplinary skills are crucial to problem solving in the built environment scenario (Chapman, 2009; Wilson & Zamberlan, 2012). This is because of the multitude of variables present as well as the significant levels of risk involved with everyday professional practice (Chapman, 2009). Furthermore, two forms of interdisciplinarity are noted in literature. The first refers to different domains within a discipline – for example, mechanical engineering and civil engineering are different domains within the engineering discipline. The second form is cross-disciplinary and is “found between the engineering and built environment disciplines and the social science and humanities” (Chapman, 2009, p. 11).

There is a historical aspect to the challenge of introducing an interdisciplinary approach. As seen above, HEIs deliver specific curricula and training programmes based on their past expectations, as well as the expectations of the industry (Hartenberger et al., 2013). This historical aspect is linked to the rivalry and hierarchical thinking that is prevalent between the built environment disciplines and this is perpetuated through “continuous specialisation and division of labour” (Hartenberger et al., 2013, p. 63).

Furthermore, different disciplines within HEIs have created self-imposed boundaries around their various areas of expertise (Chapman, 2009). Along with this, the prevailing attitudes of academics are seen to “impose intellectual borders and institutional structures can also create boundaries between teaching and research” and these attitudes have created divisions between the different disciplines (Chapman, 2009, p. 21). Some early attempts at formulating a “common culture” and language amongst the built environment students proved problematic and were hindered by interpersonal and operational challenges (Chapman, 2009, p. 10). Furthermore, common programmes were found to be difficult to run and more needed to be done to create a common understanding of the terminology and differences related to interdisciplinary studies (Chapman, 2009). Wilson and Zamberlan (2012) support this, pointing out that in recent years there has been a rise in interdisciplinary programmes. Often, interdisciplinary programmes within departments are the result of a particularly innovative lecturer. Unfortunately, in most of these cases these programmes cease to operate if the lecturer leaves the Department (Ohagunwa, MacKenzie, & Lorenzo, 2015; Wilson & Zamberlan, 2012). Despite these problems, however, the interdisciplinary approach was still recommended (Chapman, 2009).

3.7.11 Interdisciplinary Approach in Practice

The faculty of engineering at the Imperial College in London has developed a number of cross departmental programmes to help "support the broader, inter-professional and skills-focused development of engineering students" (Alpay, Ahearn, & Bull, 2011, p. 226). The faculty has incorporated various methods and approaches to develop skills and knowledge awareness of its students beyond the boundaries of single disciplines (Alpay et al., 2011). A unified strategy, with established support structures in place, is coordinated by the faculty of engineering to assist students to "reflect on their learning experience and capture distinct learning outcomes" (Alpay et al., 2011, p. 238). It is felt that this interdisciplinary approach helps to formulate a common identity within engineering as well as motivate students to pursue a career in the profession (Alpay et al., 2011).

Furthermore, it was discovered that the attitudes of staff also improved regarding this approach. Previous attitudes were territorial with a "'getting something for one's department' approach" (Alpay et al., p. 238). However, the approach became far more collegiate in nature, with a growing appreciation of the value of a multi-departmental collaboration (Alpay et al., 2011). Moreover, the academic staff had become open to the idea of collaborating with other engineering disciplines to enhance their own courses, which is an approach beneficial to the teachers and students alike (Alpay et al., 2011).

3.7.12 Challenge of Teaching Universal Design to Undergraduate Students

Rodber and Wormald (in Dong, 2009) identified that the primary challenge to including the concept of UD was changing the "designers' mind-sets from the now hackneyed 'solution providers' to one of 'user-led innovation'" (2009, p. 237).

The next challenge relates directly to the lack of interdisciplinary collaboration. Despite the recommendation of a multidisciplinary approach towards inclusive design, it is suggested that the "perceived complexity" of bringing other disciplines into the design process deters many from this process (Dong, 2009, p. 238). Other challenges involve difficulties related to incorporating user involvement within a large class setting, gaining ethics approval in working with people with disabilities and a shortage of case studies (Dong, 2009; Hitch et al., 2012). Educators also struggled to position the concept of UD within their courses (Dong, 2009). Furthermore, they were hesitant to create a separate course just for UD for fear that students would then regard UD as something only for people with special needs (Dong, 2009; Hitch et al., 2012). Finally, the difficulty of placing the project within real scenarios meant that the students had to create hypothetical problems and it was hard for them to imagine actual situations involving people with disabilities (Dong, 2009; Hitch et al., 2012).

3.7.13 Problem-based Learning (PBL) and Working in the Community

There are two other recommendations regarding new teaching methods for engineering students that are worth noting. These are problem-based learning (PBL) and students working in the community (Ahern, 2010; Coyle, Jamieson & Oakes, 2005; NAE, 2005). Both of these approaches are regarded as promoting interdisciplinarity as well as developing attributes such as teamwork and communication skills. An example of each of these approaches is looked at below.

3.7.13.1 Problem-based Learning (PBL)

Briefly put, PBL involves students working together to define a problem, as well as their learning issues around the problem, after being presented a particular challenge or situation to solve (Ahern, 2010). Students are first presented with the challenge and then lectures and tutorials may follow. The focus is on the students and how they can develop their critical thinking (Ahern, 2010). Research suggests that the PBL approach promotes the motivation to learn within students and also helps them "to improve the softer skills that engineers are so often criticised for lacking: cooperation skills; communication skills; teamwork skills" (Ahern, 2010, p. 110).

Two examples where PBL has been incorporated into the engineering education programme are provided here. Firstly, University College Dublin (UCD) incorporated PBL into two of its transportation courses that are taken in the penultimate and final years of the civil engineering degree (Ahern, 2010). Secondly, the Faculty of Engineering at King Abdulaziz University (KAU) modified its curriculum in 2004 to satisfy the requirements of the Accreditation Board for Engineering and Technology (ABET) accreditation criteria EC2000 described above (Abdulaal, Al-Bahi, Soliman & Iskanderani, 2011). As part of his modifications, the faculty follow the example of several other HEIs and incorporated PBL into their curriculum. They incorporated PBL into two introductory first-year engineering design courses, following on from the experience of Arizona State University (Abdulaal et al., 2011).

The PBL approach has reaped rewards at both institutions (Abdulaal et al., 2011; Ahern, 2010). Ahern (2010) reports that the students at UDC started to think more critically about transport models and "engaged in topics in a way that is impossible in a normal lecture" (2010, p. 116).

They also gained the ability to discuss the merits of various models in much more meaningful ways, as opposed to only describing transport models as they had done in previous years. The students declared that they enjoyed the PBL approach, acknowledging that while it was "messy and difficult", it did help them develop "better team working skills, better communication skills and better research skills" (Ahern, 2010, p. 115).

Abdulaal et al (2011) echo these sentiments, declaring that the PBL approach had a significantly positive impact on the teamwork skills, lifelong learning skills, design skills and communication skills of the students. The approach also enhanced their "use of modern techniques and problem-solving skills" as well as their awareness of local and global challenges (Abdulaal et al., 2011, p.400). Furthermore, it was found to increase the confidence of the students in their own abilities (Abdulaal et al., 2011). Reflecting on their experience of PBL the faculty concluded that;

1. Project-based learning is an efficient learning and teaching model suitable for engineering education;
2. Project-based courses increase the students exposure to engineering design attributes and allow the attainment of higher levels of learning even for freshman-level students; and

3. Project-based learning courses require commitment and sincere work from the course instructors, as well as leadership, motivation and support from the college management, to ensure sustainability (Abdulaal et al., 2011, pp.400-401).

It is worth noting that while PBL is beneficial to students in many respects, as described above, it is also a resource intensive method of teaching (Patil & Codner, 2007).

3.7.13.2 Working in the community

Increasingly, the notion of students working in the community to expand their knowledge, skills and experience has been encouraged (Coyle et al., 2005; Litchfield, Javernick-Will, Knight & Leslie, 2014; NAE, 2005). This approach is regarded as promoting interdisciplinarity as well as developing attributes such as teamwork and communication skills. A current example of a project with students working in the community is provided below.

In addressing the need for engineering undergraduates to be more than just technically solid to be successful, Purdue University in the United States has established, and run a tremendously successful programme for 19 years called the Engineering Projects in Community Service (EPICS) (NAE, 2005).

The EPICS projects are formulated to get engineering students, as well as those from other disciplines, involved in joint activities to “support committee-based organisations that serve community needs in social services, education and environment” (Coyle et al., 2005; NAE, 2005, p. 42). Hence, the students work in teams that are multidisciplinary in nature and take place in a social learning context. The projects are also long-term, with some students staying involved with a single project for a number of years (Coyle et al., 2005; NAE, 2005). Through their work in these projects the students get first-hand experience of real-world problems at a community level, becoming exposed to the various political and economic dynamics that influence engineering in a societal context (Coyle et al., 2005; NAE, 2005). Moreover, the length of involvement of the students gives continuity to the projects and the added technical depth and disciplinary depth of the student teams has a significantly positive effect on delivery to the community (Coyle et al., 2005).

Ultimately, the project creates a win-win scenario between the academy and the community where everyone benefits. The students get credited for their work through the participation in the community project. The benefit of the EPICS approach has also come to the attention of the engineering industry which, as of 2005, has supported such projects at seven different institutions throughout the United States, while the project template has been adopted at 20 institutions in total as of 2014 (Coyle et al., 2005; Hagerman, 2014; NAE, 2005).

3.7.14 Increased Involvement from Industry

In light of the fact that the capabilities of current engineering graduates are falling short of expectations of the engineering industry, Witt et al. (2013) recommend that HEIs and the industry embark on a closer collaboration. Witt et al. (2013) further suggest that the common understanding of definitions and terminology is reached between the industry and education along with the development of a "revised conceptual framework which better reflects the complexity of the HEI-industry context" (Witt et al., 2013, p. 131). This conceptual framework could assist HEIs in becoming more effective in meeting the needs of the built environment sector and society in general (Witt et al., 2013).

3.7.15 Summary of Changes in Engineering Education

This section began with an explanation of the change needed in engineering education as well as the graduate attributes required of engineers for employability and challenges of the 21st century. It then described the introduction of ABET and the other accreditation processes in the world designed to incorporate a multidisciplinary approach to address those challenges. Furthermore, despite slow progress in effecting change in engineering education, the positive move by many HEIs towards adopting a multidisciplinary approach was explained. It then looked at the methods of teaching deemed necessary to equip students with the attributes required for the challenges of the modern world. Teaching methods related to a multidisciplinary approach, as well as the concept of UD, were explored, along with their related challenges. The teaching methods of PBL and students working in the community were also explored. After taking note of the various changes taking place in engineering in the international arena, focus turns to the South African context, which is examined in the following section.

3.8 Engineering Education in South Africa

As the study explores the preparation of undergraduate civil engineering students within the South African context it is helpful to gain an understanding of the state of the nation's engineering education.

3.8.1 South African HEIs: the Professional Civil Engineering Degree

3.8.1.1 The Qualification for Civil Engineering:

The undergraduate degrees that leads towards a professional civil engineering qualification are the Bachelor of Science in Engineering (Bsc Eng) (Civil) and the Bachelor of Engineering (BEng) Civil). Currently, there are six HEIs in South Africa that conduct this training programme, they comprise of:

- University of Cape Town (UCT)
- University of Stellenbosch (US)
- The University of KwaZulu-Natal, (UKZN
- The University of Johannesburg (UJ)
- Universiteit van Pretoria (UP)
- University of Witwatersrand (Wits) (ECSA, 2014).

Most of these engineering faculties have some kind of programme linked to the undergraduate degree to encourage and develop the successful graduation of their civil engineering students. For example, the Engineering and Built Environment Faculty at Wits University has a dedicated for Academic Development Unit to assist struggling students (Wits, 2015). Incidentally, UCT also has a dedicated Academic Development Programme within the EBE faculty (UCT, 2015). Additionally, the Faculty of Engineering at US has Extended Degree Programmes, as well as a language support programme to support students who do not have English as their first language (US, 2015). These extra academic support programmes are designed to support students who have the necessary aptitude for a civil engineering degree, but may not have received the adequate support and training during their school careers (UCT, 2015; US, 2015; Wits, 2015).

Furthermore, A cursory review of the websites of these six universities indicated that all of them have a Disability Service/Unit as well as a dedicated Transformation Office and /or Transformation Charter except for the University of Pretoria, which does express its dedication, however, towards access, throughput and diversity in its strategic objectives (UCT, 2015; UKZN, 2015; UP, 2015; US, 2015; Wits, 2015).

3.8.2 Graduate Attributes: South African Context

The engineering education accreditation system in South Africa is governed by ECSA and like in many other countries that are signatories to the Washington accord, it is closely aligned with the ABET accreditation system (Alves, Flumerfelt, Kahlen & Manalang, 2013).

In line with this outcomes-based accreditation system, degree programmes are accredited according to "the skills and knowledge a graduate has when leaving the University" instead of the amount of hours spent teaching on a particular subject (Martin, Maytham, Case, & Fraser, 2005, p. 167. Hence, the global trend had a direct impact on engineering education in South Africa. Martin Maytham, Case and Fraser (2005), in one of the few research papers regarding South African engineering education, report that after consultation with chemical engineers within the industry, the Chemical Engineering Department at UCT began moving towards an outcomes-based education as early as 1992. The four-year chemical engineering degree was finally accredited as an outcomes-based degree in 2001 by ECSA (Martin et al., 2005). Besides the fundamental sciences, the principles of process engineering are incorporated into the degree "to provide graduates for the chemical and mining industries" (Martin et., 2005, p. 168). To gain an understanding of the graduates' preparedness for industry, an investigation into how they perceived their competencies was conducted (ibid). The study revealed that areas of strength included technical breakdown and problem-solving skills as well as communication skills to some degree (ibid). In particular, it was found that students at UCT benefited from close interaction with the diverse population within classrooms and on-campus (ibid). However, shortcomings involved the ability to work in multidisciplinary teams, as well as a lack of practical preparation, leadership and management skills (ibid).

A key finding was the discovery that non-technical competencies are just as important as technical competencies and Martin et al. (2005) established the following conceptual framework "of how the various graduate attributes fit together in the engineering workplace to build towards success" in *Table 3.2* (Martin et al., 2005, p. 168)..

Table 3.2

A Conceptual picture of graduate attributes and their interactions (Martin et., 2005, p. 168).

Management	
Teamwork	
Communication	
Interpersonal skills	
Technical knowledge	Technical skills

Martin et al (2005) further suggest that competencies of technical knowledge (viewed as the science of engineering) and technical skills (viewed as the practice of engineering) present the foundation of success within the engineering industry. Furthermore, they stipulate that the other attributes of communication, interpersonal skills, teamwork and management skills rest upon that foundation and are integral to success. The relationship between the attributes is shown in *Figure 3.4*.

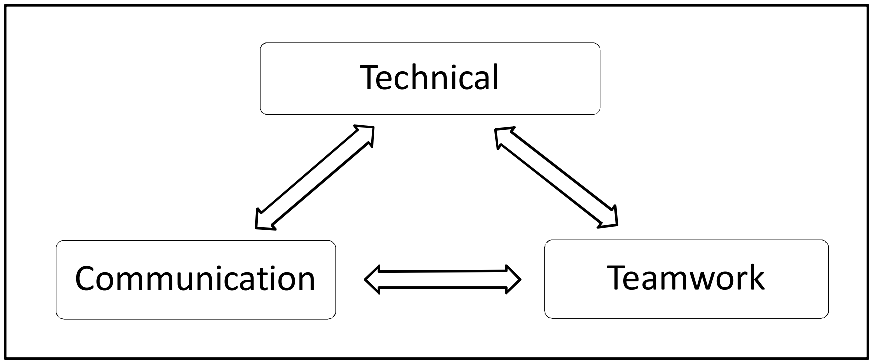


Figure 3.4 The interaction of graduate attributes (Martin et al., 2005, p. 168).

To recap, the study by Martin at al. (2005) highlights the fact that chemical engineering students at UCT struggled through a lack of working within a multidisciplinary approach, as well as a lack of the development of their management and practical experiences. The study also highlights the dual importance of technical and non-technical skills and stipulates that these have a close and symbiotic relationship (ibid). So much so, that it is imperative that future curriculum development must adopt an integrated approach as "the non-technical skills cannot be taught in isolation from the technical context in which they will be used" (Martin et al., 2005, p. 179).

3.8.3 Limited Research

Besides the study above, there appears to have been limited research conducted relating to educational development and engineering students in HEIs in South Africa. The small number of studies that have been conducted focus predominantly on race and gender, and no studies have been focused on issues relating to disability. Jansen examined the response of a university in South Africa to the challenges posed by the Mode 2 knowledge thesis of Michael Gibbon within the Faculty of Engineering at the University of Durban-Westville (currently UKZN) in KwaZulu Natal province which is referred to as a "black university" (Jansen, 2002, p. 407). His research focused on the implications of Gibbon's thesis for knowledge, inquiry and professional identity in a proposed university-industry partnership (Jansen, 2002). Rushton, Skuy, and Fridjhon (2003) conducted a study examining the performance on Raven's Advanced Progressive Matrices by African, East Indian, and White engineering students in South Africa. This study was conducted within the Faculties of Engineering and the Built Environment at Wits University. It showed cross-cultural generality highlighted where difficulties experienced by one race group were problematic for other race groups too (Rushton et al., 2003).

3.8.4 UCT

3.8.4.1 The Importance of Education to Civil Engineering and the Transformation Process

It is evident from the literature that engineering, and more specifically civil engineering, plays a major role in increasing societal equality for people with disabilities. Furthermore, when engineering students make a positive impact on the lives of people who are disadvantaged or socially excluded, the students gain a sense of professional responsibility and compassion (Burke, de Paor, & Coyle, 2010; Gellenbeck, 2005; Ludi, 2007; Mihelcic, Phillips, & Watkins, 2006; Stapleton, Jordanova, Lakov, & Lyng, 2004).

In striving for an inclusive society and social justice for all, it is necessary to develop context-appropriate strategies that assess the suitability of existing interventions that govern the integration of people with disabilities into communities and the workplace. Reviewing existing interventions in the South African context, the researcher is of the opinion that the integration of disability concretisation within delivery systems of government, like HEIs and the operation of civil society, is generally still in its initial stages.

Van Zyl (2008) reported that until students in higher education are trained to be better service deliverers, services will not improve for people with disabilities. This puts focus on the higher education system of South Africa, and more specifically (for the purposes of this study), the education and training programmes of undergraduate civil engineers within tertiary education.

As part of its transformation agenda, UCT has expressed its dedication and willingness to strive "to work actively through transformative dialogue toward creating an institutional environment that is more open, more honest, more trusting, more accommodating, more creative, and at the same time continues to be no less robust as an academic institution" (Macdonald, 2010, p. 80; UCT, 2005, p. 2). Furthermore, the concern over the preparation of future civil engineers within the country prompts reflection upon the words of Wulf and Fisher (2002) at the turn of the millennium. As they faced the transformation process of engineering and engineering education in America, they asked what could be done to increase the student`s "ability to respond" to the complex problems of the modern world. The evolution of this reflection resulted in the focus of this research study regarding the preparation of undergraduate civil engineers to contribute to an inclusive society for people with disabilities. It also directed focus towards the University of Cape Town and its ability to produce socially conscious, global engineers (Pawley, 2009).

3.8.4.2 Background of UCT

The University of Cape Town is the oldest university in South Africa and has a very diverse community with staff and students representing over 100 countries across Africa and the globe (Louw, 1979). On the University's website, Dr Max Price, the Vice Chancellor of the institution, declares that UCT is committed to "producing graduates who are not only well-educated, but also mindful of the responsibilities of democratic citizenship" (University of Cape Town (UCT), 2015a, para. 6). The University is aware that as a HEI it has a responsibility to install strong democratic values in its graduates. As a result, the University is committed to improving and assisting the development and transformation of South African society. The University has partnered with many other institutions to "further enrich the academic, social and cultural diversity of our campus" (UCT, 2015a, para. 4).

3.8.4.3 Transformation at UCT

The transformation of South African Higher Education is essentially informed by two pieces of legislation. These are *Education White Paper 3: A Programme for the Transformation of Higher Education (EWP3)* (1997), and the *National Plan for Higher Education* (*National Plan*) (2001). *EWP3* is a landmark piece of legislation that essentially outlines the framework of the vision of the South African government for the transformation of higher education to "redress past inequalities, to serve a new social order, to meet pressing national needs and to respond to new realities and opportunities (Department of Education (DoE), Foreword, 1997).

The *National Plan* was formulated by the South African government to outline the "framework and mechanisms for implementing and realising the policy goals" of *EWP3* (DoE, 2001, Foreword).It identifies five policy goals and strategic objectives. These are:

(i) To increase access and to produce graduates with the skills and competencies necessary to meet the human resource needs of the country.

(ii) To promote equity of access and outcomes and to redress past inequalities through ensuring that student and staff profiles reflect the demographic composition of South African society.

(iii) To ensure diversity in the institutional landscape of the higher education system through mission and programme differentiation to meet national and regional skills and knowledge needs.
(iv) To build high-level research capacity, including sustaining current research strength, as well as to promote research linked to national development needs.
(v) To build new institutional identities and organisational forms through the restructuring of the institutional landscape of the higher education system, thus transcending the fragmentation, inequalities and inefficiencies of the apartheid past and to enable the establishment of South African institutions consistent with the vision and values of a non-racial, non-sexist and democratic society (Department of Education, 2001).

Looking at the above, it is evident that the new democratic South Africa dedicated itself to the transformation of higher education and institutionalising a new social order (Badat, 2007). With regard to transformation of the HEIs in South Africa, Badat (2007) identifies three key factors. To begin with, he explains that all of the HEIs in South Africa were “profoundly shaped” by the apartheid order and that the “patterns of advantage and disadvantage” continue to influence the current higher education system (Badat, 2007, p. 6). Secondly, he stipulates that the political and socio-economic priorities of the apartheid separate development programme had a deep influence on research and teaching at HEIs. In that sense, it is now the duty of higher education in the post-apartheid era, to “address and respond to the development needs of a democratic South Africa” (Badat, 2007, p. 6). Finally, he identifies three aspects influencing the current challenge of transformation. These are the general pursuit of economic development, social equity and the quest to deepen democracy. He adds that “for good political and social reasons these aspects must be pursued simultaneously” (Badat, 2007, p. 7).

In the new millennium, Macdonald (2010) identified that UCT, as a "historically white and privileged university was positioned as 'in need' of transformation by those within and outside of the university," (p. 75). It is against this backdrop, as well as a context described above, that UCT aligns to the commitment of the *National Plan* towards "achieving diversity in the South African higher education system" (Badat, 2007, p. 16).

The University has established a Transformation Services Office (TSO) to coordinate transformation activities; communication on transformation; policy development; transformation leadership development and advice and support to university committees and stakeholders (UCT, 2014a).

3.8.4.4 The EBE Faculty and Departments of Civil Engineering

3.8.4.4.1 Background

The Faculty of Engineering and the Built Environment (EBE) has come a long way since UCT produced its first engineering graduates in 1918. Today it houses six departments covering engineering and the built environment disciplines. These are:

a) Three departments dedicated to the built environment disciplines:

- Architecture, Planning and Geomatics
- Civil Engineering – Bachelor of Science in Civil Engineering (BSc (Eng))
- Construction Economics and Management

b) Three departments dedicated to the engineering disciplines:

- Chemical Engineering
- Electrical Engineering
- Mechanical Engineering (EBE, 2014a).

The EBE faculty boasts the highest number of engineering research-rated academics in South Africa. Furthermore, the faculty claims to have strong links with industry and government agencies as well as connections with other African universities and leading academic institutions globally (EBE, 2014b).

The BSc (Eng) degrees in Chemical, Civil, Electrical, Electrical & Computer, Electro-Mechanical, Mechanical Engineering and Mechatronics are all accepted by ECSA regarding the academic requirements for registration as a professional engineer and are internationally recognised (EBE, 2014c).

3.8.4.4.2 Department of Civil Engineering

Based on information obtained on the website of the Department of Civil Engineering, the department "offers a fully integrated undergraduate civil engineering programme comprising up-to-date courses in all the traditional branches of civil engineering such as structures, steel and concrete materials, geotechnics, hydraulics, water supply, wastewater treatment and transportation" (EBE, 2015, para. 2).

In 2004, the academic staff restructured the Civil Engineering programme to meet the needs of the modern Civil Engineering industry, while maintaining the fundamental mathematical, physical and engineering sciences upon which Civil Engineering is based. The new programme pays particular emphasis to urban engineering which involves the fundamentals of hydraulics, transportation, roads, water supply and wastewater treatment, and which are applied in several courses including the management of cities (EBE, 2015).

3.8.5 Summary of Engineering in South Africa

This section begins with a review of which South Africa universities offer the professional civil engineering degree and explores some the social justice initiatives associated with it. This is followed by a look at graduate attributes required in the South African context and the discovery that non-technical and technical competencies are equally important. This is followed by an explanation as to the dearth of literature relating to engineering in South Africa. A brief description of UCT followed, along with its transformation duties as a HEI in South Africa. The section ended with a brief description of the Faculty of Engineering and the Built Environment as well as the Department of Civil Engineering at UCT.

3.9 Conclusion of Chapter Three: Literature Review

The chapter set out to describe the literature relevant to the study. The prevalence of disability turned out to be greater than previously estimated and there was extensive international policy that addressed the needs and rights of people with disabilities. Despite the existence of all the policies, the majority of people with disabilities still suffer hardship and discrimination on a daily basis. The built environment turned out to be a multi-dimensional endeavour involving many different professions, which presented a challenge to the incorporation of the concept of UD. Furthermore, the modern world has brought with it new challenges to engineering which have forced the profession to readdress its practice and education. There are new demands on professional engineers which extend to attributes beyond technical knowledge. Moving on to the South African context, the desperate situation linked to the shortage of professional engineers and the urgent need for transformation was made clear. Finally, a brief insight into UCT was provided, including the EBE Faculty and the Department of Civil Engineering.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

At the beginning of the section the rationale for incorporating the production line model into the study is described. The exploratory case study design is then introduced as the choice of research design of the study. This is followed by a description of the study population and a detailed list of the participants is provided. Thereafter the data collection methods are described, including the pilot phase of the study and the development of the interview schedule. This is followed by the data management and analysis techniques. The section ends with a description of the ethical considerations taken during the study.

4.2 The Incorporation of the Production Line Model as Methodology

The researcher's choice of incorporating the concept of the "production line" model into the methodology of this study was influenced by a number of factors. The first factor related to the researcher's background. The researcher has no background or expertise in the field of engineering whatsoever. The daily experiences of the researcher within the built environment were those of a consumer, trying like most of the general public to access and enter public transport systems and buildings. Nevertheless, the researcher was acutely aware of the strong engineering context of the study, as well as the importance of understanding the context in which a research study occurs "towards creating impactful research" (Murphy-Hill, Murphy, & Griswold, 2010). This stirred the interest to incorporate a model related to engineering in order to make it familiar to the engineering stakeholders who would participate in the study.

Once this idea gained clarity, the next challenge was to find the right model that enhanced the methodology and was suitable for the study.

Secondly, the researcher searched literature for examples of conceptual frameworks or research methodologies used in evaluating the preparation of engineering students to enter employment as graduate engineers (Chandrasekaran, Stojcevski, Littlefair, & Joordens, 2012). There does not appear to be any preferred methodology related to the study of engineering education. In a study of inter-professional collaboration and education regarding the movement of people and the aspect of UD, Hitch et al. (2012) adopted a qualitative approach and conducted many interviews and focus groups with 76 participants. Thereafter, the data was analysed by coding, and the outcomes were arranged into themes. Borrego et al. (2012) employ a mixed-methods approach in their study of awareness and adoption of innovative engineering education programmes. The authors gathered information from survey responses from 197 Engineering Department chairs in the United States. Thereafter, they followed an embedded research design where they analysed the quantitative and qualitative data separately and then amalgamated all the data during the analysis phase. While documenting the experiences of Spanish engineering lecturers under the Bologna process, Llamas-Nistal et al. (2013) utilised a less complex, short survey which was distributed via Google forms and only took approximately 5 min to complete. Finally, in their respective studies exploring engineering competence and the accreditation systems, Lucena et al. (2008) and Patil and Codner (2007) both conducted analysis and reviews of selected texts on engineering education. Hence, it became evident that a vast range of methodologies were used in these studies, and the choice of methodology seems to depend on the researcher's preference.

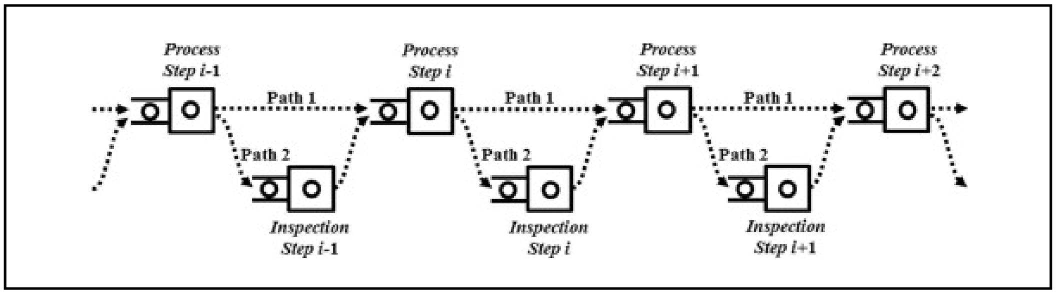
Thirdly, the researcher's selection of the model was influenced by NEPAD's quest to transform the African economy and industry (NEPAD, 2008). NEPAD reported the immediate need for African HEIs "to produce engineers with the knowledge and skills that will enable the region to engage proactively in the competitive global **manufacturing** industry" (NEPAD, 2008, p. 9). It specifically recommended improving the quality of training of engineers through establishing partnership between training institutions and industry, and improving production in Africa. It further recommended that "**production** and research for development of the engineering sector should be considered an integral part in engineering education curricula" (NEPAD, 2008, p. 6). NEPAD's references to "manufacturing" and "production" further influenced the researcher's choice of the production line model in the methodology.

4.3 The General Description of the Model and its Application to the Training of Civil Engineers in South Africa

4.3.1 The Production Line Model

Many different models relating to production lines and assembly lines were explored. Eventually the model by Tirkel and Rabinowitz (2013) was found. The rationale behind using this model was further enhanced by the utilisation of "in-line inspection" at designated inspection steps within the production line process (Tirkel and Rabinowitz, 2013, p. 38). More specifically, these inspection steps along the production line allow for "the measurement and quality assessment of items produced" (ibid) as shown in *Figure 4.1.* This resonates with the key principle of quality assurance in tertiary education, in that the model provided the opportunity to gain insight into what was happening at any stage in the process (Tirkel and Rabinowitz, 2013). This was the underlying value of the model, in that it allowed for the exploration of the relevant stakeholders and external factors at particular stages along the production line process.

Figure 4.1 Production line with inspection steps (Tirkel and Rabinowitz, 2013, p. 40)



While the model was incorporated into this study because it allowed for quality assessment along identified inspection steps at different stages in the production process, it should be acknowledged that originally, the model was used to conduct a cost benefit analysis on the use of inspection within a production line. The work originally stems from semiconductor wafer fabrication, in which "dies are produced on silicon wafers that stream through the production line, via process and inspection steps" (Tirkel & Rabinowitz, 2013, p. 38). Hence, the work is of a technical nature and relies on empirical data. It was not originally designed for a qualitative setting and this is seen as a possible weakness of the model.

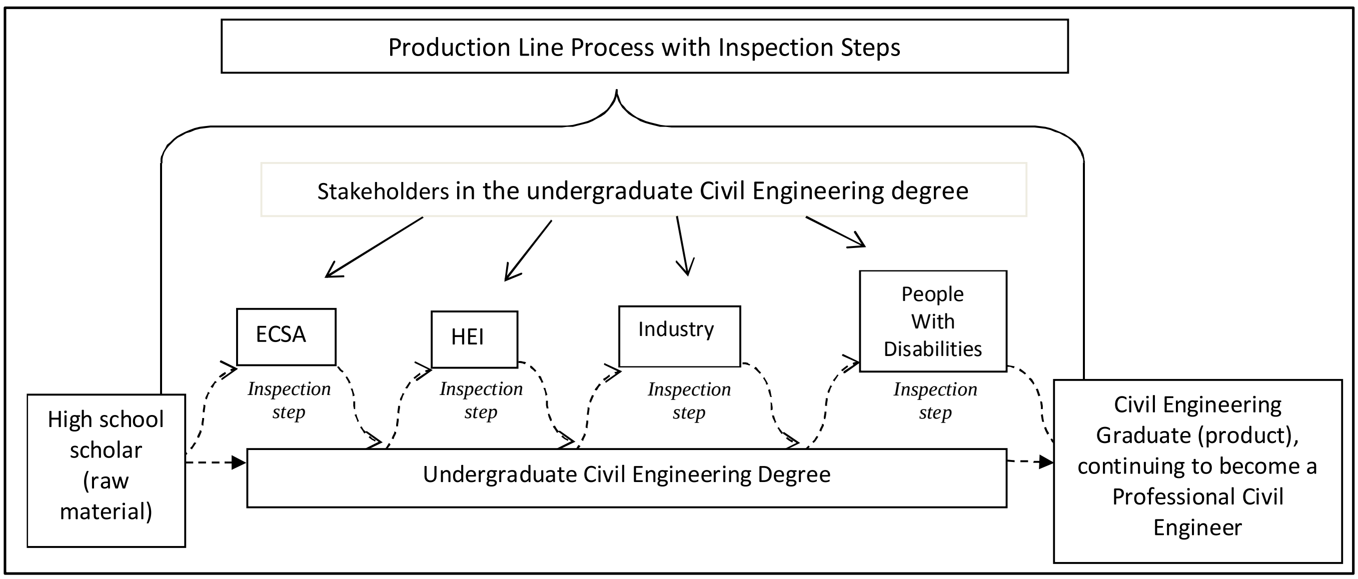
Furthermore, with the aim of minimising production costs, the focus of Tirkel and Rabinowitz (2013) was concerned with improving the performance of machines instead of the process technology. This differs from the current study which is exploratory in nature and concerned with gleaning information related to approaches, resources and experiences of stakeholders within a multiple case study. The difference in context between the studies may also be a weakness. However, Tirkel and Rabinowitz (2013) stipulate that inspection can be used to improve "the quality of the process technology" (2013, p. 38). It is felt that the aspect of inspection that provides a "quality assessment of items produced" is the real strength of the model in both studies (Tirkel & Rabinowitz, 2013, p. 38). Despite the fact that the original study is focused on semiconductor wafers on a mechanised production line, while the current study is looking at the experiences related to the undergraduate civil engineering degree process, both studies share the common factor that inspection allows for the opportunity to assess the quality of the product in order to improve the process method.

4.3.2 Application of the Model to the Training of Engineers in South Africa

The stakeholders in the process of becoming a professional civil engineer have been identified in section 1.4. The stakeholders are mainly the ECSA, the higher education institutions and the engineering industry. However, for the purpose of this study, two additional stakeholders have been identified, namely, the undergraduate students in the engineering education program, and people with disabilities who are seen as beneficiaries of the skills of the graduates of the education programme. The use of the Production Line Model, with inspection steps, in the process of becoming a professional civil engineer in South Africa is depicted in *Figure 4.2*. Utilising the model, the civil engineering undergraduate is viewed as the "raw material" that is being fashioned towards becoming a civil engineer graduate (the product). Furthermore, and emphasising the strength of the model, the use of the inspection steps provides an opportunity to explore the roles of the interested stakeholders and their impact on the process. This also allows for an assessment of the quality of involvement of each stakeholder along the production line process (Tirkel and Rabinowitz, 2013), potentially offering insight into what could be modified and improved. As the governing body of engineering practice and education in South Africa, ECSA plays the role of "quality controller" within the process; the HEI where the undergraduate civil engineering degree is conducted is viewed as the "factory" where the raw materials (high school graduates) are being refined to become the product (civil engineering graduates); the employers of civil engineering graduates, the Industry, are seen to "utilise and refine" the product further in the process of becoming a professional engineer; and finally, the recipients of the skills, practices and expertise of civil engineers, the society, or in this case, people with disabilities, are viewed as the “consumers” of the product.

It is important to note here that this view of students as “raw materials” is not intended to dehumanise students in any way, or even homogenise them as being all the same and take away their individuality. Rather, it is merely to extend the analogy of the production process, to show that becoming a civil engineer is a process of gradual refinement towards becoming a specific, specialised product.

Figure 4.2: Phase 1 of becoming a Professional Civil Engineer in South Africa



4.4 Research Design

The study adopted a qualitative exploratory case study research design, involving multiple-cases. These provided the researcher the opportunity to explore an area of interest in greater detail. Case studies aim to provide an in-depth, descriptive and holistic view of a single entity, phenomenon or social unit through the use of multiple sources. Furthermore, they are conducted in natural settings and provide insight into how phenomena operate or function over time in the real world. Yin (1984) describes the case study research method as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (1984, p. 23).

Case studies rely heavily on inductive reasoning when dealing with multiple data sources within a real-life context (Cornelisse & Clark, 2010; Hyde, 2000; Merriam, 1989; Yin, 2003). The case may involve any unit of social life organisation, in other words, an individual person, communities, cultural groups, phenomena, workplace environments, institutions, events, programmes or policy and legislation (Berkes, 2004; Caldwell, Herold, & Fedor, 2004; Yin, 1984).

An exploratory case study design may be utilised when there is not a clear, single set of outcomes to the intervention that is being explored (Yin, 2003). In that regard, the exploratory case study design is good when analysing that which is common and that which is different, particularly when dealing with cases that have similar major criteria (Easterbrook et al., 2005). They are also suitable for pilot, or preliminary studies where there is no clarity as to what phenomena are significant, or what method to use for measuring the phenomena (Easterbrook et al, 2005). In many cases, exploratory case studies do not require an initial specific hypothesis. The exploratory case study design seemed appropriate for this study in that it was addressing a phenomenon that was not yet known. Hence there is no clarity regarding the outcomes of intervention (Yin, 2003).

4.5 The Research Setting

4.5.1 The Department of Civil Engineering at the University of Cape Town

The Department of Civil Engineering is one of seven departments within the EBE faculty. The department is actually the oldest one in the nation, and possibly Africa, having been established in 1910(UCT, 2016). Currently, the Department has a staff component of 47 academics. In 2013, there were 650 civil engineering students registered at the University. These comprised of 424 undergraduate students, 14 postgraduate diplomas, 187 students doing their masters' degree, and 25 students that undertook a doctoral thesis. The annual intake of first year students has been slowly increasing and in 2016, the Department welcomed 130 new first-year students.

The commitment of the University to infuse transformation into teaching, learning and research, galvanised the interest of the researcher to ask the question, "Are undergraduate civil engineering students at UCT being prepared to contribute to the development of an inclusive society that accommodates people with disabilities?" Initial enquiries suggested that, at the moment, the curriculum for the programme does not prepare the students for such a role. This stirred the researcher's interest to explore the process by which the students may be prepared to contribute to the development of an inclusive society that accommodates people with disabilities. *Figure 4.3* provides a clear depiction of the infusion of the production line model into the methodology used in exploring the preparation of undergraduate civil engineering students within the UCT Department of Civil Engineering.

4.6 Study Participants

4.6.1 Sampling

The method of purposeful sampling was undertaken in the study. The hypothesis that the investigator wishes to understand and gain insight into, and subsequently selects, “a sample from which the most can be learned” is the basis of purposeful sampling (Merriam, 1989, p. 61). In addition, purposeful sampling involves a researcher selecting a sample based on their “own knowledge of the population, its elements, and the nature of your research aims” (Babbie & Mouton, 2004, p. 166). In this study, the process of sampling was viewed as purposeful, in that the selected participants were deemed to be the most knowledgeable with regards to the research topic. A convenient sampling process was utilised to select the lecturers and students in the study. Many participants were also then chosen according to their availability, particularly the lecturers at the UCT Department of Civil Engineering.

4.6.2 Selection of Participants

In the case of a multi-dimensional concept such as the built environment, the education of civil engineers that contribute to an inclusive society that accommodates people with disabilities will be a multi-dimensional process (Dong, 2009; Handy et al., 2002; Hartenberger et al., 2013). This will involve various key stakeholders, including those that govern the education of the students, as well as the consumers of what they have been taught. The stakeholders that govern the education of the students would include the tertiary education institution where they undertook their civil engineering degree, as well as the controlling body for the profession and the profession itself, because they maintain the requirements as to what the students are being taught. The recipients of what civil engineering students are being taught are represented by society in general, as they use the services and infrastructure that sustain and enhance quality of life on a daily basis. The experiences of people with disabilities, presented in Chapter One, focused on how they were excluded from society, because the built environment did not accommodate their needs. Hence, people with disabilities would represent an interested party in what future civil engineers were being taught, particularly with regard to the accommodation of people with disabilities in the built environment.

In this exploratory process the idea was to get insight from each of the stakeholders with regard to their approaches, experiences and challenges related to the undergraduate civil engineering degree. Hence, an interview process with a selection of representatives from each stakeholder (besides ECSA) was identified.

ECSA

There were difficulties in engaging with representatives of ECSA. This inspection step therefore involved reading through the documents on the website of ECSA to gain an insight into its operations. This is expanded upon in section 4.8.3 Main Study.

UCT

In order to get a clearer insight into the transformation and social responsiveness aspects of the University, as well as the experiences and challenges surrounding the undergraduate civil engineering degree, the participants from UCT were split into two sections, namely, participants outside the Department of Civil Engineering and participants inside the Department of Civil Engineering

UCT: Outside the Civil Engineering Department

The aim was to conduct interviews with participants who represented top level staff concerned with maintaining the standard and reputation of academic programmes, as well as the overall management of UCT as a higher education institution of South Africa. This was to gain an idea of the university's stance and commitment towards creating an inclusive society. Of those representing Outside of the Department, the following participants were targeted and interviewed:

- The Registrar of the University, or his nominee, to represent the management of the University. The registrar is the overseer of all operations regarding policy, education and everyday function of UCT.
- The Deputy Vice Chancellor (Transformation) is a key member of the University leadership. He is responsible for monitoring the implementation of the transformation agenda.
- The Director of the Disability Service, which is a unit that works towards the removal of any barriers that might prevent students and staff with disabilities from fulfilling their potential. The unit also advocates the policy of equal opportunities adopted by the University.
- The participants from the Faculty of Engineering and the Built Environment, where the civil engineering programme is based, included:
    - The Dean of the Faculty, who is the overseer of the policy, operation and education within the faculty and all its departments.
    - The Transformation Officer of the Faculty, who is responsible for the transformation agenda of the faculty.

- o The Chairperson of the Undergraduate Education Portfolio of the faculty, a portfolio that is responsible for monitoring the education and training of all undergraduates at the faculty.

UCT: Inside the Civil Engineering Department

The aim was to interview participants who were at the coalface of running the undergraduate civil engineering degree, including the Head of Department, the lecturers, and the students. This was to get insight into their experiences and challenges, not only in running the degree as such, but also in carrying out the transformation policies of the University while doing so. The following participants were targeted and interviewed:

- The Head of the Department of Civil Engineering, who is the overseer of the policy, operation and education within the Department of Civil Engineering.
- The lecturers of the Department of Civil Engineering, who are responsible for facilitating learning according to the accreditation requirements and standards defined by the Engineering Council of South Africa and UCT. A focus group interview consisting of a convenient sample of seven lecturers was conducted.
- The students and graduates - besides the stakeholders interviewed along the production line process, the students were identified as the ‘raw materials’ going through the process of becoming professional civil engineering graduates. On graduating from the university, they are considered as the ‘products’ of the undergraduate civil engineering degree. As such, the researcher assumes they have a rich experience of the production line process. Therefore, it was deemed pertinent to gain an insight into their reflections of the process as a whole to further identify key areas of common interest for the stakeholders, in line with the aim of the study.

The two groups were targeted and interviewed; the current students in the undergraduate programme; and the graduates of the undergraduate programme. Of the first group (current students), the researcher conducted interviews with:

- Four students from year one of the undergraduate civil engineering programme
- Four students from year two of the undergraduate civil engineering programme
- Four students from year three of the undergraduate civil engineering programme
- Four students from year four of the undergraduate civil engineering programme

Of the second group (graduates), the researcher conducted interviews with:

- Two graduates of the UCT civil engineering programme

Industry

The demands of Industry uphold and inform the on-going provision and standard of engineering in South Africa. This includes the level of technical knowledge and range of desired graduate attributes of civil engineering graduates from UCT. Therefore it is vital to gain insight into the approaches, resources and experiences of industry relating to the UCT undergraduate civil engineering programme. In line with existing structures in civil engineering practice in the country, the researcher targeted and interviewed four participants in the industry - two civil engineers who had experience with consulting (designing and project management); a civil engineer who had experience with construction; and a civil engineer who had experience in both the public and private sectors.

It is important to point out that a consulting civil engineer does not refer to a civil engineer who is working on a consulting basis – rather, in this case, the term “consulting” refers to the practice of designing and overseeing a project on behalf of a client. This is usually done in close collaboration with a construction civil engineer who is working on behalf of the construction company in the development of that project.

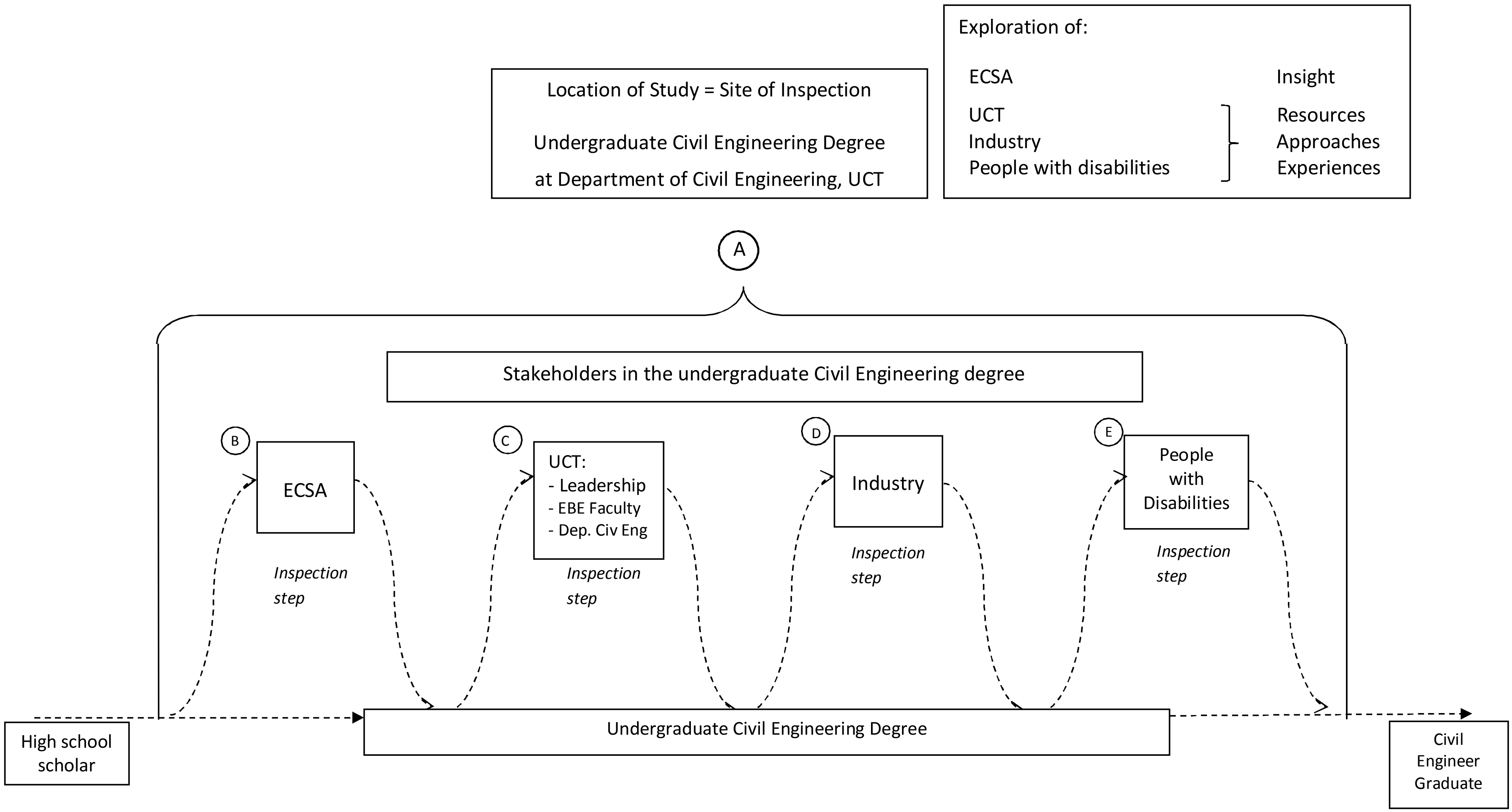
People with Disabilities

As consumers who are on the receiving end of the knowledge, skills and practices of the UCT undergraduate civil engineering programme, it is important to gain insight into the resources, approaches and experiences of people with disabilities. In light of the vast range of different disabilities and experiences of disability, and to make the study manageable, it seemed wisest to interview representatives of disability member organisations. Furthermore, it was important that these representatives were people with disabilities themselves as all research pertaining to disability should include the participation of persons with disabilities at every stage, as reinforced by the motto of the disability community: “Nothing about us without us” (Stone, 1997, p. 2). Therefore the researcher targeted and interviewed two representatives of the Western Cape Disability Network,

4.6.3 Incorporating the Production Line Model

This section describes the placement of the representatives of the stakeholders at each inspection step as reflected in *Figure 4.3.* This exploratory study is located in the Department of Civil Engineering, and it is labelled site “A”, one of the inspection steps. The activities at site A are impacted by the other stakeholders. The accreditation board, ECSA, is labelled site “B”, another inspection step. The UCT, where the undergraduate civil engineering education programme is being explored, is labelled site “C”, and it is another inspection step. The industry that provides employment for the graduates of the civil engineering education programme while they continue the process of becoming professional civil engineers is labelled site “D”, and it is another inspection step. The last inspection site is labelled site “E”, where people with disabilities that benefit from of the skills of civil engineers in the industry, are represented.

Figure 4.3: Production Line Model – Location of study inspection steps



4.7 Procedure

Permission to carry out the study was received from the Faculty of Health Sciences' Human Research Ethics Committee of the University of Cape Town. The participants were invited to participate in the study via letter or email (Appendix E). Once the participants responded, a meeting or focus group was arranged at a suitable date and time.

4.8 Data Collection

4.8.1 The in-depth Interview Process

For the collection of data, the study adopted the in-depth interview process according to Legard, Keegan and Ward (2003), who identify four key features related to in-depth qualitative interviews. Firstly, the in-depth interview combines flexibility with structure, in other words, the interviewer will have an idea of certain themes, or a range of themes, to incorporate into the interview process (Legard, Keegan, & Ward, 2003). Secondly, the interview is interactive and fosters the ability of the participant to talk freely. Often interventions by the interviewer are based on initial responses by the participant to key questions and are generated further accordingly (ibid). Thirdly, the researcher utilises various probes and techniques to gain deeper insight and exploration of subjects. The in-depth format further enables the researcher "to explore fully all the factors that underpin participants answers: reasons, feelings, opinions and beliefs" (Legard et al., 2003, p. 141). Finally, the key features ensure that in-depth qualitative interviews are conducted on a face-to-face basis. Such interviews are regarded as an intense experience for both parties and cannot be held telephonically, for example, because "a physical encounter is an essential context for an interview which is flexible, interactive and generative, and in which meaning and language is explored in depth" (Legard et al., 2003, p. 142).

4.8.2 The Pilot Study

A pilot study was conducted in the form of one-on-one, semi-structured interviews with three selected participants from the EBE faculty. The researcher is a person with quadriplegia, paralysed from the shoulders down, and uses a large, motorized wheelchair. As a result, general mobility, travelling from one place to another, especially long distances, can present a range of challenges. For example, it is not possible for the researcher to simply ‘get up and go’ to an impromptu appointment or meeting. In consideration of his health and well-being, the researcher needs to follow a structured daily programme regarding when to eat, when to sit up in the wheelchair and when to lie down. Any appointments, especially those involving long-distance travel, need to be planned meticulously and well in advance. Even then, there is no guarantee that the researcher will be able to travel, and circumstances will depend very much on how the researcher is coping on the day at hand. Taking this aspect of restricted mobility and potentially challenging logistics into consideration, it was decided at the outset of the study that the researcher would use the services of a research assistant to arrange and conduct interviews with the participants.

However, to ensure that the researcher obtained a feel of the research process, two of the three interviews were conducted by a research assistant and one was conducted by the researcher. The first participant was the Head of the Department of Mechanical Engineering within the Faculty of Engineering. This participant was chosen on a purely practical basis, as he was readily available for an interview. It was also quite convenient and helpful because the mechanical engineering degree is similar to the civil engineering degree regarding its timeframe as well as the predominant focus on technical subjects and lack of apparent flexibility in introducing new subjects. The second participant was the academic development person from the Department of Civil Engineering. These two participants were interviewed by the research assistant. The third participant was the Head of the Centre for Transport

Studies, who was interviewed by the researcher. All three interviews were recorded, transcribed and underwent thematic analysis. The pilot study was undertaken as the primary step in refining the interview process and the schedule of questions.

There were two parts to each interview. The first part of the interview focused on the attitude of the participant towards disability and the second part focused on the key areas relating to resources, approaches, and experiences of participants, as described above, in preparing undergraduate civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities. To gain insight into the knowledge and attitude of the participants towards disability, a range of questions were incorporated into the interview schedule, which has been adapted from a locally designed disability-attitudinal survey instrument (Appendix G). This qualitative survey instrument was developed by Jackie Opperman, a senior social worker residing in the Western Cape, South Africa. The instrument has been successfully utilised in both public and private sector organizations, including banks, parastatals, medical and life insurance, as well as retail. The instrument was also successfully administered in exploring attitudes of staff members towards employing people with disability at UCT (Opperman, 2003). The instrument was administered to elicit qualitative responses from interview participants, and it allowed each participant to express his/her own feelings and discuss them in a non-judgmental, safe environment (ibid).

Two main issues emerged from the pilot study. The first issue related to the second part of the interview, which explored the resources, approaches and experiences of the stakeholders in their preparation of undergraduate civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities. The questions were pertinent to the objectives of the study and generated rich data from the participants. The second issue related to the first part of the interview, which attempted to explore qualitatively the attitudes of the participants towards disability. This made the interview process cumbersome, and in the interest of manageability, it was decided not have a separate part of the study focusing on the attitudes of participants alone. However, as literature has highlighted the impact of attitudes towards disability (Boyle, 1997; Minton, 1992; Stone & Colella, 1996; Wordsworth, 2003), a number of questions from the Attitudinal Survey were incorporated into the general interview schedule. Furthermore, while the questions in the interview schedule remained generically the same, they were slightly modified in accordance to the context of the participant being interviewed. Examples of this may be seen in in the interview schedule for a representative of UCT (Appendix H) team and the interview schedule for a participant representing people with disabilities (Appendix I).

The second issue to emerge from the pilot study phase was the theme of transformation. Reading and reflecting on the data from the pilot study, the importance of the dialogue on transformation surfaced as paramount when exploring the issue of inclusiveness. The interview allowed for initial insight into UCT's impact on the EBE Faculty in relation to its policy on transformation and social responsiveness. It became apparent that whatever transformational agendas and/or implementation strategies that the stakeholders in the main study may have in place, whatever they did towards developing an inclusive society, really mattered in the broader context. This seems to strengthen the fourth element of the conceptual framework represented in *Figure 2.1*.

4.8.3 Main Study

Informed by the issues arising from the pilot study, the main study duly focused on questions relating to the resources, approaches and experiences of the stakeholders. Furthermore, while the attitudinal survey was not used during the study, many of the questions from the survey were found to be productive and conducive to the interview process as a whole. Consequently, a number of questions from the survey were incorporated into the interview schedule, including the following;

1. How do you define disability?
2. Have you had any interaction with people with disabilities? If yes, what has the impact been?
3. Do you think reasonable accommodation is a fair requirement in any community? Is it a burden? What would the person with a disability expect?
4. What has hampered the accommodation of people with disabilities within the community?
5. How have you or your organisation accommodated people with disabilities?
6. Would there be positive or motivating factors to accommodate people with disabilities in this community?

These questions were either modified or re-phrased to make them applicable to the settings of the research participants. Further questions were also asked either for clarity or further exploration of the participants' responses.

4.8.3.1 Challenges encountered

At the beginning of the data collection process, the interviews were conducted by a research assistant. This persisted until it no longer became possible for her to arrange interviews. The research assistant did other work within a very structured environment and it became difficult to arrange interviews with all the participants, particularly ECSA, the lecturers and students of the Civil Engineering Department at UCT, and the representatives of the industry, due to their time constraints. The research assistant conducted the one-on-one, in-depth interviews with the following participants: the Registrar of UCT, the Deputy Vice Chancellor of UCT, the Dean of the EBE faculty, the Transformation Officer of the EBE Faculty, the head of Department from the Department of Civil Engineering, the director of the Disability Service, and two representatives of the Western Cape Disability Network,. All of these interviews were conducted in the offices of the participants. Hence, for reasons given above, the research assistant ceased to be involved with the study and the researcher took over conducting the rest of the interviews. It is acknowledged that this presents a potential limitation to the study.

The researcher became responsible for arranging and conducting the interviews with the following participants – ECSA; the Chairperson of the Undergraduate Education Portfolio of the EBE faculty; the lecturers of the Department of Civil Engineering (focus group of seven); the current students in the undergraduate civil engineering programme (four x four focus groups of four students each); the graduates of the undergraduate civil engineering programme; and three participants representing the industry - a civil engineer who had experience with consulting (designing and project management); a civil engineer who had experience with construction; and a civil engineer who had experience in both in the public and private sectors).

However, the researcher encountered additional challenges in setting up face-to-face in-depth interviews with participants representing ECSA as their offices were in Pretoria which is just short of 1,500kms from Cape Town, where the researcher resides. Considering the difficulties encountered in travelling long distances as described above, coupled with the negative experiences of flying, as described in the personal experiences in the introduction to this study, the researcher was dissuaded from risking flying to Pretoria for such a critical interview.

In place of travelling a long-distance for a face-to-face interview, the literature alluded to an alternative method of interview. Indeed, the use of telephone interviews has been deemed acceptable and even beneficial under certain circumstances. Supporting arguments include conducting them in the interest of interviewer safety, especially in the case of a potentially dangerous investigation, as well as saving costs, particularly if the researcher is on a restricted budget (Sturges & Hanrahan, 2004). The telephone has also been an effective medium in gathering data on sensitive topics, where the relative anonymity of speaking on the telephone compared to face-to-face interviews has enabled respondents to feel more relaxed and secure (Fenig and Levav, 1993; Sturges & Hanrahan, 2004).

The main concern of the researcher regarding telephone interviews was their impact on the quality of the data. In this regard, research has produced mixed results. Sturges and Hanrahan (2004) documented that in 1992, Aquilano discovered a variation in the reported amount of drug use, where telephone interviews reflected a number significantly lower than face-to-face interviews. Furthermore, in an impartial review of the pros and cons of both telephone and face-to-face interviews, Irvine et al. (2012) discovered that telephone interviews were more suitable for research that seeks “relatively simple or descriptive data” (2012, p.103). They suggest, however, for studies that “require a level of rapport that encourages extended reflective accounts” (ibid), where in-depth material is essential in addressing research questions, thus placing greater importance on quality of data over quantity, face-to-face interviews are preferable.

Finally, the research indicates that telephone interviews are far more demanding, requiring a greater of effort than face-to-face interviews. Gillham (2005) declares that;

> It is extremely hard work to keep going. Because interviewer and respondent have only vocal communication to go on, it requires, if anything, even more concentration than a normal interview. And related to that, irrespective of level of structure, an endurable length of time is less, usually much less than with a face-to-face interview. (2005: 103)

Vandermate (Vandermate in Irvine et al., 2012) and Hermanowicz (2002) refer to difficulties in conducting a normal conversation on the telephone when there are problems with audio quality and frequent “breakdowns and misunderstandings in communication” (Hermanowicz, 2002, p. 497). These factors negatively impact on the quality of data (Irvine et al., 2012) within a setting that is “readily compromised” (ibid).

The researcher was further discouraged from conducting interviews on the telephone because of the weakness of his voice. The researcher has always been aware that since becoming a quadriplegic, the quality and clearness of his voice, as well as the ability to project sounds, has reduced significantly. This is concurrent with previous research. In a study examining the characteristics of speech following cervical spinal cord injury, MacBean, Ward, Murdoch, Cahill, Salley and Geraghty (2006) reported that, in line with previous research, damage to the laryngeal and respiratory systems which cause shallow breathing coupled with diminished control of expiration, resulted in “prosody and phonation during connected speech” (MacBean, Ward, Murdoch, Cahill, Salley, & Geraghty, 2006, p. 179). Their findings among 35 participants with cervical spine cord injuries revealed speech characteristics involving impaired vocal quality and intensity, a degree of lower intelligibility resulting from diminished respiratory support, as well as “inappropriate variation of pitch and loudness and excessive variation in intonation” (MacBean et al., 2006, p. 179).

In view of these prevailing factors, the researcher was not at all confident in conducting an interview using the telephone. Hence, owing to the risk of compromising the quality of data as described above, coupled with the researcher’s lesser degree of voice quality (and related lack of confidence when speaking on the telephone), telephone interviews were not included in the process of data collection. Therefore, in the case of ECSA, it was decided that instead of conducting in-depth interviews, a review of the documents on their website would be undertaken in order to gain an insight into their vision, practice and operations.

Furthermore, in light of the importance of the issue of transformation that became evident in the pilot study, the process of data collection from each inspection site in the main study included the review of available documents on policies and research reports pertaining to transformation and social responsiveness. Specifically at the UCT inspection site, the outlines of the courses offered in the undergraduate programme, as recorded in the *Student Handbook of the Faculty of Engineering and Built Environment*, were explored as part of the available resources on transformation towards producing civil engineering graduates who are able to contribute to an inclusive society that caters for people with disabilities. The researcher looked out for the following key words in the outlines of the courses: “disability”, “accommodation”, and “inclusive society”. If a keyword was identified, a follow up in-depth interview was conducted with the lecturer in charge of the specific course to obtain details about the course.

4.9 Ethics

Throughout the study, with regards to the researcher – researchee relationship, all participants were treated as partners in the research process where they had the right to their own information during the study. They were empowered in the context that they were satisfied their voice and input had been heard and was reflected in the research findings, and that they were not treated as "passive" subjects. The study adhered to a Code of Conduct for the researcher as offered by Wolfendale (1999). In line with this, the participants were provided with open and honest descriptions of the objectives of the research as well as clear statements concerning the nature of the participant's involvement along with an estimated time scale (Wolfendale, 1999). The study also adhered to the ethical principles outlined in the Seoul version of the Declaration of Helsinki (World Medical Association (WMA), 2008).

Furthermore, all information was gathered and used with informed consent. All participants signed a consent form. The rights to privacy and confidentiality of the participants were respected. All data collected was kept in a safe and secure place to which only the researcher had access. There was no link between the interview data (tapes and transcripts) and any identifying data about the research participants. Furthermore, where necessary, pseudonyms were used to protect the identity of the research participants.

The guiding principles for this research study were to preserve the dignity, rights and well-being of all participants through beneficence, non-maleficence, respect and justice, which shows respect for the interests and the rights of others within an academic context (Meltzer, 2006; Ravitsky & Wilfond, 2006; Yan & Munir, 2004; Mertens, 1989). Beneficence entails respect for the rights of others, and generally looking out for their well-being (Ravitsky & Wilfond, 2006). The principles of beneficence are to prevent and remove harm, promote welfare (doing good for others) and weighing up whether the risks outweigh the benefits (Beauchamp and Childress, 1994; Meltzer, 2006; Ravitsky & Wilfond, 2006).

Furthermore, the researcher made sure that the study was worth conducting, that it would make a meaningful contribution to the body of knowledge and that it was ethically sound. To this end, a proposal of this research study was drafted. Once all corrections were made to the satisfaction of the supervisor and researcher, a revised edition was submitted for postgraduate review. After further recommendations and corrections were made, the proposal was submitted to the ethics committee of UCT where it obtained ethical clearance.

Non-maleficence can be described as the principle of doing no harm through the research process or otherwise (Meltzer, 2006; Ravitsky & Wilfond, 2006). The researcher ensured that the participants were not exposed to "risks that are greater than the gains they might derive" (Bogdan & Biklen, 1992, p. 53). Where deemed necessary, this identified area of concern was put forward by the researcher at the beginning of interviews. The participants in the study were treated with respect, dignity and courtesy.

Within research there needs to be justice and a concern for the rights of the participants. Mertens (1989) defines justice in research as "ensuring that those who bear the risk in the research are the ones who benefit from it; ensuring that the procedures are reasonable, not exploitative, carefully considered, and fairly administered" (p. 24). The primary concern for all research that includes human participants is the protection of their human rights and equitable treatment (Harris et al., 2007; Polit & Hungler, 1995). Throughout the study, the researcher made sure that respect for human rights was upheld and that all participants were treated equally, and on an equal status to the researcher himself.

The respondents' decision to participate in the research was voluntarily and made without any form of pressure. It was made clear to participants that they had the freedom and the right not to partake in the study, as well as to remove themselves from the study at any time, if they wished to do so.

4.9.1 Informed Consent

It is an essential requirement that voluntary, informed consent is gained from all participants in the research, that is "without threat or undue inducement (voluntary), knowing what a reasonable person in the same situation would want to know before giving consent (informed), and explicitly agreeing to participate (consent)" (Mertens, 1989, p. 24). Informed consent depicts that the participants have an understanding of the type of information the researcher requires, the reasons for the research being conducted, what purpose it will be used for, expectations of participation in the study, as well as how it may directly or indirectly affect them (Britz & le Roux-Kemp, 2012). It further emphasises the importance of researchers accurately informing participants of the nature of their research. Participants are only able to provide informed consent if they have a complete understanding of their requested involvement in the study. This includes "time commitment, type of activity, topics that will be covered, and all physical and emotional risks potentially involved" (O'Leary, 2004, p. 53).

All participants were given a consent form to sign (see Appendix F). The consent form contained information about the researcher (name, university and degree completing). The focus of the study and the reasons for the study being conducted were clearly indicated, as was the need for the participants' input. The consent form was used to obtain permission to audio-tape each of the interviews.

4.9.2 Privacy, Confidentiality and Anonymity

In all research the participants right to privacy, confidentiality and, if appropriate, anonymity should be respected (Keller & Lee, 2003). Privacy is the control over access by others to oneself and information relating to oneself; including maintaining the boundaries against divulging protected information or the receiving of information that is unwanted (Miles & Huberman, 1994). Confidentiality involves protecting the identity of those supplying the research data. It is important that as far as possible the identities of the participant and the organisations/situation that they are involved in are protected. Protection of confidentiality may involve the following: storage of data; access to raw data; permission for use of data; publication of research findings in a way that does not allow for easy identification of participants; and final destruction of raw data (O'Leary, 2004; Keller & Lee, 2003). Anonymity goes one step beyond confidentiality and refers to protection against possible identification, even from the person conducting the research (O'Leary, 2004). Providing anonymity is essential. All information that may divulge which data was gathered from which individuals or organisations should be avoided (Keller & Lee, 2003).

4.9.3 Voluntary Participation

The participants' decision to partake in the research must be voluntary and made free of any pressure. Participants must understand that they have the right and choice to not assist the researcher in the study, as well as the freedom to remove themselves at any time from the study (Miles & Huberman, 1994; O'Leary, 2004). Sharing information "honestly and fully, consulting and obtaining agreement, keeping promises and not deceiving each other, will all help to ensure that consent to participate is informed and voluntary" (Bindless, 2000, p. 2). In addition, participants were autonomous (made the rational decision to participate); not coerced (no power play was involved) and not induced (no money or reward was given). The process leading up to the interviews enabled the participants to make a choice as to whether they wanted to be involved with the study or not. This was made clear by telephone as well as the information sheet and consent form. The participants were also asked verbally, prior to all interviews. Subsequently, all participation was entirely voluntary, and there was no coercion involved.

4.9.4 Feedback

O'Leary (2004), states that it is crucial for the researcher to ensure the authenticity of the data that is obtained from the participants. This can be done by asking participants to "confirm accuracy, relevance, and authenticity of interpretations (O'Leary, 2004, p. 51). This can be done when a researcher requests that participants confirm that the essence of their stories have been captured correctly. Feedback regarding the transcribed data and emerging theory was communicated to participants via e-mail and telephone as part of the process of member checking. The participants were given common outcomes of the study without revealing specific viewpoints, which may have identified certain individuals.

4.5 Ensuring Rigour and Trustworthiness

The research process adhered to the principles of rigour and trustworthiness as much as possible. To ensure rigour, the researcher clearly described the procedures used, thereby making sure that all information was recorded accurately and also that data obtained was representative of the "whole" picture. All sources of information used by the researcher were described (Law, Stewart, Letts, Pollock, Bosch, & Westmorland, 1998). The constructs of credibility, dependability, transferability and confirmabilty have been used to describe the four aspects of trustworthiness (Guba, Lincoln, Polit, & Hungler in Graneheim & Lundman, 2004; Miles & Huberman, 1994; O'Leary, 2004).

Credibility refers to the focus of the research, the appropriateness of data collection and how the process of analysis was addressed. Credibility of the research findings deals with how well categories and themes cover the data, so that no relevant data has been excluded and no irrelevant data included (Polit & Hungler in Graneheim & Lundman, 2004). To ensure credibility the researcher employed the process of member checking. Member checking is regarded as the single most critical technique for establishing credibility (Guba & Lincoln in Rolfe, 2006). In this study there was feedback with the participants via telephone or email during the transcribing process. These follow-up communications served to verify the responses of the participants from their interviews and any discrepancies were amended accordingly.

Dependability refers to the degree to which data changed over time and how the researcher catered for this during the analysis process (Guba in Graneheim & Lundman, 2004). In order to address the dependability issue more directly, the researcher reported the processes within the study in detail, thereby enabling a future researcher to repeat the work, if not necessarily to gain the same results (Shenton, 2004). It was anticipated that this in-depth coverage would allow the reader to assess the extent to which proper research practices had been followed.

Transferability is the extent to which the results could be transferred to other settings or groups (Polit & Hungler in Graneheim & Lundman, 2004). It is ultimately up to the reader to decide if transferability has taken place but the researcher can facilitate this by presenting an account of the findings which is rich and vigorous, together with appropriate quotations (Graneheim & Lundman, 2004). To address transferability, the researcher included, as an addendum, several of the data analysis documents used to generate the answer to the research question. The complete set of data analysis document was put on file and is available upon request. It was anticipated that this access to the study's "paper trail" would give other researchers the ability to transfer the conclusions of this study to other cases, or to repeat, as closely as possible, the procedures of this research (Shenton, 2004).

Finally, confirmability refers to how the findings of the study emerged from the data and not from the predispositions of the researcher (Graneheim and Lundman, 2004). It is important for the researcher to maintain an awareness of his or her contribution to the construction of meanings throughout the research process; this is referred to as reflexivity. Reflexivity encourages researchers to explore the ways in which their involvement in a particular study influences, acts upon and informs their research (Shenton, 2004). In this study, the researcher made clear his values and philosophical assumptions that may have influenced the research.

4.10 Conclusion of Chapter 4: Methodology

At the beginning of the chapter the incorporation of the production line model into the study was described. The choice of research design of the study was then introduced as the exploratory case study design. After that the study population was described and a detailed description of the selection of participants was provided. Thereafter, the data collection phase, including the pilot phase was discussed. This was followed by an explanation of the management and analysis techniques and the section ended with a round-up of the ethical consideration taken during the study.

CHAPTER FIVE

FINDINGS

5.1 General Introduction

The primary aim of this study was to explore the preparation of civil engineering students at the University of Cape Town (UCT) to contribute to the development of an inclusive society that accommodates people with disabilities. An exploratory, descriptive and contextual qualitative research design was utilised for the study. The secondary aim of the study was to identify key issues of interest from the interviews of the stakeholders, who are involved in the preparation of the civil engineering students. These aims were achieved using the production line model (Tirkel & Rabinowitz, 2013) to address the following key objectives of the study:

- To gain an insight into ECSA, as the "quality controller" of the civil engineering profession, with regard to its functions, operations and relationship with other stakeholders, in particular, higher education institutions
- To explore the approaches utilised by each of the stakeholders in the preparation of the civil engineering students
- To explore the resources available to each stakeholder in the preparation of the students
- To explore the experiences encountered by each stakeholder on the preparation of the students
- To explore the perceptions of current students and graduates of the programme in their preparation to contribute to the development of an inclusive society that accommodates people with disabilities

5.2 The Engineering Council of South Africa (ECSA)

5.2.1 Introduction

As indicated in section 4.3.2, for the purpose of this study, ECSA is perceived to play the role of “quality controller” within the process of “producing” civil engineering graduates. Coming from a background with limited knowledge about the civil engineering profession, the researcher read through various documents on the website of ECSA to gain some insight into the profession. The documents may be classified into the following two groups, namely -

- Documents that describe the roles and functions of ECSA; and
- Documents that present ECSA’s plans on transformation

5.2.2 The Roles and Functions

The following themes emerged from documents that describe the roles and functions of ECSA - “Establishment of ECSA”, “Collaboration with the Council for the Built Environment (CBE)”, and “ECSA at work”.

5.2.2.1 Establishment of ECSA

ECSA was established in terms of the *Engineering Profession Act, 2000* (Act 46 of 2000). It is the successor to the *Engineering Profession of South Africa Act, 1990* (Act 114 of 1990). The primary focus of the Act was the promotion of public safety, health and interests in relation to actions of persons registered with ECSA. The objective of Government in establishing ECSA was to ensure “accountable performance of quality engineering work across economic sectors, through a process of professional registration of practitioners, and the regulation of matters incidental thereto:

- Principle focus: Public safety, health and interest through registration;
- Sets and audits academic and professional development standards for engineering practitioners;
- Sets and enforces standards of professional conduct;
- Builds relationship bridges internationally to achieve international recognition for registered persons;
- Advises Government on matters of importance with regard to engineering."

(ECSA, 2008, para. 2)

5.2.2.2 Collaboration with the Council for the Built Environment (CBE)

While ECSA has full autonomy, it is still accountable to Government, as well as the profession and the public regarding the transparency of the operations of its business in its everyday functioning. To some degree, ECSA is also answerable to the CBE. The CBE is a statutory body established in terms of the *Council for the Built Environment Act, 2000* (Act No. 43 of 2000) (CBE Act). The introduction of the *CBE Act* was established to rectify problems within the built environment. It also was to create climate to facilitate ongoing transformation and growth of the professions. The *Council for the Built Environment Act* establishes the CBE as the umbrella body of the built environment professions. Furthermore, it facilitates the operations of all of the six built environment professions (*Figure 5.1*).

The councils for the professions falling within the ambit of the CBE include:

(i) South African Council for the Architectural Profession, established by the *Architectural Profession Act, 2000*;

(ii) South African Council for the Project and Construction Management Professions, established by the *Project and Construction Management Profession Act, 2000*;

(iii) Engineering Council of South Africa, established by the *Engineering Profession Act, 2000*;

(iv) South African Council for the Landscape Architectural Profession, established by the *Landscape Architectural Profession Act, 2000*;

(v) South African Council for the Property Valuers Profession, established by the *Property Valuers Profession Act, 2000*; and

(vi) South African Council for the Quantity Surveying Profession, established by the *Quantity Surveying Profession Act, 2000*.

The objectives of the CBE are to:

(a) Promote and protect the interests of the public in the built environment

(b) Promote and maintain a sustainable built environment and natural environment

(c) Promote on-going human resource development in the built environment

(d) Facilitate participation by the built environment professions in integrated development in the context of national goals

(e) Promote appropriate standards of health, safety and environmental protection within the built environment

(f) Promote sound governance of the built environment professions

(g) Promote liaison in the built environment professions in the field of training, both in the Republic and elsewhere, and to promote the standards of such training in the Republic

(h) Serve as a forum where the representatives of the built environment professions may discuss the relevant:

- Required qualifications;
- Standards of education;
- Training and competence;

- Promotion of professional status; and
- Legislation impacting on the built environment; and

(i) Ensure the uniform application of norms and guidelines set by the councils for the professions throughout the built environment” (CBE, n.d.a, pp. 1-2).

The CBE states that its objective is to “champion sound governance of the professions, appropriate standards of health, safety and environmental protection, standards of training and on-going human resource development in the built environment” (CBE, n.d.b, para. 2). Hence, as the facilitator between the built environment professions and government, responsibility rests with the CBE for transforming the professions. Furthermore, it fosters the growth of the professions as well as contributing to the development of the built environment. Therefore ECSA, along with its own statutory duties and functions, also has a deep interest in the mandate of the CBE. With regard to this relationship, ECSA has pursued a full participatory process along with other engineering professions, through the CBE.

5.2.2.3 ECSA at Work

5.2.2.3.1 Empowerment for the Work

In order to achieve the Act’s main focus, “ECSA is empowered to perform a variety of functions, such as:

- Setting and auditing of academic standards for purposes of registration through a process of accreditation of engineering programmes at universities and technikons
- Setting and auditing of professional development standards through the provision of guidelines, which set out ECSA’s post-qualification requirements for registration
- Prescribing requirements for Continuing Professional Development

- Prescribing a Code of Conduct and Codes of Practice, and enforcing such conduct through an Investigating Committee and a Disciplinary Tribunal
- Identification of work (IDoW) of an engineering nature that should be reserved for registered persons by the CBE
- Advising the CBE and the Minister of Public Works on matters relating to the engineering profession and cognate matters
- Recognition of professional associations, such as engineering associations, institutes, institutions and societies
- Publication of a guideline tariff of fees for consulting work, in consultation with government, the profession and industry
- Doing such other things as may be necessary for the proper performance of its functions in terms of the Act" (ECSA, n.d.a, para. 1)

Each ECSA council serves a four year term and consists of 30 members. Since its inception in 2001, the current council is the fourth one to be appointed. In 2011, the staff component comprised of 63 members. According to point 3 of the *Engineering Profession Act* (EPA), the council consists of the following members, appointed by the Minister, "taking into account, among other things, the principles of transparency and representivity:

(a) Thirty registered persons, excluding candidates, of whom at least 20 must actively practise in the engineering profession –

> (i) Who must be nominated by the voluntary associations, registered persons and prescribed nominating bodies;
>
> (ii) Who must represent the categories of registered persons contemplated in section 18, in the prescribed manner; and

(iii) Who must represent the different disciplines of the engineering profession in the prescribed manner;

(b) Ten persons, of whom at least –

(i) Six must be professionals, in the service of the State nominated by any sphere of government; and

(ii) One must be nominated by the department; and

(c) Ten members of the public nominated through an open process of public participation" (Republic of South Africa, n.d., p. 4).

The Council consists of various committees to meet the requirements of its mandatory functions. (Please see Figure 5.1 for a diagram of the full organisational structure of the ECSA committee.)

Vision and Mission

Though being granted set powers and responsibilities by the State, ECSA developed a vision and mission statement towards meeting its responsibilities, and strengthen its own identity as an autonomous body. Its vision is "to ensure that South Africa enjoys all the benefits of a strong, competent, growing, sustainable and representative engineering profession, able to provide all the expertise necessary for the socio-economic needs of the country and to exert a positive influence in South Africa" (ECSA, n.d.b, para. 1). Its stated mission is "to create the circumstances in which society is confident that the engineering profession in South Africa is able to carry out the functions necessary for the socio-economic growth in the country" (ECSA, n.d.b, para. 2)

ECSA pursues the achievement of its objective through:

- Setting and monitoring of standards to international norms;
- Certifying and ensuring the competence of individuals through registration;
- Ensuring quality of engineering education through accreditation;
- Regulating professional conduct; and
- Growing the profession in quantity and quality, in partnership with stakeholders (ECSA, n.d.b, para. 2).

In order to carry out the mandated functions, ECSA put in place nine High Impact Committees (HICs). These nine committees are the Investigating Committee (IC); the Central Registration Committee (CRC); the Audit, Risk and Compliance Committee (ARCC); the Finance and Staff Committee (F&SC); the International Affairs Committee (IAC); the Education Committee (EC); the Transformation Committee (TC); the Strategic Advisory Committee (SAC); and the Engineering Standards Generating Body (ESGB). The layout of these committees, along with their sub-committees, can be seen in *Figure 5.1*. Each one of these has a specific focus in carrying out the tasks of the Council. For the purpose of this study, the researcher focused on the operations of four of these nine committees in terms of how they affect the education and practice of civil engineering. These are the CRC; the EC; the TC; and the SAC. Each of these committees has direct or indirect impact on the preparation of undergraduate civil engineering students. These impacts will be referred to later.

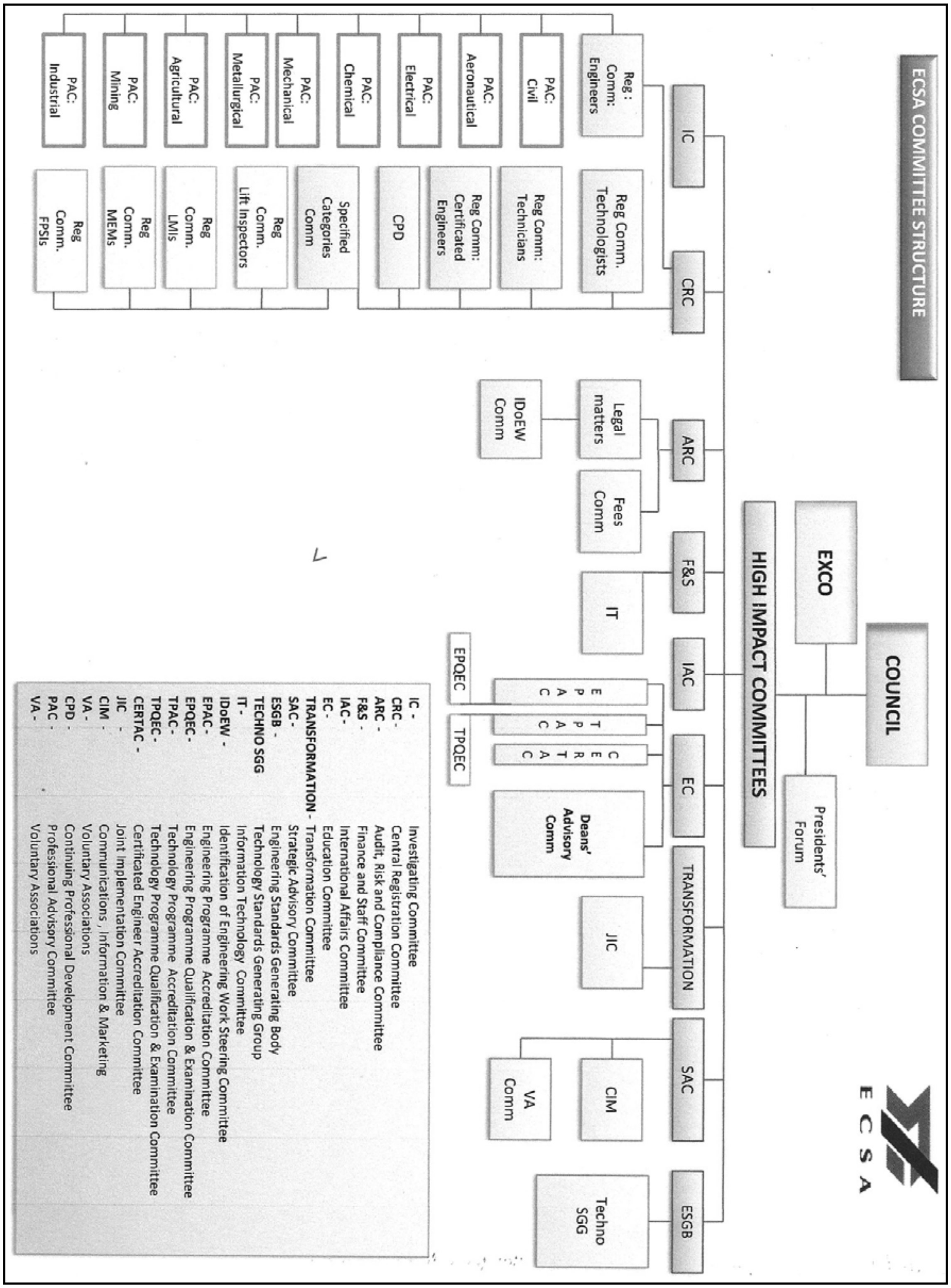


Figure 5.1 Organisational structure of the ECSA committee (ECSA, 2012, p. 29)

5.2.2.3.2 Core Functions

The following sub-themes emerged as the "Core functions" of ECSA - "Quality and quantity", "Practice" and "Education".

Quality and Quantity

ECSA works in collaboration with the State and the engineering profession in the promotion of a high level of education and training of practitioners in the engineering profession, thereby facilitating full recognition of professionalism in the engineering profession. Hence it can be said that ECSA's core functions revolve around two areas. These are, firstly, the practice of engineering in South Africa; and secondly, engineering education in South Africa. Furthermore, these two key issues arose from their 2010 strategic planning process, where ECSA put full focus on its mandate "to ensure that South Africa has an appropriate supply of competent engineering personnel (the right quantity), with the appropriate levels of education, training and experience (the right quality), for the right application, at the right time" (ECSA, 2010a, p. 4).

Practice

Paying attention to the quality of engineering practice in South Africa, ECSA set out to "ensure:

- the regulation of practice by investigating complaints and disciplinary processes;
- that South African registered engineering practitioners are recognised when measured against international standards; and
- the development of relevant standards for identification of engineering work, and regulation thereof" (ECSA, 2010a, p. 4).

There are a number of ECSA HICs involved with the standard of practice of engineering in South Africa. The regulation of practice is governed by the Investigating Committee and the Audit, Risk and Compliance Committee (ARCC). The international standard of South African engineering practice is governed by the International Affairs Committee and the Engineering Standards Generating Body (ESGB). Finally, the development of relevant standards is governed by the ARCC and the ESGB (ECSA, 2012).

Education

Regarding the quality of engineering education, the data revealed that ECSA set out to "ensure:

a) competent engineering practitioners through effective registration and continuing professional development processes;

b) appropriate development of engineering practitioners through accreditation of engineering programmes;

c) regulation of practice by investigating complaints and disciplinary processes;

d) that South African registered engineering practitioners are recognized when measured against international standards; and

e) the development of relevant standards for identification of engineering work and regulation" (ECSA, 2010a, p. 4).

The HICs directly governing the quality of engineering education include the Central Registration Committee which governs the effective registration of practitioners and the CPD processors, as well as the Education Committee, which determines the accreditation of engineering programmes (ECSA, 2012). The work of these HICs is expanded upon below.

5.2.2.3.2.1 The Role of SAICE

The role of the South African Institute for Civil Engineers (SAICE) provided an excellent demonstration of two of ECSA's HICs at work. SAICE is a learned society that serves the civil engineering profession in South Africa. The data revealed that the society performs quite a few functions on behalf of ECSA and subsequently plays some role as part of the production process. This led the researcher to incorporate SAICE into the study as a sub-inspection step in the production line model of the study. SAICE was regarded as a stakeholder having influence over the quality control of the product. One-on-one, in-depth interviews were conducted with two of SAICE's members, regarding the approaches, resources and experience of the institute relating to the preparation of the sub-themes: "The registration process", "No awareness of 'graduateness'", "No formal structure" and "ECSA not as involved".

The Registration Process

To begin with, while ECSA has its own structures in place, it also involves its Voluntary Associations to perform a number of tasks (ECSA, 2012). The scope of the involvement of the Voluntary Associations is determined by the SAC, one of the HICs mentioned above. Furthermore, the CRC (another HIC) uses SAICE in the registration process of professional civil engineers. Hence, findings revealed that the ECSA – SAICE relationship is crucial to the standard of civil engineering in South Africa, including the successful facilitation of civil engineering undergraduates becoming professionals. To become a professional engineer, a candidate engineer must go through an interview process, which assesses their competencies and experience. A SAICE participant explained: "*The candidate engineer, as they are called, will approach ECSA for registration and they have to submit a whole long document of their experience and everything they have done – and every phase where they have done it, and* *this is assessed by people who are members of the ECSA committee, and if they think that the person has had sufficient and varied enough experience, then it goes to the interview phase which is conducted by me and a colleague – there are two of us to conduct the interview to make sure that what he is claiming is correct*" (Participant).

Findings revealed that this interview process is a crucial step to becoming a professional civil engineer. Furthermore, the interview needs to be conducted by experienced engineers who have developed a special skill in assessing and evaluating the strengths and weaknesses of a potential future professional civil engineer.

After the interview process, the report of the interviewers goes back to the Professional Advisory Committee for Civil Engineering, which is a sub-committee of the CRC and they make the final decision as to whether the candidate becomes a professional engineer. So while the standards and requirements are set by ECSA, the work is carried out by SAICE on a voluntary basis.

No Awareness of "Graduateness"

Furthermore, findings revealed that ECSA had little or no knowledge of "graduateness", which is a large factor in UCT's approach in preparing their students for their professional careers. The participants of the study who conducted the Professional Review (PR) interviews for ECSA stated that the nature of the questions had not changed in the last 12 to 15 years. When asked whether they had any questions that refer to society for social justice, or global citizenship, the participant answered: "*Not directly, no*" (Participant), and on the topic of "graduateness" he responded:

"*We do not know what they mean by that – basically, we talk to the chap and we see that he knows what he's talking about – we also get a sense of who he is and what is about and we gauge whether we are happy that he is ready to go to the next step in becoming a professional"*(Participant).

Continued Professional Development

The work done by SAICE is not limited to interviewing candidate engineers. They also develop and run Continued Professional Development (CPD) courses which all civil engineers need to participate in on a regular basis, throughout their careers. The CPD courses are also governed by the CRC.

No Formal Structure

Findings revealed that, while a lot of responsibility was put on SAICE as a Voluntary Association by ECSA, there was no formal, structured relationship between the two organisations. It was explained that there was, "*no relationship at all officially – but SAICE does advise ECSA*" (Participant).

ECSA not as involved

Their relationship was further highlighted by a civil engineer practicing in the private sector: "*ECSA are the regulatory body and they regulate engineering almost with a fingertip touch, I would say. But the guys who are really there for our industry – because of the work we do, it needs a heavier hand in terms of regulation – I think that they get SAICE to do a lot of the heavy work for them*" (Participant).

Another participant in the private sector expressed: "*ECSA, if I can say it, is a little more aloof – of actually getting their hands dirty. They pick up the government regulations and are quite strict on that sort of thing*" (Participant).

5.2.3 Documents that Present the Plans for Transformation

There were two themes that emerged from documents that present ECSA's plans for transformation. They were "Setting the education agenda" and "Transformation in action".

5.2.3.1 Setting the Education Agenda

The following sub-themes emerged from "Setting the education agenda". They were: "Mandate", "Accreditation and recognition", "Training of undergraduate students", "Generic exit level outcomes" and "Requirements of Complementary Studies".

Mandate

ECSA is empowered by the *Engineering Profession Act, 2000* (Act 46 of 2000) (EPA), to oversee the education and progress of engineers in South Africa, as has been described. This includes setting and auditing of academic standards for registration, through a process of accreditation of engineering programmes at universities and technikons. Furthermore, as mentioned above, ECSA's EC advises on matters of education, in so far as they impact on policy and standards relating to engineering education. More specifically, the data revealed that it is the mandate of the committee to formulate policies and position papers, with regard to engineering education, and to assess the general state of aspects of engineering education. It is in this area that the council has a significant impact on the preparation of undergraduate civil engineer students towards contributing to an inclusive society that accommodates people with disabilities.

Accreditation and Recognition

One of the key objectives of ECSA is ensuring that qualifications presented for purposes of registration meet the necessary requirements. It is concerned with maintaining the quality of engineering education in South Africa. ECSA has an Education: Engineering Programme Accreditation Committee (EPAC, 2014) and they deal with policy regarding the accreditation of engineering examinations. It was discovered that ECSA's accreditation system for BEng-type programmes was reviewed by a Washington Accord review team in September 2010. This is an international agreement regarding qualifications being accepted in other countries. Essentially it means that professional civil engineers who qualified in South Africa may practise overseas.

Training of Undergraduate Students

With regards to the education of future engineers, ECSA is empowered by EPAC to conduct Accreditation Investigations (visits) at higher educational institutions, to check whether the engineering qualifications on offer can be recognised by ECSA, for purposes of registration. Furthermore, ECSA has the power to set its own written or oral examinations. This might be conducted by ECSA or a higher education institution.

Generic Exit Level Outcomes

The findings revealed that ECSA is responsible for the accreditation process of engineering education in South Africa and that the council reviews the curriculum of UCT every five years. ECSA provides the guidelines for the exit level outcomes of the BSc Civil Engineering degree. These are, essentially, the minimum criteria for the delivery of the undergraduate civil engineering degree and the findings revealed that ECSA leave it to the HEIs to decide on the specific aspects of the training programme. The purpose of the qualification is to "build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practising engineer" (ECSA, 2004, p. 2).

After four to five years of training in a tertiary institution, an engineering student should be competent in the following ten exit level outcomes:

1. Engineering problem solving
2. Application of special and fundamental knowledge
3. Engineering design and synthesis
4. Investigation, implementation and data analysis
5. Engineering methods, skills, tools and information technology
6. Professional and general communication
7. Impact of engineering activity on society and the environment
8. Team and multi-disciplinary working
9. Lifelong learning
10. Professional ethics and practice

To achieve the exit outcomes, the training programme content is defined by six principal knowledge areas essential to an engineering degree. These are:

(a) Mathematics, including numerical methods and statistics;

(b) Basic Sciences: the natural sciences essential to the programme;

(c) Engineering Sciences;

(d) Engineering Design and Synthesis;

(e) Computing and Information Technology;

(f) Complementary Studies: the knowledge required in engineering practice:

(i) The immediate environment of engineering including communications, engineering economics, health, safety and the environment;

(ii) Studies intended to broaden the graduate's perspective and provide a sample of the wide environment of the engineer (ECSA, 2001, pp. 1-3).

Moreover, a number of principles and assumptions based on the general policy of ECSA underlie the Standards for Engineering Bachelor's Degree Programmes; these are:

- Exit level standards are to be internationally comparable and procedures for accrediting programmes against those standards are to be according to best practice, transparent and fair.
- The standards contain elements of transformation of degree programmes. It is recognised that the standards challenge educators both within engineering faculties and in supporting disciplines. The standards are those judged necessary for the engineering graduate and educators will be expected to rise to the challenges.
- The programme outcomes include the development of general abilities of problem solving, communication, analysis, teamwork and societal aspects in order to be consistent with the South African Qualiications Authority (SAQA) critical cross-field outcomes.
- ECSA wishes to encourage diversity and innovation in university engineering programmes and confines its specific requirements to the minimum set of outcomes. Institutions are therefore given freedom to determine how students attain outcomes and are assessed.

- ECSA expect the engineering graduate to be sensitive to the wider social and economic contexts in which engineering is practised (ECSA, 2001).

Requirement of Complementary Studies

Findings uncovered that there were a number of areas in the Council accreditation regulations which alluded to its engagement with civil society within the undergraduate civil engineering degree. ECSA defines two knowledge areas that undergraduate civil engineers are expected to acquire. The first knowledge area is that of Natural Sciences and includes physics (including mechanics), chemistry, earth sciences and the biological sciences, “which focus on understanding the physical world, as applicable in each engineering disciplinary context” (ECSA, 2012, p. 4).

The second area is defined as Complementary Studies, as mentioned above, and involves knowledge outside initial sciences, but which is relevant to the practice of engineering in two ways:

a) knowledge that is “essential to the practice of engineering, including but not limited to engineering economics, the impact of technology on society and effective communication”; and

b) knowledge that broadens “the student’s perspective in the humanities, social sciences or other areas to support an understanding of the world” (ECSA, 2004, p. 4).

In addition, it was found that Complementary Studies knowledge must be sufficient and appropriate to support the student in satisfying Exit Level Outcomes 7 and 10. Exit Level Outcome 7 is the Impact of Engineering Activity and involves the civil engineer’s “critical awareness of the impact of engineering activity on the social, industrial and physical environment” (ECSA, 2004, p. 6). Exit Level Outcome 10 focuses on Engineering Professionalism and teaches students of “the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence” (ECSA, 2004, p. 7).

5.2.3.2 Transformation in Action

The following sub-themes emerged from the “Transformation in action”: “Time to mature”, “The role of transformation”, “Engineering Skills Summit”, “Transformation outcomes: Reaction to strategic plans”, and “Second Skills Summit”.

Time to Mature

It was uncovered that the first Engineering Council was appointed for 2001 - 2004. During the tenure of the second Council from 2005 to 2009, however, the council had not been seen to be a leader within the profession. To prepare for the challenges associated with the Football World Cup in 2010, ECSA underwent an in-depth phase of self-reflection to evaluate its strengths and weaknesses as an organization, from an internal point of view, as well as its opportunities and threats, from an external point of view. From its analysis it identified the following strengths: it was recognised as the “Leader of Built Environment” with “Internal resources to support organisational core values” (ECSA, 2008, p. 13).

However, amongst its weaknesses the council was regarded as an “exclusive club” that “lacked legitimacy”. Finally, it had poor relations with the CBE, which seemed to fit its relationship with other stakeholders “within government structures” (ECSA, 2008, p. 14).

From the analysis process, the Strategic Plan (2008 – 2011) evolved, with a logical framework which identified the goals for the way ahead. The council also attached a business plan to the strategic goals, including a budget and performance targets, as well as monitoring and evaluation processes. It was felt that the plan would enable the council "to communicate our goals to staff, to our stakeholders, both internal and external, as well as to other organisations (government and the private sector), with whom we will be collaborating for the realisation of the objectives of this plan" (Nayagar, in ECSA, 2008, p. 4).

Reflecting on the time spent leading up to the 2010 World Cup, the President of the 3rd ECSA Council (2009 – 2012), expressed that even the "global economic meltdown could not dampen the spirit with which these challenges were handled in order to make South Africa proud and be ready to host one of the World's largest events, the 2010 FIFA World Cup" (ECSA, 2010c, p. 3).

The data revealed that, since formulating the Strategic Plan (2008 – 2011), ECSA had addressed its objectives, as well as the significant challenges presented by preparing for the 2010 Soccer World Cup. Hence, findings determined that 2008 represented a time when ECSA "came of age". Prior to this, it seemed that ECSA was perhaps not as effective as it could have been since its inception in 2001. The Council had also come under criticism by the engineering fraternity at large and chose to seize the moment and opportunity to establish its identity, and take ownership of its role, as the custodian of engineering in South Africa.

The Role of Transformation

ECSA and the engineering fraternity were fully aware of the need to promote engineering, among all population groups, as an attractive career. It was found that ECSA sees itself in partnership with the main stakeholders, namely, the State, the profession, the industry, the educational sector, and the CBE. Findings revealed that ECSA was aware of the "salient challenges that are associated with its role in the national development agenda" (ECSA, n.d.c, p. 1). The organisation has "embarked on a journey of transformation in order to ensure maximum efficiency in the delivery of its core mandate and consequently improve its service to the engineering profession and the public at large" (ECSA, 2010d, p. 1). Of paramount importance is the need to ensure a "critical mass of registered engineering professionals, whilst striving to meet the set equity targets" (ECSA, 2010d, p. 1). This puts focus once again on the core functions of ECSA regarding engineering education and practice in South Africa and the potential impact they have on the undergraduate civil engineering degree. It also highlights a connection between the core functions of engineering education and practice, and the goal of transformation. It is important to note that the transformation framework is an integral part of ECSA's statutory obligations and consequently underlies all of their strategies, objectives, and operations.

Engineering Skills Summit

The data uncovered that ECSA's inaugural Engineering Summit took place in 2011. The goal of the summit was to get all the stakeholders together to collaborate and plan the way forward, with regard to the challenges facing engineering in South Africa. The data identified three key challenges at the Engineering Summit. These were the "engineering skills pipeline, with a focus on 'Improving throughput in the Engineering Bachelor's Degree'; challenges related to candidate phase experience; and South Africa's national infrastructure provision" (ECSA, 2011, p. 1). With regard to challenges facing the candidacy phase, ECSA claimed that with the move towards a lean organisation, there has been a retreat from the culture and practice of developing candidates from graduation. They identify the challenge "to restore and expand the candidacy programmes that develop the individual from graduate to professional level, so that the evidence of competence required for the registration application can be presented" (ECSA, n.d.d, p. 2). ECSA further identify it as a "multi-faceted problem," requiring "organisational commitment, an adequate supply of supervisors and mentors, the role of incentives, systems for managing training" (ECSA, n.d.d, p. 2). Furthermore, the potential expansion of the training programme has a direct impact on the preparation of undergraduate civil engineering students.

The Summit was deemed very successful and commanded the attention of key stakeholders. It signalled the commitment and intent of ECSA to extend its operations far beyond the narrow mandate as specified in the EPAC. As one participant expressed, "the Summit was of great value to me and the profession at large. It was refreshing to see that ECSA has transcended from exercising authority as a stipulation of an Act, but that it was moving towards moral advocacy" (ECSA, 2011, p. 7). The summit also highlights the connection between the goals of transformation and those of improved engineering education and practice.

Transformation in the Profession

As described earlier, the main challenge facing ECSA has been to increase the number of professional engineers. This challenge is paralleled by the need to increase the number of Black engineering practitioners within the profession. The data uncovered that there was a steady decline in the registration of professional engineers from 1998 to 2008. This downward trend resulted in SA experiencing a dire shortage of engineers.

The data further revealed that the period from 2009 to 2010 showed the beginning of the turnaround towards improved figures for the number of professional engineers, as well as the number of engineer candidates. While there was only a slight increase in professional engineers from 2008 to 2009, there was a significant growth rate regarding the registration of candidate engineers in 2009. This was an early sign of promise that the strategic objectives of the Council were beginning to bear fruit. The trend continues indicating a steady year-on-year increase regarding both professional and candidate engineers.

Furthermore, the period 2011/12 in particular indicated significant progress regarding candidate engineers. There was also an improvement with the increased quantity of professional and candidate engineers of colour, as well as female engineers towards 2013(ECSA, n.d.e).

Transformation Outcomes: Reaction to Strategic Plans

Staying with the transformation theme, data revealed that, as of 2010, in line with its strategic objectives, ECSA's HIC on Transformation (TC) had established a Joint Implementation Committee (JIC) and a Transformation Task Team (TTT), amongst other initiatives, to address the shortage of Black engineers in the South African situation. The JIC was tasked with making sure that the registration system incorporated the new competency standards. The goal of the TTT was to facilitate a more holistic transformation process in the quest to establish a diverse and representative engineering profession. Moreover, in March 2011, ECSA approved a number of priority projects on the recommendation of the SAC. These included the Candidacy Phase and the Engineering Skills Pipeline, that were highlighted at the Engineering Skills Summit

The efficacy of these initiatives is indicated by the numbers in the graphs and tables above and ECSA has had significant periods of success in addressing its transformation objectives.

The Roadshow, along with ECSA's other transformation activities were part of the strategic objective to advance "ECSA's relevance in SA society through promotion of its role and have influence on matters pertaining to the Engineering Profession" (ECSA, 2013). ECSA's reactions to the objectives of earlier strategic plans, as well as the current initiatives, including the Roadshow, indicate that they have made progress with their transformation agenda.

Second Skills Summit

ECSA hosted another Engineering Skills Summit in October 2012. A report from the summit containing recommendations was presented to the Minister of the Department of Higher Education and Training (DHE&T) in January 2013. These recommendations aim to influence policy and practice of engineering education, which in turn will lead to increased engineering graduate output. A joint Engineering Education working Group was constituted by the DHE&T in April 2013 between ECSA, the DHE&T and universities throughout the country. On the agenda was the approval of a candidacy phase learning programme and regulations for professional recognition. As described earlier, this could have a direct influence on the preparation of undergraduate civil engineering students.

5.2.4 Summary of ECSA Findings

ECSA was formed by the government and empowered by the Engineering Profession Act of 2000, to perform certain mandatory functions. It emerged that ECSA's core functions related to engineering education and practice in South Africa. The importance of SAICE emerged in assisting ECSA to fulfil part of its functions. This was followed by a close inspection of the criteria of the undergraduate civil engineering degree highlighting the direct impact of ECSA on the preparation of the undergraduate students to contribute to an inclusive society that accommodates people with disabilities. The underlying goal of transformation was explained as the growth of ECSA into an effective organisation. The first and second Engineering Skills Summits were then described highlighting the development of skills initiatives towards improving engineering education and practice. The following section explores the findings of UCT, as the "manufacturer" of the "products" (civil engineering graduates) within the production line model of the study.

5.3 The University of Cape Town

5.3.1 Introduction

Within the production line model of the study, the University was regarded as the "manufacturer" of the "product" (civil engineering graduate) in the production process. Furthermore, for the purpose of this study, UCT is divided into two sub-sections. The first sub-section presented here includes participants who work outside of the Department of Civil Engineering. More specifically, they represent the leadership of UCT, the leadership of the EBE faculty and the Disability Service. They are regarded as upholding the name and reputation of UCT, as well as performing a management role at the University. They are referred to collectively in this section as participants from "Outside the Department". The second sub-section refers to those participants who work inside the Department of Civil Engineering. They represent the leadership and staff (lecturers) of the Department of Civil Engineering, who are involved with the day-to-day running of the undergraduate civil engineering degree. Collectively they shall be referred to as participants from "Inside the Department".

In line with the aim and objectives of the study, one-on-one in-depth interviews were conducted with the participants from “Outside the Department”, with a view to exploring their attitudes towards issues of disability, as well as the resources, approaches and experiences regarding the preparation of undergraduate civil engineering students to contribute to an inclusive society that accommodates people with disability. The researcher read through transcripts of in-depth interviews and documents relating to the undergraduate civil engineering curriculum, transformation and disability policy at UCT, as well as social responsiveness reports of the university. The findings are presented in three themes entitled: “Resources”, “Approaches” and “Experiences”. Separate sub-themes were also identified in each theme.

5.3.2 “Outside the Department”

Participants from “Outside the Department” were perceived to generally reflect a positive attitude towards issues of disability, as well as a dedication towards the transformation process in the university. Furthermore, they were proud that the university had put transformation as well as disability policy, along with implementation plans and structure, in place on campus. The participants were confident that the leadership of UCT had established a culture of caring and transformation throughout the university, and most believed that issues surrounding disability would receive the same amount of attention as the other two key transformational issues of race and gender. The participants also felt that the staff would ensure that the implementation of the transformation plan would be carried out in order to achieve its goals.

5.3.2.1 Resources

Two prominent sub-themes emerged from “Resources”. They were “Guided by legislation” and “Transformation”.

5.3.2.1.1 Guided by Legislation

Findings discovered that UCT was guided by legislation with regard to its transformation process. The *EWP3* outlined that the role of higher education plays a fundamental part of the process of societal transformation in creating a better quality of life for everyone (DoE, 1997). In that sense, higher education has a series of purposes. Firstly, higher education is regarded as a “key allocator of life chances” and a major conduit in creating an equitable level of achievement within South African society (DoE, 1997, 1, 1.3). Secondly, higher education is a pathway for citizens to “fulfil specialised social functions, enter the learned professions, or pursue vocations in administration, trade, industry, science and technology and the arts” and hence, creating a new democratic society of accomplished individuals (DoE, 1997, 1, 1.3). Thirdly, higher education contributes to the advancement of society in its ability to think, invent and produce. It promotes the “development of a reflective capacity and a willingness to review and renew prevailing ideas, policies and practices based on a commitment to the common good” (DoE, 1997, 1, 1.3). Finally, higher education enhances and engages in “academic scholarship and intellectual inquiry in all fields of human understanding, through research, learning and teaching” (DoE, 1997, 1, 1.3).

From the framework of the *National Plan,* three key objectives relating to the preparation of civil engineering students to contribute to an inclusive society emerged. Firstly, the *National plan* calls for the promotion of “equity of access and to redress past inequalities through ensuring that the staff and student profiles in higher education progressively reflect the demographic realities of South African society" (DoE, 2001, Section 1, 7). This speaks directly to UCT's transformation policy regarding increasing the amount of students and staff who were previously disadvantaged, including those with disabilities. Secondly, the *National plan* encourages the production of "graduates with the skills and competencies necessary to meet the human resource needs of the country" (DoE, 2001, Section 1, 7). This relates directly to enhancing graduate attributes at UCT.

Finally, the *National Plan* calls for the "advancement of all forms of knowledge and scholarship, and in particular, addresses the diverse problems and demands of the local, national, Southern African and African contexts" (DoE, 2001, Section 1, 2). This speaks to the development of African related topics as well as the incorporation of the topic of disability within the lectures of the undergraduate training programmes. The guiding principles and framework for the transformation of higher education outlined above in *EWP3* and the *National plan* are seen to directly influence the transformation policies and agendas of UCT as explained in the following theme of "Transformation".

5.3.2.1.2 Transformation

There were six significant sub-themes that were revealed within "Transformation". They were: "Transformation policy", "Transformation Services Office", "Role of leadership", "Established institutional structures", "EBE Faculty Transformation Charter", "Disability policy" and "Disability service".

Transformation Policy

Findings discovered that UCT was guided by legislation with regard to its transformation policy. Influenced by the *EWP3* and *National Plan*, transformation is recognised as a goal of the University's strategic plan. It highlights the interventions that UCT believes it needs to make in order to develop itself in particular ways over the next five to 10 years (UCT, 2009). The six key strategic goals within the strategic plan for UCT 2010 – 2014 are:

- Internationalising UCT via an Afropolitan Niche;
- Transformation of UCT Towards Non-Racialism – Redress, Diversity, Inclusiveness and the Recognition of African Voices;
- Working Towards a Desired Size and Shape for UCT;
- A Vision for the Development of Research at UCT: Greater Impact, Greater Engagement.
- Enhancing the Quality and Profile of UCT's Graduates; and
- Expanding and Enhancing UCT's Contribution to South Africa's Development Challenge (UCT, 2009).

Furthermore, the transformation goal has four elements:

- making the University a more representative institution in terms of its academic and support staff, and of its student body;
- promoting enhanced intellectual diversity;
- transcending the idea of race; and
- improving institutional climate and having an enhanced focus on our intellectual enterprise on African perspectives (UCT, 2009).

The University is committed to developing itself into a transformed institution, in which people no longer hold stereotypical views of others based on their gender, race or disability. Moreover, UCT puts forward that a transformed university will be one in which the underlying historical power relationships, of which various forms of discrimination are symptoms, are fundamentally altered and equalised (UCT, 2009).

There are four strategic objectives for the transformation of UCT; these include:

- implementing policies that result in a change to the University's student and staff demography in order, ultimately, to become a truly non-racial institution, and to reduce gender inequities at senior staff levels;
- making the University a place that is experienced by all its staff and students as being inclusive and nurturing; and
- developing inclusive curricula and engaging with African voices (UCT, 2009).

UCT's Strategic Plan 2010 – 2014, further outlines the need to define its graduate's attributes and it specifically mentions the issues of global citizenship and awareness of social equity, as well as an ability to engage with communities (UCT, 2009). UCT stipulates that students in post-apartheid South Africa must have a critical knowledge and understanding of the country's history and the experience of its citizens. The implications of this history must be made relevant to their fields of study and future work (UCT, 2009).

Findings revealed that, from the outset, the issue of transformation has been taken very seriously by the University. In line with its strategic objectives, laid out in the UCT Strategic Plan 2010-2014, UCT has developed extensive policies on transformation to use as sound resources in addressing these issues. The transformation policy at UCT looks at transformation in general and at redressing previous injustices within South Africa. Amongst its objectives, the policy looks at raising the demographic profiles of previously disadvantaged staff and students at the University, as well as instilling a culture of respect and dignity for all across all campuses. However, it further recognises that: "Transformation in a university context must also touch the substance of what we learn, teach and research" (UCT, 2009, p. 6).

This alludes to introducing new topics and relevant issues into the lecture rooms in order to meet the development needs of South Africa's emerging democracy.

Transformation Services Office

It was found that UCT has established a Transformation Services Office (TSO) to coordinate transformation activities; communication on transformation; policy development; transformation leadership development and advice; and support to UCT committees and stakeholders (UCT, 2014a).

Role of Leadership

The culture of transformation at UCT appears to be backed up by strong leadership and a committed approach at the highest level. The leadership is very aware of the rights of the staff and students, at all levels, and is proud to have structures that are there to defend those rights. Furthermore, with regard to achieving the goals of transformation and upholding the rights of people with disabilities in particular, they feel that they have made a conscious effort in achieving those goals. All in all, there appears to be strong commitment from the leadership of UCT, coupled with a well-established structure of transformation fora and on-going committees, which support that leadership. This finding is emphasised in the following statement from one of the participants: *"one of the things the registrar is required to do is to ensure that the university complies with legislation – morally and constitutionally we must accommodate people with disabilities, all the way to legislation on buildings and their compliance with the needs of people with motor disabilities"* (Participant).

An example of this commitment from leadership towards transformation was evident when the University leadership "forced" a particular faculty to accept a student with a disability whom they had previously rejected. A member of the leadership explained to the faculty that there was policy in place that is applicable to everyone and it must be interpreted and enforced correctly. A participant declared: "*We explained to them that there is no reason why a person who is blind cannot be a physiotherapist*" (Participant).

Established Institutional Structures

Findings revealed that the established structures enhance UCT`s transformation operations and enable any pressing issues to reach the higher levels of leadership. For example, introducing the topic of teaching disability in the curriculum as part of the transformation agenda could be passed on from the transformation fora to the Faculty Board, which meets four times a year. The Faculty Board consists of members of the leadership of the faculty, as well as other stakeholders in the civil engineering programme, including employers and members of the civil engineering associations.

The EBE faculty has 14 people on their transformation committee. There is no separate portfolio which addresses the issue of disability in the EBE faculty, although the Dean responded that this may be a good idea. Disability is incorporated into the transformation agenda of the faculty along with the issues of race, gender and HIV/AIDS. The idea is that they should all be treated equally, without one area of discrimination taking precedence over another.

The EBE transformation committee is split into two sub-committees. One of the sub-committees deals with employment equity and its primary focus is on the demographics of staff members. The equity sub-committee strategises around initiatives within the faculty, or suggests to the departments what they should be doing, whether it is related to race, gender or disability. The faculty recognises that it is short of its demographic target and is striving to rectify that. A participant expressed*: "The academic staff level is not where it should be and everybody is aware of that"* (Participant).

The other sub-committee focuses on the values and culture of the faculty. This addresses the institutional climate within the faculty. A participant explained that the focus is: "*How do we appreciate and trust one another, and how do we care for one another*" (Participant).

Furthermore, the faculty has a set of indicators that tracks transformation. These are the demographic profiles that track the areas of gender, disability, race and international staff; and they are reviewed on an annual basis. This is followed by a strategic day-session with the Dean's Advisory Committee, where intended outcomes are evaluated and reviewed. Findings suggest that UCT had made great strides in achieving its transformation goals. Transformation had been incorporated into all planning and budgeting aspects of the University, as opposed to being an add-on, separate strategy. On-going and important dialogue on transformation, through the established forum, was also established.

EBE Faculty Transformation Charter

The transformation objectives of the University have had a direct influence on the EBE faculty Transformation Charter, in which each member of the faculty embraces transformation and accepts the teaching, research and social responsibilities, which accompany their role in the future development of South Africa and the African continent. In achieving this, the faculty endeavours to formulate curricula and research activities that contribute to national goals, and an infrastructure conducive to achieving those goals (EBE, 2014d).

The faculty has formulated its Strategic Plan 2010-2014, including Transformation; Education and Training; and Interaction with Training Institutions and Industry.

Regarding the transformation process, “the faculty commits to:

- defend the fundamental values of the University in determining who shall be taught, what shall be taught and who shall teach;
- support, promote and inform the unfolding transformation objectives of the University;
- ensure that the quality of our teaching and research, in our various disciplines, is of the highest standard nationally and internationally, and is recognised as such;
- ensure that our curricula and research activities contribute to national goals, and provide an infrastructure conducive to achieving these objectives;
- strive continually to achieve equity and excellence in our appointment of staff, as well as the recruitment of students, in line with our Faculty targets;
- establish appropriate Departmental and Faculty mentoring programmes for staff, which encourage continuous development of all staff;
- strive to create a climate of mutual respect and trust among all staff and students in the Faculty, which is vital for collegiality and open discussion;
- foster an open, caring, and supportive environment within our Faculty;
- adopt a fair, transparent and professional approach in all matters relating to performance appraisal and management;

- have appropriate representation of all sectors of the Faculty on our Faculty and Departmental Committees; and
- appreciate that diversity among staff and students enriches us all, and to ensure that the various cultures, languages and traditions of our staff and students are fully respected" (EBE, 2014d, para. 2).

The faculty monitors and reviews its progress through the Faculty Transformation Forum, which represents all the members of the faculty. In turn, this forum reports directly to the faculty regarding any necessary or appropriate interventions (EBE, 2014d, para. 3).

Disability Policy

In line with the transformation process, the University adopted its policy on disability in March 2011. This was regarded as a progressive step in raising the profile of disability at UCT. A participant acknowledged that the disability policy *"codifies everything in one document and it is useful in that regard"* (Participant).

The Disability Policy provides a strong resource for the university itself, the Disability Service and staff and students with disabilities at UCT. With regard to its practical obligations, there are four key aspects of the disability policy. Firstly the University commits to improving access to the built environment on campus whereby: "Improved access to students and staff with disabilities will be formally included as a performance objective of the relevant members of the University of Cape Town" (UCT, 2011, p. 2).

Secondly, the University dedicates itself “to developing admission, recruitment and retention practices and policies for persons with disabilities, which will maximise participation in higher education at UCT” (UCT, 2011, p. 4).

Thirdly, the policy stipulates that:

> “The University must include disability in its employment equity plan and targets. It must put in place measures to facilitate the recruitment, retention and career advancement of people with disabilities, including such reasonable accommodations as will optimise their ability to meet the requirements of their job.” (UCT, 2011, p. 4)

The Disability Service is tasked with fulfilling the responsibility of reasonable accommodation (UCT, 2011).

Finally, with regard to research and teaching, the University acknowledges the value of disability-related fields and the “growing stature of Disability Studies as a relevant academic discipline along with other social justice disciplines” (UCT, 2011, p. 4).

Furthermore, paying attention to training programmes:

> “The University acknowledges the need to include, where appropriate, perspectives on disability in relevant undergraduate and graduate programmes e.g., Social Development Studies, aspects of Engineering and the Built Environment, Urban Planning, Transport Studies, Film and Media, Sociology, Psychology and the MBChB programme, to name a few.” (UCT, 2011, p.4)

Hence, besides the need to incorporate staff and students with disabilities onto the campus and making the campus disability friendly, UCT recognises the fundamental importance of including the subject of disability in lectures across all disciplines (UCT, 2011).

Disability Service

Data revealed that the Disability Service is well supported within UCT, and has managed to raise the profile of disability in general, throughout the campus. The main focus, and most successful area of the Disability Service, has been the provision of reasonable accommodation for students and staff with disabilities on campus. The leadership look to the Disability Service as UCT's instrument to help accommodate students and staff with disabilities, as well as assist with making the University campuses disability friendly. A participant declared: *"The disability unit has got that firmly on the agenda and gradually we're getting it. The disability unit has a ring-fenced budget, that is, the money that is allocated for the current work on campus"* (Participant).

It was discovered that the Disability Service had been placed under the auspices of Transformation Services. Until approximately three years ago, the Disability Service was located in the Department of Student Wellness.

5.3.2.1.3 Achievement of the Resources

It was discovered that the University has been relatively successful, on a consistent basis, with regard to employing and enrolling staff and students with disabilities, respectively. The following tables give an indication of the number of students and staff with disabilities at UCT. They represent a wide range of disabilities, across all races, and these numbers have risen steadily over the years. Furthermore, most of the faculties at UCT have a contingent of staff and/or students with disabilities.

5.3.2.1.3.1 Students with Disabilities at UCT

Table 5.1

Number of Different Disabilities of Students across each Faculty in 2011- 2013 (UCT, 2014b)

	SCI	COM	HUM	EBE	HEALTH	LAW	Total
Chronic Illness							
2011	1	12	4	4	0	0	**21**
2012	1	5	5	2	1	0	**14**
2013	1	2	4	1	0	0	**8**
Psycho-social		0					
2011	0	4	0	0	0	0	**4**
2012	2	1	6	0	0	0	**9**
2013	3	5	5	1	1	0	**15**
Hearing Impairment							
2011	1	0	0	0	2	1	**4**
2012	1	0	4	1	1	0	**7**
2013	2	0	1	1	1	0	**5**
Specific Learning Disability							
2011	0	0	0	0	0	0	**0**
2012	12	28	19	8	2	4	**73**
2013	Total across faculties						**209**
Motor Impairment							
2011	8	4	13	2	3	0	**30**
2012	2	3	8	1	0	0	**14**
2013	8	4	13	2	3	0	**30**
Visual Impairment							
2011	0	1	6	0	1	1	**9**
2012	0	3	1	0	0	0	**4**
2013	0	1	6	0	1	1	**9**
Wheelchair Access							
2011	0	0	3	0	0	0	**3**
2012	0	0	0	0	0	0	**0**
2013	0	0	2	0	0	0	**2**
Temporary							
2011	3	11	4	5	0	0	**23**
2012	3	11	3	7	2	0	**26**
2013	3	8	11	6	1	0	**29**

Speech Impairment							
2011	0	1	0	0	0	0	**1**
2012	0	3	1	0	0	0	**4**
2013	0	2	1	0	0	0	**3**
Neurological Impairment							
2011	0	0	0	0	0	0	**0**
2012	1	0	3	0	0	0	**4**
2013	0	1	1	0	0	0	**2**

It should be noted that there may be more students with disabilities than recorded in the above table. This is because some students prefer not to disclose their disability (Reinette Popplestone, Director of the Disability Service, personal communication, September, 9, 2013). The total number of students who disclosed their disability in 2012 was 46 students, and in 2013 this figure had risen to 500 students (Disability Service, 2014b).

5.3.2.1.3.2 Staff with Disabilities at UCT

The tables below provide a detailed description of the disability type of staff members at UCT from 2009 to 2013, as well as their gender and racial profile.

Disability Type

From 2009 to 2013, persons who were hearing impaired represented the largest proportion of staff with disabilities. Other disabilities that were more common, were physical disabilities and visual impairment (UCT, 2014b). The number of staff with disabilities has remained more or less the same over the years. However, there has been an increase in the total staff of UCT, therefore the proportion of staff with disabilities has decreased a little from 0.95% in 2009 to 0.84% in 2013 (UCT, 2014b).

Table 5.2

Number of UCT Staff with Disabilities by Disability Type and Subtype 2009-2013 (Disability Service, UCT, 2014b)

Disability Type	**Year**				
	2009	**2010**	**2011**	**2012**	**2013**
Chronic Illness	8	8	7	7	6
Hearing Impaired	12	15	16	15	15
Physically Impaired	12	9	8	8	8
Psycho-social impaired	1	2	2	2	2
Speech Impaired	4	3	3	3	3
Visual Impaired	2	3	5	5	6

Gender Profile

The table below indicates a slightly higher prevalence of women amongst the staff with disabilities.

Table 5.3

Gender Profile of UCT Staff with Disabilities 2009 – 2013 (Disability Service, UCT, 2014b)

		2009	**2010**	**2011**	**2012**	**2013**
Females	n	22	23	23	23	22
	% of total disabled staff	57.9%	59.0%	56.1%	57.5%	55.0%
Males	n	16	16	18	17	18
	% of total disabled staff	42.1%	41.0%	43.9%	42.5%	45.0%

Racial Profile

The table below (*Table 5.4*) indicates that White staff with disabilities represented the most prevalent group from 2009 to 2013. However, there has been a steady increase in the rise of Black staff with disabilities over the same period.

Table 5.4

Racial Profile of UCT Staff with Disabilities (Disability Service, UCT, 2014b)

		2009 n=38	**2010** n=39	**2011** n=41	**2012** n=40	**2013** n=40
African	n	3	4	6	5	5
	% of total disabled staff	7.9%	10.3%	14.6%	12.5%	12.5%
Coloured	n	8	8	10	8	9
	% of total disabled staff	21.1%	20.5%	24.4%	20.0%	22.5%
White	n	22	24	22	24	23
	% of total disabled staff	57.9%	61.5%	53.6%	60%	57.5%
Foreign national	n	5	3	3	3	3
	% of total disabled staff	13.1%	7.7%	7.3%	7.5%	7.5%

5.3.2.2 Approaches

Two sub-themes emerged from the data in the theme of “Approaches”. These were: “Graduateness” and “Social Responsiveness”.

It should be noted that it was felt that there was an overlap in findings between “Resources” and “Approaches” in some areas. For example, a policy establishes the standpoint of an institution on how to address an issue, and therefore could be regarded as an approach towards that issue. However, in this study, it was decided that it worked better to present policy as a Resource, as was the case when presenting *Transformation Policy* and *Disability Policy*. Furthermore, it was discovered that findings related to transformation could be divided between the themes of Resources and Approaches. The sub-themes of “Graduateness” and “Social Responsiveness” were placed under the theme of “Approaches”, because it was felt that they represent UCT’s approach to addressing the creation of an inclusive society, at a broad level.

5.3.2.2.1 Graduateness

Aspect of Graduateness

Findings revealed that the sub-theme of graduateness was introduced in UCT’s Strategic Plan 2009 - 2013. The Strategic Plan outlines the need to define its graduate’s attributes and it specifically mentions the issues of global citizenship and awareness of social equity, as well as an ability to engage with communities. Findings revealed that there was a strong approach to graduateness at leadership level at UCT. The aim was to produce students who are critical and reflective. A participant explained: “*Students must have a broad understanding of the world and other aspects of society and environment – the assumption is that the engineering faculty will then draw upon those graduate attributes and specify them within the faculty and within the departments”* (Participant).

The motivating factor behind graduateness was the importance of graduating students having a broader view of the world they live in, including a sense of value and a sense of social justice. A participant described these key graduate characteristics as:

> *"social responsiveness; global citizenship; health, safety and environment; ethics and professionalism and we also have a good technical side – a technical content to think critically – that is the fifth one. I would not like any graduate to leave this faculty not having key graduate characteristics."* (Participant)

5.3.2.2.2 Social Responsiveness

It was found that UCT has established a strategic goal to improve its contribution to South Africa's development challenges. Furthermore, it aims to do this through relevant research as well as incorporating students into socially-responsive learning opportunities. Aspects of UCT's social responsiveness agenda include the following:

- research activities;
- engagement with policy development;
- public commentary on development issues and strategies;
- social outreach activities by students;
- programmes to empower external constituencies;
- improvement of the relevance of the curricula; and
- providing opportunities for lifelong learning (UCT, 2015c).

The socially responsive activities that UCT engages in throughout the year are published in the annual *Social Responsiveness Report*.

A sub-category that emerged from the interview process was: "Quite a bit happening".

Quite a Bit Happening

The findings highlighted a strong commitment to social responsiveness at UCT. Data revealed that there were a number of projects on-going regarding social responsiveness activities at the EBE faculty. Some were linked to communities directly or via a non-government organisation. A participant expressed that:

> *There is quite a bit that happens in this faculty regarding social responsiveness. There are people that provide water or housing in poor communities and things like that. . . . Engineers without Borders got involved in there as well – and there are many students that are part of that.* (Participant)

However, the point was raised that disability was not necessarily involved. The participant added that: *"How much is related to disability is the question? I also think that disability is almost this orphan that nobody thinks of because there are so many problems that are so in your face that it is forgotten – that is the impression that I get"* (Participant).

5.3.2.3 Experiences

One sub-theme emerged from the theme of "Experiences". This was: "Meeting transformation objectives".

5.3.2.3.1 Meeting Transformation Objectives

The data revealed seven sub-themes concerning "Meeting transformation objectives". These were: "filling quotas"; "challenge of addressing different diversities"; "challenge of interdisciplinarity"; "difficult campus"; "definition of disability"; "Implementation of policy"; and "disability forgotten about".

Filling Quotas

Findings revealed that UCT has encountered a challenge in trying to meet their affirmative-action targets. All areas and faculties throughout UCT have targets and concessions are made for a set number of disadvantaged candidates who would not normally get into UCT on the basis of their examination results. Despite these concessions, they still find it very challenging to fill these vacancies. A participant explained:

> *There are numbers in a list of affirmative-action targets if you like, for people who would not normally get into UCT on what would be called merit – and so we reserve a number of places for people who are so defined in affirmative terms — we're supposed to do that in our employment equity processes too and we regularly review those things but it is really hard to – you cannot force these things, so when jobs are advertised, for example, we cannot manufacture people who do not exist.* (Participant)

Challenge of Addressing Different Diversities

Findings revealed that University leadership was very sensitive to not placing the needs of one disadvantaged group over another; it was important not to let one group precede another. However, in reaction to this, some felt that disability still did not get as much attention as it deserved. A participant declared:

> *These things are not to be ranked –just as it is important not to rank the status of women over the status of Black people –but yes, from time to time some people will think that one is more important than the other and take priority – but I don't think that is being consciously done, people from any of the three categories (race, gender, disability), they may think that this has been the case – whether those perceptions are justified by the fact, I do not know.* (Participant)

Another participant expressed:

> *You have to also understand that a massive amount of energy in this university is being consumed by people saying, "We need to have the African voice in the teaching environment" – there is a hierarchy of issues and exclusions – the triplets, as I like to call them – the triplets of race, gender and disability – disability is still the runt of that litter – it really is.* (Participant)

Challenge of Interdisciplinarity

In line with the transformation agenda, findings suggest that the issue of graduateness is taken very seriously at the faculty and that all lecturers believe in the value of the graduate attributes. As one participant declared: "*I think it is important that students do graduate with a social conscience – particularly coming from this part of the world*" (Participant).

However, the participant also highlighted a major challenge to incorporating issues of social justice and global citizenship in that it required collaboration across faculties and departments and this was very hard to do at UCT. She explained:

> *It is really hard at UCT because of interdisciplinarity – it is very hard to achieve this at UCT – the global citizenship elective which I was talking about just now really crosses engineering and humanities and there has already been objections from humanities – they say it is a course that they should be teaching – so every time one tries to do anything interdisciplinary at UCT there are often objections from people within certain disciplines – it is their turf, not your turf – so one has to find new ways of doing things and thinking about things in increasing knowledge.* (Participant)

Difficult Campus

Findings discovered that one of the biggest problems facing the leadership of UCT in accommodating people with disabilities is that the campus was built on the side of a mountain. Despite this, they were determined to improve the situation by making all new buildings accessible and were aware that they could do better. A participant explained:

> *The issue of motor disabilities is very difficult in terms of the physical layout of the campus – not on a flat piece of ground and I think there has been a huge improvement from what was 25 years ago. I think that a lot has been done in terms of physical access but they think it has become clear there is a lot more to be done*. (Participant)

Implementation of Policy

It was revealed that the Disability Service felt that they could not address the transformation objective of introducing disability and disability related issues into teaching effectively, because of the resources available to them. Given the current situation they admitted that the approach had to be more pragmatic. A participant explained:

> *Our primary focus has to be service provision and I suppose the truth is that service provision is remarkably time-consuming – and energy and resource consuming – so although we do advocacy and although I do some presenting – for example, I've been asked to present to the Department of Human Genetics on the disability policy– I mean, I would love to teach full-time*. (Participant)

Disability Forgotten About

Some felt that disability was not considered a high priority despite disability policy in place. One participant explained that, regarding disability policy, "*not a lot has changed since its* *introduction – and there seems to be a sense that simply having a policy vouchsafes one from doing anything else*” (Participant).

5.3.2.4 Summary of Outside of Department findings

The findings revealed that UCT had established a very strong transformation policy, which accompanied and aligned with its strategic objectives. It was discovered that the transformation policy was backed by strong leadership from the highest levels of UCT and a culture of caring had been created in the EBE faculty. It emerged that there was a strong teaching and research component within the transformation policy, that strived to develop inclusive curricula and an African voice. The strong policy and leadership role was judged to be a resource to UCT regarding all its transformation operations. It further emerged that there was an extensive disability policy, which essentially had a three pronged approach; increased number of staff and students with disabilities; accessibility on campus; and incorporation of disability as a topic in the undergraduate training programmes. UCT also held a strong responsibility towards graduate attributes, as well as being socially responsible to the broader community and had established policy and annual reports to back this up. With regard to the theme of experience, the data revealed that UCT had extensive quota processes to promote the education of those previously disadvantaged. Challenges related to meeting the transformation targets included the vast diversity of staff and students and the difficult campus terrain. Statistics showed a significant number of staff and students with disabilities working at UCT. Despite this, it emerged that some participants, who were not part of leadership, felt that disability was not taken as seriously as race and gender issues. Findings further discovered that UCT has done adequately regarding increasing numbers of staff with disabilities, as well as making campus as accessible as possible. Focus on the EBE faculty revealed that adopting an interdisciplinary approach at UCT was very difficult.

5.3.3 Inside the Department

The second sub-section presented here refers to those participants who work inside the Department of Civil Engineering. They comprise the leadership and staff (lecturers) of the Department of Civil Engineering, who are involved with the undergraduate civil engineering degree. The stakeholder "UCT: Inside the Department" echoed the sentiment of the university leadership in their commitment towards achieving transformation. However, they expressed how extremely difficult it was to carry out the transformation plans under the weight of their daily obligations and challenges faced as lecturers. This resulted in a disparity between the confidence expressed by the leadership of the university that the staff would implement the policies of the university relating to transformation and disability, including the adoption of an interdisciplinary approach where necessary, and the ability of the staff to do so. The issue of disability in particular, received increasingly less attention compared to the issues of race and gender. Participants representing "Inside the Department" said that while they were sympathetic to the needs and accommodations of people with disabilities, they simply did not have the capacity to address them.

Once again, the findings are produced in the themes of: "Resources", "Approaches" and "Experiences". Separate categories were also identified within each theme.

5.3.3.1 Resources

One prominent sub-theme emerged under the theme of "Resources". It was: "the undergraduate programme".

5.3.3.1.1. The Undergraduate Programme

The training programme was regarded as a resource available to the Department of Civil Engineering in the preparation of their students. The data revealed five relevant sub-themes within “the undergraduate programme”, namely: “curriculum”, “complementary studies”, “inclusive curricula”, “elective”, and “second year camp”.

Curriculum

The data revealed that in terms of graduateness, and the accreditation agreement that the University has with ECSA, every student must attain 10 exit level outcomes to achieve qualification of the B.Sc Degree. These outcomes are predominantly of a technical nature, as civil engineering is a very technically orientated degree. With regard to incorporating the topic of disability, however, there were quite a lot of theoretical lectures around community engagement, which related to what students would probably be working with in the communities; on aspects of their built environment; and infrastructure. Commenting on the exit level outcomes required, a participant stated that:

> *Most of these are technical outcomes. There are some outcomes which refer to things like an awareness of the impact of technology on society and environment – an understanding of how to work with communities*. (Participant)

Complementary Studies

Data revealed that, for the department to be accredited with the ECSA, they need to show that, somewhere along the line, they had a course that dealt with social awareness and that very often these are elective courses (further investigation revealed that ECSA prescribed this knowledge area as Complementary Studies, as described under the findings section on ECSA). A participant explained that the areas where the ECSA criteria say something about understanding social or environmental impact, dovetails with the University’s notions of graduateness. She stated: “*There are hints in the engineering Council criteria that suggest* *engineering students should be more than just technicians – they need to know something more than just technology*" (Participant).

Inclusive Curricula

It was discovered that under Goal Two: Transformation of UCT Towards Non-Racialism – Redress, Diversity, Inclusiveness and the Recognition of African Voices, the University was dedicated to "developing inclusive curricula" (UCT, 2009, p. 5).

Elective

With regard to the new, third year elective on civil engagement called Social Infrastructure, the data revealed that most of the students were attracted to it. However, it clashed with other courses of the engineering programme. A participant explained:

> *There is a new course called social infrastructure which is basically set for engineers. 95% of the students doing it are engineers – and it is sort of communities and perspectives in the first half. And in the second half we looked at water shortages and food supplies and urban services like sanitation and climate change and that type of thing – and so that sort of integrates engineering with civil society.* (Participant)

Another participant declared:

> *It was quite a popular course – as a choice a lot of people were interested but initially the timetable that they planned for it clashed with a course that they had already set up for us*. (Participant)

Second Year Camp

One area of the programme that occasionally incorporates disability is a camp conducted in the second year of the undergraduate civil engineering degree. A participant explained that the focus is on accessibility. She added that there is a presentation from the director of the Disability Service who is visually impaired. She also said that the camp motivated the students to appreciate disability more and prompted them to think out of the box with regard to designing around accessibility. She explained:

> *(The students) have to do something on-campus and it is usually around accessibility – and that is second year – it is a pretty short course but intense, about a week and a half long. (Disability Service Director) speaks to them and it is very impressive because she is animated – and they see somebody using Braille when presenting something to them*. (Participant)

However, it was soon discovered that this is a survey camp and it does not focus on accessibility every year. Another participant, who took part in the survey camp at a different time declared, *"– ours was different, we didn't do that – in our year, we had to design a cycle track through campus*" (Participant).

While the data revealed that, occasionally, there were opportunities for students to engage in the topic of disability, these engagements relied on chance, depending on specific years and timetables. At the time of writing the Social Infrastructure elective had included a session on disability, conducted by a guest lecturer with a disability. However, there was no formal integration of disability into the training programme at a faculty level.

5.3.3.2 Approaches

One sub-theme emerged from the data in the theme of "Approaches". It was: "Transformation".

5.3.3.2.1 Transformation

Paying attention to the approach of UCT regarding the incorporation of disability into the teaching and research aspect of transformation, three sub-themes emerged from the data. These were: "No disability agenda at the Department", "Open-minded approach", and "Possibility of introducing Universal Access".

No Disability Agenda at Department

Findings revealed that there is no formalised disability agenda at the Department of Civil Engineering. At the beginning of his interview for this study, a participant declared that he thought the interview "*would not take very long – regarding the question posed in the study*" (Participant). He explained that, regarding the issue of disability at the Department, "*at the moment we do nothing! That's the word. Nothing*" (Participant).

Open-Minded Approach

However, the data further uncovered that many participants inside the Department, including the one mentioned above, kept an open-minded approach towards incorporating the topic of disability into the undergraduate civil engineering programme. A participant stated: "*The opportunity is that, yes – engineers should know, for example, how to deal with people with disabilities. I think that would be very valuable, so it is something I would be prepared to do in professional practice*" (Participant).

Possibility of Introducing Universal Design

In a follow-up discussion with many of the lecturers of the Civil Engineering Department, the topic of UD arose – one of the participants stated that it would be possible to introduce this to students. She explained: *"We have design projects in most of our courses – it is really not that difficult to just explicitly mention to them – think about Universal Access and consider it"* (Participant).

Another participant agreed, stating that regarding their curriculum, they have argued that:

> *We want to take the user, society, seriously – we have always spoken about UCT civil engineering trying to have more sensitivity to community and to everybody in the community, and this is a really nice topic to look at broader issues. I mean the whole thing about an inclusive society is so fundamental to what any educational institution in this country needs to be dealing with*. (Participant)

5.3.3.3 Experiences

There was one sub-theme that emerged from the theme of Experience, namely, "Heavy workload".

5.3.3.3.1 Heavy Workload

There were four sub-themes to emerge from here. They comprised: "Heavy workload", "Already struggling", "Incorporating disability into the curriculum", and "Concern for students".

Heavy Workload

One of the first findings to emerge at department level was that the lecturers carry a very heavy workload, both in teaching and researching as well as administration tasks. Subsequently, the inclusive, family culture that is advocated at leadership and faculty level becomes weaker at departmental level because the staff and lecturers have so much on their plates. A participant explained:

> *We are supposed to be teaching, we are supposed to be researching and doing administrative tasks. We are also expected to do our bit – but that bit ends up being quite fragmented. I do all these things as an extra on top of everything else, so I am not involved in transformation.* (Participant)

Another participant declared: *"Also it is a workload problem apart from anything else – so from a survival point of view, you very quickly learn not to poke your nose into too many things"* (Participant).

Already Struggling

The lectures of the civil engineering programme feel that they are already trying to pack five years into a four-year programme. The average time for students to graduate for the four-year programme is five years. The Department offers 144 credits per year. The benchmark laid down by the Council of higher education is 120 credits per year. Consequently, the Department is overloading their students by 24 credits per year. There is recognition that they cannot teach the students everything they need to. A participant expressed: *"We struggle already to give our students what they need"* (Participant).

Incorporating Disability into the Programme

Some participants reiterated that despite a few interactions with people with disabilities over the years, there was no specific focus on disability within the undergraduate course at the Civil Engineering Department. They welcomed the idea of including disability in the undergraduate civil engineering programme, but maintained that the overriding challenge was that of shortage of time. The whole programme is very scientifically focused, and because of that lecturers struggle to integrate all the academic knowledge components into their courses. One participant explained: *"The bottom line is that while I am sympathetic to it, I am also sympathetic to a hundred other things that our graduates should know about but we never get around to actually teaching them"* (Participant).

Concern for Students

The findings also uncovered that the lecturers were genuinely concerned about their students. They were not only worried about what they were learning during the undergraduate degree; they were also concerned about what kind of people the students were going to become, along with their level of maturity and life decisions, and more specifically how they would work in teams. The lecturers felt that civil engineers have a specific role to play in society, and therefore carried a heightened responsibility to possess developed qualities of empathy and tolerance. As one lecturer expressed:

> *I'm dealing with fourth years in my class and there are some technically gifted and brilliant students there, but I'm really concerned about who they are as people and their choices in life and their interaction with others. In my view there are probably a couple of top students who cannot work in teams – and it is pushing that, the spirit of what this is about – I do not know how on earth you do it and it is completely contrary*

to any assessment regime – but if there was time to be human beings – I think civil engineers need to be human beings. (Participant)

5.3.3.4 Summary of Inside of Department findings

The findings revealed that the undergraduate training programme was regarded as a resource to the lecturers. A look at the approaches of UCT revealed that, while there was no disability agenda within the Department of Civil Engineering, they held an open-minded approach to incorporating it, along with UD, into the lectures. However, it was a shortcoming that there was no formalised manner in which disability was incorporated into the training programmes. Participants at the Department of Civil Engineering described the challenges of a heavy workload and administration as hindering the UCT transformation processes and incorporation of disability into the training programme.

5.3.4 Reflections of "Raw Materials" and "Products"

In line with the objectives of the study it was felt pertinent to get the reflections of the "raw materials" (current students) and the "products" (graduates), on the undergraduate civil engineering degree. In general, most of the students and graduates were aware of disability and that there was a Disability Service at UCT. Most of them felt that the topic of disability and the concept of UD could be incorporated into their training programme at an early stage, in a similar manner to which the "green" environmental aspect concerning the built environment is introduced into their course. A number of participants expressed a particular regret at UD not being introduced from the outset. All of them welcomed an interdisciplinary approach to learning about engineering and society, including the interaction with people with disabilities.

The reflections of the current students are presented first, below. The graduates, comprising of students who had graduated over the last 10 years, are presented after that.

5.3.4.1 Current Students

There were seven themes that emerged from the reflections of students. They were: “Early years technically orientated”, “Disability in the second year – building standards”, “Input from industry”, “Aware of disability at UCT”, “Enjoy topic of civil engagement”, and “No formal link to industry”.

Early Years Technically Orientated

Findings revealed that the civil engineering undergraduate course is, in general, a very technical programme. In particular, the first and second year focuses strongly on mathematics and basic sciences and there is little attention paid to interaction with civil society. The students confirmed this to be the case. A participant expressed: *“It is a BSc in engineering – so right now we’re more focused on maths and science”* (Participant)

Disability in the Second Year - Building Standards

The data revealed that some participants felt that the issue of disability could be introduced during the topic of building standards. They felt that they could be made aware of the concept, in much the same way that they are made aware of the impact of engineering on the environment. A participant stated:

> *It is very important –I think this should be part of building standards. I mean there are green star buildings ratings and that is a huge plus– I think the city of Cape Town – our headquarters over there – our main offices are green star and that’s what they want to do – and you could link that to disability as well.* (2nd year student)

Input from Industry

With regard to the input from the industry, some participants felt that this aspect could be incorporated into their lectures, as opposed to being outside events, as these were poorly attended. As one participant explained:

> *Yes, so not to make it a compulsory event – but make it where the students are thinking, "We would have this lecture normally but they have made space for this presentation from who-ever" – like a geotechnical company during the geotechnical lecture*. (2nd year student)

Aware of Disability

Findings revealed that most of the participants were aware of students with disabilities on campus and that there was a Disability Service at the University. A participant expressed: *"I do not think the University is very good with that. Are they? – Because there are so many, many stairs"* (1st year student).

Another participant stated:

> *I know that there is a disability office – I think with regards to the disability Jammie – I know that it is quite inaccessible – because there is only one for quite a few people who actually need it.* (2nd year student)

Enjoy Topic of Civil Engagement

Data revealed that students welcomed the topic of civil engagement in their course. They appreciated this as they felt that it gave a "real-life" aspect to what they were learning. A participant stated:

> *Well, "Urban" was a good example of getting a broader perspective of what the reason is – why we're doing engineering and how we can apply it – We had Prof*

Armitage and he did a great job – he gave us the background as to why and where does it come from? (3rd year student)

Another participant added:

Yes, and it was very good because – he even gave background to the whole crisis in Cape Town – where it all started and it all came down to sanitation – and all the politics involved – it is not just numbers. (3rd year student)

No Formal Link to Industry

The students were asked whether there had been any input from industry in their course. Findings revealed that regarding the undergraduate degree, there was no formal link between industry and the University. The interaction revolved around a number of events arranged by the student council or by SAICE. As one participant stated: *"There are a couple of evenings that come about"* (Participant).

5.3.4.2 Graduates

There were 11 themes that emerged from the reflections of the past students. They were: "Early years technically orientated", "No focus on disability", "Accessibility/UD not taught from the beginning", "Sense of awareness needed", "Interaction with industry", "Professional studies", "Relationship with professional bodies", "Experience of Universal Design in practice", and "Fear of disability".

Early Years Technically Orientated

The findings echoed those of the current students in that the early years of the civil engineering course are strongly focused on mathematics and the basic sciences. A participant expressed:

> *First and second year were probably a lot more focused on the hard technical aspects.* (Participant)

No Focus on Disability

The data reveal that while the subjects of accessibility and disability were mentioned when doing design, there was no real focus on it. As one participant expressed, *"it wasn't focused on accessibility – it was part of it but not the focus."* (Participant)

Accessibility/Universal Design not Taught from the Beginning

Findings revealed that the subject of accessibility and/or UD tended to be an add-on and was not incorporated from the beginning. As one participant expressed, "*but again the mind-set still at the University is to teach a person how to design something first and then for them to, in their designs, incorporate everything else."*(Participant)

The participant then indicated that it would make more sense to incorporate the concept of UD from the outset. She expressed:

> *It would make more sense because for example, it is no good if I design my building now, and then only afterwards I have to start thinking about how are disabled people going to come into my building, and then I had to change my whole design, as opposed to thinking about it and incorporating it into my design right from the beginning. It also saves time.* (Participant)

Sense of Awareness Needed

It emerged from the data that the past students felt that they lacked an important sense of awareness concerning the accommodation of people with disabilities in the built environment. As one participant explained:

> *You can be aware and then you can be aware – you can either think, okay, that's something we need to check, or you can actually have a clear understanding of what the different levels of needs might be and how to meet those needs and what is available to meet those needs – so we definitely had no scope on that level of awareness.* (Participant)

He then added the importance of this awareness regarding the role of civil engineers in society:

> *It would be good in general to have an awareness of what is the role we have to play within society is. As designers of civil service and infrastructure serving a broad society – what does that broad society make up? What are all the things you need to be aware of in general across any type of infrastructure provision – it would be helpful to see more of that role in a perspective of society – and what their needs are.* (Participant)

Interaction with Industry

The findings further revealed that apart from the obligatory work for a company who gave them their bursary, the past students did not have much interaction with Industry. One participant described the public health and safety week held by UCT every year: *"It was a* *general thing – like a thing they normally do on the Jammie steps – it was not anything for us."* (Participant)

Professional Studies

Findings revealed that the past students underwent a short professional studies course during their undergraduate degree. For the most part, they felt it was beneficial, although it was for a limited time. As one participant explained:

> *He cannot teach us everything in a week, but he tries to touch on the main focus of a lot of things – and part of that course was including environment and disability and the way we behave as professionals and the choices that we make. It made us aware that we had to start acting as a professional.* (Participant)

Relationship with Professional Bodies

The data identified that similar to the relationship with industry, the past students had a limited relationship with the professional civil engineering bodies, although they learn about it early on. One participant explained, *"We were told about SAICE in first year and they said get involved now."* (Participant).

Another expressed: *"I was also a student member of SAICE and basically just got the magazines"* (Participant).

Experience of Universal Design in Practice

The data uncovered that since working for a company in the "real world", the past students did not receive much input regarding accessibility and/or UD in practice. One participant indicated that:

> *I was just really told, "Okay, do this design." – I started with the design and as I started reading manuals and then I saw in the manuals that you need to start thinking about this and about that.* (Participants)

Fear of Disability

The data also revealed an underlying fear of disability. One participant referred to a friend of his who had an intellectual impairment who is trying to make corporates aware of people with intellectual impairment who may be good at certain types of work. He explained:

> *Most organisations are scared to employ that kind of disability because there is just this unknown factor. You don't know when somebody might, for example, have a tantrum and then that is a big issue – that is the fear – but actually the fear is not warranted if you have an understanding of the environment that needs to be in place – that you can accommodate and you can end up having an employee that is one of your best employees.* (Participant)

5.3.4.3 Summary of Reflection of Products

The reflections of the "products" gave some interesting feedback regarding the undergraduate training programme and the stakeholders involved. It soon emerged in the data that the students were quite socially aware and were immediately interested in disability and accommodations necessary for people with disabilities in the built environment. Also quick to emerge was the fact that the civil engineering undergraduate course was very technical and very work intensive and dominated the time of the "products" throughout their training programme. With regard to the topic of disability, it was found that many of them attended a survey camp during the second year, which focused on accessibility surrounding a car park and they interacted with the director of the Disability Service who had a visual impairment.

However, the same course was not repeated every year and sometimes it focused on bicycle tracks. With regard to civic engagement, there was a popular elective that was available in the third year, called Social Infrastructures. This elective was, however, not available to everybody because of timetable clashes. It was also discovered that students did not have much interaction with Industry or even the professional bodies, only really coming into contact in their final year, as they began to focus more on their future careers. To recap, their approach towards disability was welcoming and they were interested in the topic of disability being incorporated into the training programme. It was clear however, that it was a difficult and challenging course and that they did not have time to concentrate on much else.

The input from the graduates reiterated the response of current undergraduates. They agreed that the BSc degree was a very technically oriented and work intensive course. It also emerged that they had not had much interaction with people with disabilities, and exposure to this was purely by chance. Their attitude was also welcoming towards disability and they felt quite strongly that the concept of UD could be introduced early on in the undergraduate degree course. It was found that in their working years, the graduates continued to have only sporadic interaction with the professional bodies and ECSA. It was found that time as a candidate engineer can be quite anti-climactic, as a lot of time is spent doing mundane but necessary things in the process of gathering experience. It was becoming a qualified professional engineer.

5.4 The Industry

5.4.1 Introduction

With regards to the production line analogy, Industry is seen as a place where the product is refined and specialised for use (as described in the methodology of the study). The researcher read through transcripts of in-depth interviews with representatives of employers of civil engineers in the private and public sector. Participants representing the stakeholder of Industry expressed a general awareness of disability, and legislation surrounding disability, in the built environment, as well as an open-minded approach towards incorporating the concept of UD into the development of new infrastructure. However, in spite of what was described as a ‘growing awareness’ of the needs of people with disabilities, it became evident that there was no formal structure in place to incorporate the accommodation of people with disabilities or the concept of UD. Consequently, disability was often forgotten about and there prevailed a lack of consultation with people with disabilities, which in turn contributed to a continued lack of accessibility in developing infrastructure. Furthermore, although recognised as necessary, there was resentment towards some of the costs related to accommodating people with disabilities in the built environment, because they were regarded as very high.

Once again the findings are presented in three themes entitled: “Resources”, “Approaches” and “Experiences”. Sub-themes were also identified in each theme.

5.4.2 Resources

There were two themes to emerge under “Resources”. They were “Legislation is there” and “Underutilised resource”.

5.4.2.1 Legislation is There

With regard to the implementation of accessibility in design, the approach of Industry was simply to use the current legislation available. It was found however, that the information was not readily available and often required extensive search. A participant explained:

> *There is legislation there and you comply with the legislation – I had to go and dig up for it – I am doing a pedestrian bridge for a railway station for the passenger rail*

association – I did some searches and eventually I managed to find it – so it is available but do not think that it is always easily accessible. (Participant)

Despite comprehensive international and local legislation encompassing all disabilities, there was a belief in the Industry that the built environment only needed to accommodate wheelchair users. A participant shared:

In the infrastructure, to the best of my knowledge, that we put in at the moment has to be wheelchair-friendly – and that is my understanding of the way that legislation has been written. So we are duty bound to comply with that. (Participant)

5.4.2.2 Underutilised Resource

The findings uncovered that participants from Industry felt they were greatly underutilised as a resource to universities. They believed they had a vast amount of knowledge, expertise and experience to share with students. One participant elaborated:

No offence to the full-time lecturers, because they have a certain position as well and a certain place, but I mean the part-time lecturers really do give you a sense of – "oh, I was actually on this site last year – this was built last year." – So you almost immediately become more interactive with the lecturer, so to speak. (Participant)

The relationship between Industry and universities will be further explored under the theme of Experiences.

5.4.3 Approaches

There were two sub-themes that emerged within "Approaches". They were: "Accommodation for disability", and "New awareness of transformation".

5.4.3.1 Accommodation for Disability

There were two further sub-themes to come out of "Accommodation for disability". These were: "Positive approach" and "Greater need".

Positive Approach

The data revealed that overall industry, in principle, has a positive approach towards accommodating people with disabilities. This accommodation leaned towards UD, in that it was linked to the area of non-motorised transport, which holistically refers to bicycles, wheelchairs and pedestrians, etc. It was acknowledged that perhaps there was a difference in delivery between the private sector and the state. It was further acknowledged that the attitude towards accessibility had vastly improved over the last 20 years. A participant shared:

> *Speaking from my experience – there is a very good relationship between all those concerned – and there is an understanding that if the contractor says there is no access for wheelchairs or prams then immediately there is a rap on the knuckle for the designer who did not take that into account*. (Participant)

With regard to the improvement in the approach towards accessibility, another participant expressed:

> *Most of the guys would agree about 95% and say, okay let's adapt this design – and let's put less steps in – or half of the steps and put a ramp on the side or something like that – if you talk about train stations – they were built a long time ago and they did not consider that necessary – it is in modern times that there is accommodation*

for disabled vehicles and things like that – and if they don't do it in the design, it is failing. (Participant)

Greater Need

One participant felt that this awareness has been influenced by the increased numbers of people with disabilities. He stated:

> *I think there is more of a need for it now – there are more people like you who have been in accidents – and there are more people who are ill – but in the old days they were not that many people around and everything was built for a normal, healthy person and that is wrong.* (Participant)

5.4.3.2 New Awareness of Transformation

Findings uncovered that Industry felt there was a new awareness and implementation, both towards transformation and accommodation of people with disabilities, in the engineering profession. Industry also believed that they had had a positive influence on transformation at universities. A participant explained:

> *I watch what the old firm does and I'm impressed – also, that since 1994, there are many more Black graduates coming through and that is good. I just think that there is more general awareness of transformation nowadays – amongst all South Africans.* (Participant)

5.4.4 Experiences

There were six sub-themes that emerged within "Experiences". They were: "Industry and government relationship", "Generation gap", "Universities and students", "Accommodation of people with disabilities", and "SAICE, associations and industry".

5.4.4.1 Industry and Government Relationship

There was one significant sub-theme to emerge from “Industry and government relationship”. It was: “Improving”.

Improving

Data revealed that the relationship between industry and government had improved in recent years, and more specifically, the period during and after the Soccer World Cup 2010.

This was because the industry and the government had, of necessity, to work together, in order to prepare adequately for the event. However, there had also been some slow progress in the relationship as a result of the transformation process. Findings showed that, until the new millennium, the industry was heavily dominated by White elderly gentlemen and this was slowly changing. A participant explained:

> *It is improving – it was disconnected. I think for many years the profession and the government were not meeting on a regular basis and there were not enough connections. I think one of the problems at that stage was that ECSA was still seen as a White boys club, so to speak.* (Participant)

Another participant added:

> *Recently I was looking at photographs of the CEOs and the board of consulting engineers in South Africa – these are the CEOs of the top 12 or 15 consulting engineering companies in the country – and it was 60/40 in favour of Black, as in non-White, members at that level, whereas before it was very much dominated by White faces. So it has changed over the last decade – and I think that change has assisted with the relationship with government.* (Participant)

5.4.4.2 Generation Gap

The data that emerged from industry supported other findings that a generation gap exists within the civil engineering profession. The demographic is top-heavy in the 60 to 75-year-old range of civil engineers. The main theme to emerge from this category was “Loss of knowledge”.

Loss of Knowledge

The generation gap is particularly evident in the public sector and is of some concern because many of these civil engineers are ready to retire and will take much needed skills and experience with them. The generation gap also exists in the private sector, although it is perhaps not as drastic. A participant stated:

> *The problem at province is that there is a big gap between the younger guys and the older guys – and the older guys are at the point where they are over 60 – and the problem is that with all their experience they are going to be retiring in a couple of years – and these younger guys, if they had somebody above them with experience to guide them they would be able to keep themselves gainfully employed. But at the moment those guys – with all their experience and technical competence – I’m not sure what is going to happen – you cannot just grab anybody.* (Participant)

5.4.4.3 Universities and Students

The findings exposed a gap between industry and the universities. The participants felt that there could be a lot more interaction between the two. Sub-themes that arose from this category comprised of: “Industry – University relationship”, “Lecturing”, “UCT doing a good job” and “Graduate attributes”.

Industry – University Relationship

Participants felt they would like to see a sharing of expertise and information between universities and the Industry, as well as getting guest lecturers from industry to speak to students. Regarding the University – industry relationship, a participant elaborated:

> *It's not very good, again, there is a disconnect because there isn't a feedback loop between what is happening at the Universities – what is happening at industry and then getting it back to the universities – we tend to be islands in the stream instead of a bridge across the stream – so therefore industry is just going ahead business as usual.* (Participant)

One of the participants felt that it was imperative that industry develop a strong relationship for its own benefit. He stated: *"Unless industry talks to the universities – there is no guarantee that industry is going to get the product that they want – and if they don't talk to the University and they get a product that does not work it is in quite significant measure their own fault"* (Participant).

Lecturing

The participants thought that one of the best ways to improve the relationship was to get people from industry to give lectures at the universities. This had happened previously and had been very successful in giving civil engineering students insight into the real-life problems and operations of industry. A participant explained:

> *How could it be improved? – by getting more professionals involved in short term lecture sessions and discussion groups with students – and I think they have got a couple of lecturers at the University of Cape Town at the moment who have got an industry background who lecture part-time.* (Participant)

Another participant explained:

> *I was given a free hand to put together a course on professional practice (PP) and the idea was to provide a link between what you were doing at university and what you were likely to be doing and encountering when you get out there in the real world – my whole approach in PP was to teach the course on a case study basis. The point of PP was to alert your fourth year engineer who was walking out of university and was now heading for his first job.* (Participant)

He invited a geotechnical specialist to give a presentation to the students. He described the outcome:

> *The enthusiasm for geotechnical engineering that flowed out of that one presentation was absolutely amazing, because now they suddenly learned that there is a thing called rock stability, there is a thing called reinforced earth, there is a thing called sliding resistance, etc., . . . they suddenly found that here are a whole string of practical things that they hadn't yet even heard of.* (Participant)

UCT doing a Good Job

Findings revealed that participants recognised the difficulty of conducting a four-year degree and felt that the University of Cape Town was doing a good job in producing civil engineer graduates. A participant expressed enthusiasm for the training programme. He expressed:

> *Undergraduates in civil engineering at the University of Cape Town do amazing things in their first year – they get very involved with complicated design work and complicated ideas – and by the third year they are doing quite heavy stuff. They do a good job at UCT.* (Participant)

Graduate Attributes

With regard to student attributes, findings revealed the skills that industry wanted students to have and be able to develop. A participant described these skills, stating:

> *The first skill you need is the ability to conceptualise a problem – you need to ask yourself, "Has the client defined the correct problem?" Then look at possible solutions – and look at your solutions, not just from a technical angle but look at your solutions from a social angle or from a maintenance angle. You can go and put a very highly sophisticated system in and then you cannot maintain it because the level of skill that you got available cannot handle it – so that is the second skill. The third skill is – can you operate in a team? Because in that scale you're going to have architects, you're going to have environmentalists breathing down your neck – you're going to have the politicians who are trying to look for glory – can you work in a team? And the fourth thing – can you communicate and communicate your ideas – can you adapt your communication according to the audience that you're communicating to?* (Participant)

5.4.4.4 Accommodation of People with Disabilities

As described in Approaches, findings revealed that industry had developed a positive approach to accommodating people with disabilities in some areas. However, as in other areas, implementation of this was not always thorough or existent. The key sub-themes that were revealed here were: "Opportunity to change things", "Afterthought and sensitisation", and "Cost".

Opportunity to Change Things

Participants recognised the need for a change of mind-set and, regarding making accommodations for people with disabilities, the need to get accessibility principles right at the design stage because once something was built it was very difficult and expensive to rebuild it properly. Regarding the willingness of industry to accommodate people with disabilities, a participant expressed:

> *I think it is there – I think there is an opportunity, I think that one of the things that isn't there is other alternative ways of accommodating people with disabilities. I mean, at our offices our toilet for the disabled is in the parking area in the basement – it is four stories. So the debate might not be about what is done but how it is done in different ways in terms of accommodating disabled people.* (Participant)

Afterthought and Sensitisation

Data revealed that this accommodation also referred to employment of people with disabilities. In the particular company stated above, they had only recently employed a person who was a wheelchair user. A participant acknowledged that the wheelchair accessibility design in the building was an add-on. He commented:

> *. . . and you picked it up when you asked me how many people with disabilities we have in our office – and for six years we had nothing, so it becomes very much an afterthought of like – "let's put them in the basement - they are okay – they can go up and down the elevator – that is fine.* (Participant)

The participant was genuinely embarrassed about this despite the fact that it was unfortunately common practice for companies to think this way. They felt that there was a strong need for a greater awareness about disability. He stated:

No, but I mean it is not understandable – it shouldn't be that way – it should be really implemented from the beginning in the design of the building. I think it is just a sensitisation – it is an awareness of this is something we have to do –it is saying, "These are my peers and I need to accommodate my peers because as much as I have my rights– they also have their rights. (Participant)

Cost

The data showed that one of the challenges regarding accommodation of people with disabilities was the cost factor. In some instances the costs were not seen as high, for example, to make dropped curbs was not very expensive. However, in other areas the cost could more than double when making something accessible. A participant explained:

For instance, I will give you the train station breakdown – in their tender they had a certain value for what they estimated the structure would cost – the reality is when you factor in things like elevators and longer ramps that you need, the cost that we ended up with now is double or in fact 2.5 times what they originally estimated – and that is a big factor. (Participant)

It was found that rising costs instilled a sense of negativity within clients around making things accessible. While there was a commitment to making things accessible, clients felt it might be hard to justify the exorbitant costs of making things accessible. A participant elaborated:

The client is looking at it and it is almost becoming a grudge cost, so to speak – In the context of South Africa where there are so many different needs for a finite case resource – they look at it and they say, "Well we could spend this money elsewhere" – and that is always going to be the case because there is always something else to *spend the money on – so as much as they fully bought into it and they know that they have to do it – at the back of their mind they will be thinking, "this is a little bit expensive"– so it is a challenge but it is an unavoidable challenge.* (Participant)

5.4.4.5 SAICE, Associations and Industry

There were two relevant sub-themes to come out of this category. They were: "Old and White", and "Other organisations".

Old and White

Findings revealed that some participants of colour felt it was difficult to feel at home within the civil engineering industry and its close-knit association to SAICE. A participant explained:

> *It was nice that you got to meet a broader – that you got a sense of community. The one realisation I had in that interaction was that – I'm not sure if it was the Institute or the industry – that it was old and White – that became very apparent. And then I almost stepped away unfortunately – and that was partially because I struggled to relate to the people who were there already.* (Participant)

Other Organisations

It emerged that there were other organisations within the civil engineering profession that brought people together. A participant stated:

> *I actually got involved with the UCT chapter of CESA – Consultant Engineers South Africa– they basically represent consultants – and they had a young professionals forum (YPF) – the YPF represents young engineers in consulting up to the cut of age of about 35 – so we wanted to provide a forum or young engineers, technicians and*

technologists and anybody in the consultant field to network and to air their views and to run workshops. (Participants)

Overall it was discovered that the various associations and institutions were a positive thing to have within the industry, with most of the professionals belonging to one or several of the groups. A participant declared:

> *I think it is in tune because of SAICE which is fairly well – SAICE does have its finger on the pulse of engineering and it also works with CESA to a certain extent but CESA is not a legislative body – whereas the ECSA is formed by the act – is mandated by the state. SAICE is a voluntary society and CESA is also a voluntary society but it is more focused on companies whereas SAICE is very much focused on individuals.* (Participant)

5.4.5 Summary of Industry findings

The first thing to emerge from the data was that industry was an underutilised resource and it was felt that more could be done in the areas of lecturing and research. Furthermore, it was found that industry had an overall positive approach towards accommodating people with disabilities but had no real direction concerning it and that building regulations concerned with accessibility were not readily at hand. With regard experiences of industry, it emerged that their relationship with government had improved since the 2010 World Cup. There was concern that many of the elderly White males, who dominate the profession, were soon retiring which meant a significant loss of expertise. If further emerged that industry was in need of sensitisation and awareness of disability. Furthermore, it was found that many new clients were demanding that projects for the environment are made accessible to people with disabilities although there were concerns about the costs attached. It was also found that significant transformation had taken place within the authoritative structures of South African engineering, as well as the professional bodies. They were not dominated by White males as they were 10 years ago and were currently more representative of the nation.

5.5 Consumers: People with Disabilities

5.5.1 Introduction

With regards to the production line analogy, society is seen as the consumers of the undergraduate civil engineering degree (as described in the methodology of the study). This study focuses on people with disabilities within society as the consumers, and therefore a key stakeholder, of the undergraduate civil degree. The participants representing the stakeholder People with disabilities highlighted a distinct lack of application and enforcement of legislation regarding making the built environment accessible. Furthermore, they acknowledged themselves as experts on their own needs within the built environment. In that regard, they viewed themselves as an underutilised resource for higher education institutions and industry alike regarding the accommodation of people with disabilities within engineering education and practice in South Africa.

Once again the findings are presented in three themes entitled “Resources”, “Approaches” and “Experiences”. Sub-themes were also identified in each theme.

5.5.2 Resources

There were two sub-themes that emerged with “Resources”. They were: “Legislation”, and “Expertise on disability”.

5.5.2.1 Legislation

The main sub-theme that emerged from “Legislation” was: “Need to apply it”.

Need to Apply It

Findings revealed that the biggest single resource that people with disabilities possess is modern day legislation promoting, supporting and protecting disability rights. This legislation pertains directly to the individual right of people with disabilities as well as to their broader rights of inclusion within society, including employment and an accessible built environment. Furthermore, this legislation is on an international and local basis and the remaining challenge is to get it implemented properly. A participant stated: *“We have got the legislation, we just need to make sure that it gets applied properly”* (Participant).
Another participant declared:

> *I think the requirement to have people with disabilities in the workplace has been good – we have been given the rights as citizens to equal rights in South Africa – unfortunately it does not always get to the man in the street and the people who affect your day-to-day life.* (Participant)

5.5.2.2 Expertise on Disability

A key sub-theme that emerged from “Expertise on disability” was: “Sharing knowledge/Workshops”.

Sharing Knowledge/Workshops

The second major resource available to people with disabilities is their own expertise on disability and the ability of some of them to create awareness around disability issues. Coupled with the rights of people with disabilities, this expertise enables them to host effective training and disability sensitisation workshops at all levels of society. A participant described the benefit of sensitising able-bodied people to disability, particularly when they will be working with a person with a disability. She explained:

> *I do a lot of workshops and I had spoken to them about cerebral palsy and they asked a lot of questions – and then this girl started and about a month after that she contacted me and said, "Thank you so much for doing this – the people here are so much more relaxed because they know what to expect.* (Participant)

5.5.3 Approaches

There was one main relevant sub-theme that emerged from "Approaches". It was: "Approach towards inclusion".

5.5.3.1 Approach Towards inclusion

There were a number of sub-themes within "Approach towards inclusion". These were: "Disability equals barriers", and "Education".

Disability Equals Barriers

Findings revealed that environmental barriers may create or exacerbate a person's disability. One of the participants who subscribed strongly to the definition of disability derived from the World Health Organisation explained:

> *If there are environmental barriers then I have a disability – but if there are no environmental barriers then I don't have a disability, I am independent. And attitudinal barriers – as soon as people, don't see disability as a limiting factor – they see the person, not the disability – that is really my understanding of what disability really means.* (Participant)

Education

Findings revealed that there were strong sentiments related to education and disability. Education was regarded as a right to individuals with disabilities by the participants but they felt that it had become one of the segregating factors in society, in that it separated people with disabilities from society at large from an early age. This was because children with disabilities often had to attend special schools or received no education at all through being disabled. In turn, participants felt that this perpetuated a cycle of socialisation that was hard to overcome. A participant explained:

> *Accommodation for people with disabilities in an education environment should be an unwritten – it should just have to be – but should not be there as "a nice to have." And the problem is we have this attitude around special schools for children with disabilities – why don't we mainstream kids with disabilities as much as we can? – and make the school suitable, because if the schools are suitable then the advanced education institutions like technical and universities, etc., will all become accessible.* (Participant)

He further added:

> *Because if a child grows up and understands disability at an early age they will carry that understanding through to their adult life – and whatever profession they follow they will always have an appreciation for disability.* (Participant)

5.5.4 Experiences

There were five sub-themes that emerged within "Experiences". These were: "Legislation and accommodation", "Universities", "Reactions towards disability", "Underused resource", and "Success and challenges so far".

5.5.4.1 Legislation and Accommodation

There were two further sub-themes that emerged from "Legislation and accommodation". These were: "Lacking implementation and commitment", and "Industry".

Lacking Implementation and Commitment

The data uncovered that despite some excellent legislation regarding the accommodation of people with disabilities within a proposed accessible built environment, there was a lack of commitment to implementing the policies. A participant expressed outright disappointment at the government's lack of commitment to implementation of policy. He stated: *"There is a lack of enforcement of existing legislation. We have some excellent laws, and different pieces of legislation, but none of them are enforced, so they become worthless"* (Participant).

The findings further uncovered a general disappointment at the lack of thoroughness in carrying out legislation. A participant stated:

> *Government should be a leader – unfortunately it is not as good at delivering as it should be. General business, if you look at shopping centres and that – most of them are pretty good and they are following the basic code, but what is really frustrating is that they have an intent to deliver, but in terms of getting the delivery done something slips through the cracks.* (Participant)

Industry

The data discovered that the engineering and built environment profession in South Africa has not yet embraced accommodation of people with disabilities or the concept of UD. A participant revealed:

> *The industry is basically NOT contributing directly in any meaningful way – have a look at Rea Vaya in Jo'burg, which was one system which was designed and built without a UD consultant – it remains largely inaccessible for many people. The same is true of the architects and road traffic engineers. It remains an uphill battle to have UD principles and accessibility included in all aspects of* out of the category *the systems.* (Participant)

5.5.4.2 Universities

The data revealed one key sub-theme out of "Universities". It was: "Curriculum and resources".

Curriculum and Resources

Another participant appreciated the hardships that UCT had regarding incorporating disability onto campus. She felt, however, that perhaps they were more successful in providing accommodations for students and staff than they were getting disability incorporated into the curricula across the faculties. She explained:

> *The disability unit has a responsibility to make sure that disability is brought into all the faculties – but I think that sometimes they get clogged up with looking for bursaries or funding for students with disabilities – they then obviously have to struggle to find accommodation for the students to bring them into the campus in terms of accessibility. So there is a lot that has been done but I do not know to what extent the disability unit at UCT is impacting on the curriculum and the education side of the University and the faculties – I suspect they are trying but I do not know if they are winning the battle.* (Participant)

Another participant felt that the situation could be improved upon and recognised the opportunity for themselves and others with disabilities to be involved, particularly regarding sensitisation towards disability, as opposed to only the accommodation of staff and students with disabilities. He stated:

> *In terms of their actual curriculum – I'm not too sure how much focus is on disability or human ability to look at the built environment – they don't study the legislation or the regulations and that is part and parcel of what they're all about – but I think sometimes in the actual teaching side there is a gap – that the students need to be more sensitised towards disability.* (Participant)

5.5.4.3 Reactions towards Disability

Participants expressed very strong feelings about how people reacted to them in society, and most of these were negative experience. A key sub-theme that emerged was: "Preconceived attitudes".

Preconceived Attitudes

The findings uncovered that prevailing attitudes towards people with disabilities did play a part in the advancement of their inclusion in the general society. The participants shared a range of experiences and emotions relating to this, from anger to frustration to trying to find out the right way to go about engaging people with disabilities.

A participant described the awkwardness of some interactions with society. He reflected:

> *Normal people don't know how to come up to you and say, "What is wrong with you?" – because that is incredibly rude. So on the one hand they will knock you out with their attitude but on the other hand they don't have the courage or the conviction*

> *to say, "I see that you're different, what is the nature of your condition?" – and so I am having to make myself better for you when actually I am quite happy.* (Participant)

5.5.4.4 Underutilised Resource

Findings revealed that in general people with disabilities represented a huge resource that is grossly underutilised. Two key sub-themes that arose were: "Workshops", and "Universities".

Workshops

People with disabilities could offer so much to all stakeholders by way of disability sensitisation and training workshops, as well as consultation on various individual projects. Even when workshops were arranged, attendance was poor. As one participant stated:

> *I have just given a two day workshop aimed specifically at providing accessible Non-motorised Transport facilities for the Polokwane IRPTN. This was organised by Department of Transport, but the turnout was very disappointing. The engineers and designers only came because the project manager made attendance compulsory for all companies to attend. On the feedback at the end of the day, all the participants felt that the workshop was very helpful as their present designs did not conform to the new legislation*. (Participant)

The participant was aware of his ability, both as a person with a disability and as a UD consultant, to become a great resource to the industry related to the built environment. He expressed:

> *We need to have many, many more engineers, architects and even just access consultants available in South Africa, as the need is huge. I do want to set up a course*

> *and a professional body in order to achieve this, but just don't have the available time.* (Participant)

Universities

Some participants recognised that they had not had much impact on universities. As one participant declared*: "I have not seen any influence of the Disability sector in any of the universities that I have worked with over the last 10 years"* (Participant).

5.5.4.5 Success and Challenges So Far

The findings have shown that it has generally been a struggle to get disability issues incorporated into the mainstream as well as the industry to implement UD policy at ground level. However, data revealed that there have been a number of successes along with a number of challenges in recent projects. There were three key sub-themes to rise out of this category, they were: "World Cup 2010", "MyCiTi project", and "Accessibility training".

World Cup 2010

Some of the successes were linked to the World Cup 2010. A participant explained:

> *In the case of both Greenpoint and Nelson Mandela Bay, we, and the architects, engineers and builders had worked long and hard to ensure that all the targets were met and exceeded. They, including the German journalists, all admitted that the accessibility that we had managed to achieve in both stadiums far exceeded what they had in their own countries.* (Participant)

MyCiTi Project

The findings uncovered that there is a lot of work being done at the moment in establishing accessible public transport systems throughout South Africa. This is an exciting prospect for many people with disabilities as it may enable them, for the first time, to get out of their localities and travel to nearby towns and thus become included in society. A participant working on the project expressed:

> *I do think that these new Bus Rapid Transport systems will have a massive impact. Already MyCiTi has broken new ground in terms of accessibility within public transport systems, and we are further improving upon that in other cities. MyCiTi has been recognised as leading the World in terms of accessibility and has been put forward for an international award. I think some of the other cities are going to be even better*. (Participant)

This project was having a positive influence on the awareness of professionals working with them in the built environment. The participant further added:

> *The engineers on the ground are learning, and adapting to provide for accessible facilities. But it is tricky; we are asking for a paradigm shift in their approaches in many cases. In the recent workshop, one engineer pointed out that he had been building pavements and intersections in Pretoria for 30 years, and felt he knew how to do it properly now. At the end of the workshop he admitted that his traditional methods were wrong, and none of his many intersections would enable people with disabilities to use them safely, and he was going to have to re-think. But there are too many engineers out there who have no clue about accessibility, who are still building inaccessible public facilities. There have been quite a number of mistakes made in relation to tactile paving, as while the concepts are pretty easy to follow, it can be*

very difficult to apply on site. Further, none of the engineers involved have had any experience before of doing it. But there has been a marked improvement as we have progressed. (Participant)

Accessibility Training

Finally, the data revealed that training on awareness of disability awareness and accessibility had a long-lasting effect. The same participant shared following:

> *I was working recently with an engineer in Polokwane, and I was impressed with how quickly he was able to grasp some of the different aspects, so during a coffee break I enquired whether he had a family member who was disabled. "No," he said, but he had attended Roger Behrens course – I had failed to recognise him – and he told me that the week they spent on Universal Design, Accessibility and Disability Awareness was the most influential week of his professional life. – That reinforces the need!* (Participant)

5.5.5 Summary of Consumers: People with Disabilities Findings

The first finding to emerge and a strong theme throughout, was that despite the resource of disability policy at the highest level, implementation and government commitment had been weak. It is also found that people with disabilities, like industry, represented a large underutilised resource to UCT and the engineering profession. Following that, the role of education was said to be vital in the transformation process as a whole. Participants felt strongly about inclusive education for children with disabilities, as well as their role as participants and consultants regarding education programmes at South African higher education institutions. The general sentiment among the consumers was that the University had done well regarding the accommodation of staff and students with disabilities on campus.

However they felt that it was still a gap in the curriculum with regard to the topic of disability not being included. It was found that a constant challenge to the consumers was the reaction of other people to their disabilities. Recent successes of the consumers that emerged included introduction of UD at the BRT systems developed for the 2010 Soccer World Cup, as well as positive feedback from engineers at training workshops on accessibility.

5.6 Summary of Chapter 5: Findings

This study set out to explore the preparation of civil engineering students at UCT to contribute to the development of an inclusive society that accommodates people with disabilities. The secondary aim of the study was to identify key issues of interest from the interviews of the stakeholders. The key objectives included gaining insight into the operations of ECSA as well as exploring the resources, approaches and experiences relating to the preparation of the civil engineering undergraduates. Finally, the reflections of the students and graduates were looked at. Throughout this chapter, each section ended with a summary which gave a concise report on the emerging themes. Therefore, it seems more productive to provide a summary that gives an overall picture of the findings through reflection of the key themes related to the approaches, resources and experiences of the stakeholder. Beginning with approaches, the key theme to emerge was that of transformation. The data revealed that both ECSA and UCT had strong committed approaches towards transforming the landscape of engineering and higher education respectively. In that sense, ECSA and UCT both had solid resources for effecting change in their transformation policies.

Looking across themes and categories, other similarities in resources to emerge were the following;

- People with disabilities and UCT (Outside the Department) both felt that legislation was a resource to them.
- SAICE is a resource to ECSA and Industry.
- People with disabilities and Industry both felt they were underutilised resources.

Finally, perhaps a difference in resources was that UCT (Outside the Department) was found to be the training programme of the civil engineering undergraduate degree.

With regard to similarities in approaches, the following was discovered:

- UCT (Inside the Department) and Industry both had no agenda regarding disability and/or incorporating the concept of UD.
- However, they both had an open-minded approach to incorporating the concept of UD.

Differences in the theme of approaches were identified as the following;

- UCT had a strong approach towards graduateness, while ECSA and industry did not.
- UCT had a strong approach towards social responsiveness, while ECSA and industry did not.

Moving on to experiences of the stakeholders, the data revealed a general lack of agenda regarding disability. Further similarities in the theme of experiences included:

- Disability is forgotten about – emerged from “UCT” and “People with disabilities” and “Industry”.
- Sensitisation on disability is needed – emerged from “Industry” and “People with disabilities” and “Products”.
- Lack of implementation of legislation - shared by “People with disabilities” and “Industry” and “UCT”.
- Lack of collaboration – the University and in this University and Industry.

- Lack of a multidisciplinary approach – the University and Industry.
- UD is cost-effective – People with disabilities and Industry.
- SAICE is hands on – Industry and ECSA.

Other key experiences related to:

- ECSA too reliant on SAICE.
- UCT – Industry relations are not very strong.
- UCT has failed to incorporate disability as an undergraduate topic
- Products felt disability should be a topic within their training programme.
- Products felt UD should be included within their training programme from the outset.

Overall, data uncovered that ECSA has yet to incorporate the issue of disability into its transformation agenda. The University had a much stronger focus on disability. It had developed an extensive disability policy which essentially had a three pronged approach in addressing disability. Firstly, the University was committed to increasing the number of staff and students with disabilities on campus. Secondly, they had committed to making the campus accessible to people with disabilities as far as possible. Finally, UCT had set out to incorporate the topic of disability within the undergraduate programmes. The data revealed, however, that while there had been progress in the first two goals, UCT had fallen short in the last one of incorporating the topic of disability into teaching. Furthermore, it was found that participants felt that disability was often overlooked in favour of the other transformation issues of race and gender. The findings are dealt with in more detail in the discussion chapter, which will follow.

CHAPTER SIX

DISCUSSION and CONCLUSION

6.1 Discussion

6.1.1 Introduction

This chapter discusses some of the key findings in this study within the conceptual framework that was proposed for the study regarding the preparation of undergraduate civil engineering students to contribute to the development of an inclusive society that accommodates people with disability. Smyth (2004) proposed the use of a conceptual framework in reflecting on the findings of a study. For this study, the proposed four elements of the conceptual framework were the participation of people with disabilities, disability policy and legislation, the transformation of engineering education and practice, and the concept of UD. To see how these four elements are evident in the preparation of undergraduate civil engineering students at UCT to contribute to the development of an inclusive society that accommodates people with disability, this chapter reviews the attitudes of the study participants towards issues of disability, as well as the resources, approaches and experiences of the stakeholders engaged in the preparation of the students.

6.1.2 The Elements of Conceptual Framework

Recalling the production line model, each stakeholder was represented by an inspection step within the production line process. The main focus of the "production process" is the training process in the Department of Civil Engineering at the University of Cape Town. The training process is reviewed in taking into account the contributory roles of the other stakeholders, namely ECSA, the University of Cape Town, made up of the leadership of the university and the faculty, the Industry, and people with disabilities.

6.1.2.1 Element 1; Participation of People with Disabilities

Attitudes towards people with disabilities have been acknowledged as major contributors to the inclusion or exclusion of people with disabilities in the society (Goreczny, Bender, Caruso, & Feinstein, 2011). Overall, the attitudes of the stakeholders towards the participation of people with disabilities in society came across as somewhat ambivalent. All stakeholders generally expressed a positive attitude and open-minded approach towards people with disabilities and their accommodation within the built environment. Despite this, very little appeared to have been done on their part to constructively contribute to improving the situation. The issue of disability seemed to be something that everybody was in favour of when the matter came up, but was also quickly forgotten when other issues came into play. A number of participants from University indicated that disability took a back seat behind issues of race and gender in the transformation process. The University, from the leadership right down to the corridors of the Department of Civil Engineering, did express a willingness to address issues surrounding disability, and a sensitivity to the challenges faced by people with disabilities.

The University of Cape Town formulated a three-pronged approach towards disability. This included increasing the amount of staff and students with disabilities on campus, making the campus accessible for them, and finally, including disability as an undergraduate topic in the lecture halls. The University had made a great progress in meeting the first two goals as it had successfully embraced disability transformation by increasing the number of staff and students with disabilities on campus. Furthermore, despite a difficult physical location where the university was built on the side of a mountain, UCT had made great strides in increasing accessibility on campus for people with disabilities. For example, it had incorporated accessibility in the construction of new buildings, or retrofitted and adapted old buildings where possible.

Furthermore, UCT had established a Disability Service Unit to oversee the integration of the staff and students with disabilities, as well as to act as consultant and watchdog in the process of making the campus more accessible. The unit was staffed and managed by people with disabilities themselves, thus responding favourably to the call for inclusion as expressed through the motto of the disability movement - "nothing about us without us" (Stone, 1997, p. 2). However, the third objective of incorporating the topic of disability into research and teaching remained a key challenge. It was positive and beneficial that civil engineering undergraduates were exposed to a diverse population on campus (Martin et al., 2005), including an increasing number of people with disabilities. However, the fact that they were not learning about disability in the lecture theatres represented a potentially negative factor in their preparation to contribute to an inclusive society that accommodates for people with disabilities.

Despite the policy on disability in the university, the ability and capacity to effect real change reduced drastically at departmental level because of the everyday challenges faced by the civil engineering lecturers. The Civil Engineering industry expressed a similar attitude. In principle, the industry welcomed and recognised the right of people with disabilities to be included in the built environment. However participants from the industry also acknowledged that people with disabilities were often forgotten about, and did not take part in decision-making processes relating to their accommodation in the society. This can be described effectively using one particular example -

> A participant from industry explained how he specifically went to search for the requirements of people with disabilities within the building regulations, to incorporate them in a new infrastructural development. He further described how it was the responsibility of industry to ensure the implementation of the legislation and to take the requirements of people with disabilities into account when designing new developments. However, when discussing the employment of people with disabilities, the participant realised that his company had not provided the proper accommodations for a number of his fellow colleagues who were wheelchair users. He was embarrassed by the fact that the wheelchair-accessible toilets were located in the building's basement, four levels below their offices.

This example highlights a kind of 'double standards' attitude that currently exists towards people with disabilities. In other words, despite the open attitude towards people with disabilities, there was still no formal structure within industry to enforce legislation and make sure that the built environment was accessible for people with disabilities. The situation is not unusual and concurs with literature – these attitudes are seen to form of invisible barrier towards inclusion of people with disabilities in society (Barnes, 2003; Goreczny et al., 2011; Hergenrather, Rhodes, & McDaniel, 2005). The same participant expressed that while there was a growing awareness of people with disabilities, there was still reluctance by industry to change towards accommodating people with disabilities, it being simply easier for industry to carry on doing things as they had always done.

The civil engineering students and graduates also expressed an open attitude towards accommodating people with disabilities in the built environment. They instantly recognised people with disabilities as a diverse group which is discriminated against and welcomed the incorporation of the concept of UD into their training programme. Unfortunately, while UCT has done well to enrol students and employee people with disabilities, as well as to make the campus partially accessible to them, it has failed to recognise the importance of including disability as a topic in the undergraduate programmes. Currently, any teaching surrounding disability was done on an ad hoc basis (Ohagunwa et al., 2015). This means that when students graduate, they do not take issues of disability with them into their professions. This contributes to the current situation, where people with disabilities still perceive that they are being discriminated against through their exclusion from the built environment. Overall, the attitude towards participation of people with disabilities may be encapsulated best by one participant who expressed –

> "How much is related to disability is the question? I also think that disability is almost this orphan that nobody thinks of because there are so many problems that are so [much] in your face that it is forgotten."

6.1.2.2 Element 2: Disability policy and legislation

A key discovery to come out the findings was the awareness of disability policy and legislation amongst the stakeholders. South Africa was one of the first countries to ratify *the CRPD*. This document, along with a local extended disability policy in the INDS (OSDP, 1997) called for a built environment that is accessible and conducive to the full participation of people with disabilities (Kayess & French, 2008; UN, 2006). For example, the government has put in place legislation that would enhance the accommodation needs of people with disabilities, and guide the Civil Engineering Industry in matters relating to building and transport regulations. Examples of this legislation include the *SANS 10400: The application of the National Building Regulations Part S: Facilities for persons with disabilities* (2011); the *SANS 784:2008: Design for Access and Mobility Part 4: Tactile indicators* (adopted

2008), and the *Accessible Public Transport Strategy (2011).* Similarly, the University of Cape Town formulated the three point approach to disability, which was also informed by *the CRPD.* People with disabilities regarded these policies, international and national, as resources to obtain their rights with opportunities for participation in society.

However, this awareness of the disability policy and legislation did not necessarily translate into implementation, as each stakeholder was unable to individually maximise the benefits of implementing the legislation that relates to issues around disability. People with disabilities reported that despite the legislations, the lack of implementation of policies still contributed to the fact that, like many other developing nations, the South African built environment remains largely inaccessible to the majority of its citizens with disabilities (Durocher et al, 2012; WHO, 2011). Though there were no interviews with representatives of ECSA which could have clarified the stance of the council regarding policy on disability, information obtained from the website indicated that despite a strong policy and commitment towards transformation, there was no apparent agenda or strategy regarding disability. In that regard, people with disabilities may argue that the quality of the current standard of South African engineering, as prescribed by ECSA, falls very short of providing an accessible infrastructure for them.

The use of the production line model for this study (Tirkel & Rabinowitz, 2013), which involves a closer inspection of each phase of the production process, has also offered the opportunity to enhance the quality of the products. Existing legislation provides a common ground, with clear direction and purpose, for the stakeholders to collaborate and build upon (Hartenberger et al., 2013; Hitch et al., 2012). Current legislation has also located ECSA as part of the Council for the Built Environment (CBE) which acknowledges other professionals engaged in the development of the built environment. Currently, the CBE comprises mainly the technical professions. In that sense, its scope has remained narrow as it does not have interaction with any governing board related to health or the well-being of people dwelling or moving through infrastructure in its quest to create an inclusive built environment. Hitch et al. (2012) identified this lack of inter-professional collaboration as being an obstacle to the participation of many people "within their respective communities regardless of individual age, gender, abilities or capacities" (2012, p. 376). Therefore the area of the built environment specifically calls for greater collaboration among stakeholders in order to create a common understanding amongst relevant professionals regarding accommodation of people with disabilities and the concept of universal design within the built environment (Afacan & Erbug, 2009; Dong 2009; Hartenberger et al., 2013; Hitch et al., 2012).

To conclude, with regard to the conceptual element of disability policy and legislation, the results of the study identify that despite a lack of implementation, the general awareness and acknowledgement of the stakeholders regarding legislation on the inclusion of people with disabilities in the built environment was the positive factor. This provides an opportunity to for the stakeholders to collaborate to incorporate the accommodation of people with disabilities in the built environment more effectively.

6.1.2.3 Element 3: Transformation of Engineering Education and Practice

After reviewing all the data generated, there was generally a strongly expressed dedication to transformation by all the stake holders. Over the last five years, ECSA had put in place important initiatives in addressing its transformation agenda. It has formulated some good plans for the way ahead within an engineering landscape in a country calling for an increase in diversity amongst professional engineers and the need to incorporate social justice into the profession. This echoes the literature from Europe and America, which has increasingly recognised the need for greater diversity within engineering education and practice in the attempt to develop an inclusive society for everyone (NAE, 2005; RAE, 2011; Wulf & Fisher 2002; Vest, 2006). However, despite ECSA's strongly expressed commitment to transformation, there is no evidence of an explicit policy on disability being included in the transformation agenda. In its role of regulating engineering education and practice, there is no explicit reference to issues about disability in the generic exit outcomes developed by ECSA. This may translate to the fact that training institutions have the choice of including or excluding the issue of disability as a professional requirement in their training programmes. In that regard, people with disabilities may argue that the quality of the current standard of South African engineering education falls very short of contributing to the provision of an accessible infrastructure for them.

This possibly manifests in a restricted way of practice within the engineering industry (Hartenberger et al., 2013; Hitch et al., 2012). Study participants from the industry indicated that they realised, to their dismay, that purely out of ignorance they had been designing for many years, sometimes decades, without accommodating people with disabilities (Darcy, 2003; Gray, et al., 2008; Hammel, et al., 2008; Shakespeare, 2006). These participants however raised the need for the university to address the "mismatch" between the skills requirements of the industry and the competencies of graduates in the built environment (Shaaban, 2014; Witt et al., 2013, p. 114). People with disabilities also strongly expressed their sentiments regarding frustration with the status quo, as they were not playing any role in the preparation of civil engineering students to contribute to an inclusive society that accommodated people with disabilities. This finding concurred with previous research (Barnes, 2003; Betts & Flower, 2001; Durocher et al., 2012; Filmer, 2008). It was therefore very encouraging that representatives of the Industry and people with disabilities were willing to partner with UCT in the preparation of the students to contribute to the development of an inclusive society that accommodates people with disabilities.

The University of Cape Town had a very strong and conscientious approach to graduate attributes, with a commitment to produce graduates who would be of benefit to the development of a young, democratic, South Africa. In alignment with international trends, the University leadership in particular was adamant that students should not leave the university without possessing the key graduate characteristics of social responsiveness, global citizenship, health safety and environment, ethics and professionalism, as well as the ability to think critically over and above their technical capability (Borrego & Cutler, 2010; King, 2012; Martin et al., 2005; NAE, 2005; RAE, 2011; Zandvoort et al., 2013). Unfortunately, the implementing of these noble goals is yet to result in the formal inclusion of disability in the undergraduate curriculum in the Department of Civil Engineering in UCT. While the staff at the Department held an open-minded approach to incorporating the topic of disability into their programme, they simply had neither the time nor the resources. In that sense, the students do not get any regular, formalized exposure to the issue of disability in their undergraduate training programme. As a result, they may remain ignorant of the issues of disability as they become professional engineers. This scenario contributes, along with other factors, to the exclusion of people with disabilities in the built environment. However, there have been some positive ad hoc projects that involved people with disabilities. For example, within the EBE faculty there was evidence that some students were involved with the NGO "Engineers without Borders". This NGO was established to help improve communities, during which the students involved encountered disability-related issues. Litchfield et al. (2014) identify that these students have already gained an advantage over their peers in terms of the development of their non-technical competencies, which will be an asset to the civil engineering industry.

Achieving the graduate attributes set by UCT, especially as it pertains to preparing undergraduate civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities, would benefit from a strong partnership between the stakeholders identified in this study. As ECSA has a regulatory role in engineering education and practice, there should be no vagueness about what is expected in addressing issues about disability. Information obtained about ECSA indicated that the professional body relies on informal collaboration with professional associations such as the South African Institute for Civil Engineering (SAICE) to carry out some of its functions. As SAICE's membership is made up of practicing civil engineers who have expressed the desire to assist universities in contributing to the training of the students, this collaboration should be formalised. The collaboration will help to address the mismatch between the skills requirements by the engineering industry, and the competences of the graduates. A study participant from the engineering industry described the implication of the continuing "disconnect" between UCT and Industry as –

> *It's not very good, again, there is a disconnect because there isn't a feedback loop between what is happening at the Universities – what is happening at industry and then getting it back to the universities – we tend to be islands in the stream instead of a bridge across the stream – so therefore industry is just going ahead business as usual.* (Participant)

Similarly, people with disabilities expressed a sense of being underutilised or not even utilised at all in the preparation of undergraduate civil engineer students. They have expressed a willingness to collaborate with all stakeholders in the undergraduate civil engineer programme, a collaboration that literature confirms to be essential (Amosun & Taukobong, 2010; Bizjak et al., 2011; Brown et al., 2009; Symons et al., 2014). The development of a strong HEI-Industry relationship would benefit not only students, but also the lecturers who were preparing the students as they would be able to identify areas of knowledge that the students require, and jointly strategize with Industry to provide it (Shaaban, 2014; Witt et al. 2013).

6.1.2.4 Element 4: The Concept of UD

Universal Design refers to the creation of objects, resources, and built environments that can be used by the entire population, without adaptation or stigma, throughout their lifespan (Larkin et al., 2015). The whole concept of UD, along with the seven principles that guide it (Imrie, 2012), seeks to eliminate discrimination by design and support full social participation for all members of society in the process of developing an inclusive society (Burke, 2013; Connell & Sandford, 1999; Darcy & Dickson 2009; Hitch et al., 2012; Imrie, 2004). The *CRPD* calls for the incorporation of UD into the built environment and in 2007 South Africa became one of the first countries to ratify the treaty, thereby committing itself to follow the implementation strategies as set out in the documents which included the incorporation of UD in the built environment. Furthermore, South African legislation that calls for the accommodation of people with disabilities, such as *SANS 10400: The application of the National Building Regulations, Part S: Facilities for persons with disabilities* have been in existence since 1990. More recent legislation pertaining to building regulations specifically calls for the incorporation of the concept of UD, including *SANS 784:2008, Design for Access and Mobility. Part 4: Tactile indicators* (adopted 2008), and *The Accessible Public Transport Strategy 2011* (Draft). These documents instruct the stakeholders involved with the development of the built environment to address the modern day requirements of a mobile community within an inclusive society.

Within such supportive context that should favour the accommodation of people with disabilities in the built environment, it would not be inappropriate to expect ECSA to have very explicit policy on UD as it relates to engineering education and practice. Unfortunately, this was not among the documents obtained from the website of ECSA. This may be the indication why, along with many other developing nations, the South African built environment remains largely inaccessible to the majority of its citizens with disabilities (Coulson et al., 2006; Durocher et al, 2012; Maart, et al., 2007; WHO, 2011), with a distinct lack of adherence to the principles of UD (DWCPD, 2014; Lucas, 2011, 2012). However, the engineering industry, the Department of Civil Engineering at UCT, students in the civil engineering program, as well as graduates of the programme all recognized the value of UD in that it not only served the need of people with disabilities, but also benefited other categories of the population that may require extra accommodation – such as the elderly or pregnant women, as well as bicycles and pedestrians (Burke, 2013; Connell & Sandford, 1999; Darcy & Dickson 2009; Hitch et al., 2012; Imrie, 2004).

In spite of the awareness of the value of UD, the integration of the concept into engineering practice and education face some challenges. In engineering practice, concerns have been echoed about the cost effectiveness of UD. People with disabilities claimed that this was nothing but a misconception around the costs of making the built environment accessible. They stipulated that besides being the legal thing to do, incorporating UD could also prove cost-effective in the long-term (Abraham & James, 2013; Bizjak et al., 2011; Lovelock, 2010, Maynard, 2009; Waller et al., 2013). Participants from the civil engineering industry also echoed similar sentiments regarding the cost effectiveness of UD. The participants described how much accommodations for people with disabilities could be done at minimal cost through the use of effective design, such as dropped curbs and tactile ground surfaces (Imrie, 2004; Waller et al., 2013). These features went beyond accommodating people with disabilities and served other purposes as well, including facilitating the passage of bicycles and the elderly, as well as parents pushing prams and more (Burke, 2013; Connell & Sandford, 1999; Darcy & Dickson 2009; Hitch et al., 2012; Imrie, 2004). In these instances, relatively simple accommodations could be incorporated at minimal extra cost and be of great success (Waller et al., 2013). It was concluded that it was worth incorporating UD for new structures because the cost of retrofitting and/or adapting them to accommodate people with disabilities at a later date was exorbitant (Abraham & James, 2013; Maynard, 2009; Waller et al., 2013). The value of the inclusion of people with disabilities in the built environment goes beyond monetary terms, as UD offers both people with and without disabilities to contribute to enriching the experience of diversity within the South African culture (Martin et al., 2005).

The challenge encountered in engineering education relates to the absence of any formal structures to incorporate the concept of UD, in spite of the fact that in 2008 UCT committed itself to producing civil engineer graduates who could "contribute to economic and scientific development, meet diverse social and cultural needs, build a vibrant civil society and consolidate democracy" (UCT, 2008. p. 12). The concept of UD has become prevalent in diverse disciplines including occupational therapy, engineering, and architecture (Larkin et al., 2015). Universal Design education is therefore often embedded within the context of multi-professional education (Handy et al., 2002; Hartenberger et al., 2013; Lawless, 2008; Hitch et al., 2012). Unfortunately, the Department of Civil Engineering has struggled to incorporate the concept of UD in the undergraduate programme. Like their American and European counterparts (Borrego, Llamas Zandvoort et al., 2013), the lecturers struggled with heavy workloads, including administration and a full curricula (Heitmann, 2005; Ramos et al., 2013). In addition, the adoption of a multidisciplinary approach was hampered by staff resistance to change (Heitmann, 2005), interdisciplinary rivalry (Hartenberger et al., 2013) and territorial attitudes between departments and faculties (Alpay et al., 2011). In that sense, the students do not get any formalized exposure to the concept of UD in their undergraduate training programme. Consequently, a foundational knowledge in UD would be missing from their skill set once they enter professional practice and this scenario further contributes, among other factors, to the exclusion of people with disabilities in the built environment.

However, there are indications from this study that the inclusion of the concept of UD in the undergraduate civil engineering programme at UCT is possible. A closer look at the generic exit level outcomes reveals that Exit Level Outcomes 7 (the Impact of Engineering Activity) and Exit-level Outcome 10 (Professional Ethics and Practice) are possible areas where the concept of UD could be incorporated into the training programme. These exit level outcomes deal directly with the impact of engineering design on society, as well as the interaction of civil engineers with the public at large (ECSA, 2004). Besides the exit level outcomes required, there is also the area of Complementary Studies which is expected to broaden the perspective of a student with regards to "the humanities, social sciences or other areas to support an understanding of the world" (ECSA, 2004, p. 4) and which speaks directly to the graduate attributes required of modern day engineers. Complementary studies also address the "impact of technology on society", and this could be an area which looks at the needs and inclusion of people with disabilities in society and more specifically, the incorporation of UD in the built environment (ECSA, 2004, p. 4). With necessary support for the academic staff, the incorporation of the concept of UD in the training program is feasible (Afacan & Erbug, 2009; Dong 2009; Frattari et al., 2013; Hartenberger et al., 2013; Hitch et al., 2012; Llamas, 2013; Wilson & Zamberlan, 2012).

To conclude the conceptual element of the concept of UD, the South African built environment remains generally inaccessible to people with disabilities. The lack of the incorporation of the concept of UD into the education of civil engineers contributes to this scenario. However, while ECSA has not given an explicit requirement, some of the current exit level outcomes provide opportunities for the inclusion of concept of UD in the training program.

6.1.3 Towards a Collective Role to Enhance Elements of the Conceptual Framework

To recap, the South African engineering fraternity has taken on the task to transform engineering practice education and practice in the nation. This is in line with the country's infrastructural development plans as well as the impending industrialisation and accelerated economic development of the African continent (NEPAD, 2008; NPC, 2012; PICC, 2012). To meet the new regional demands, as well as meeting the requirements of the globalised world (ASCE, 2011; NAE, 2005; RAE, 2011; Wulf & Fisher, 2002), the engineering fraternity in South Africa is following in the example of America and Europe in its transformation process. It recognises the need to transform the education of civil engineers in order to promote the attributes associated with global citizenship and social responsiveness (ASCE, 2011; Baillie & Catalano, 2009; NAE, 2005; Nieusma & Riley, 2010; RAE, 2011; Wulf & Fisher, 2002), especially in the accommodation of people with disabilities in an inclusive society. To achieve this noble goal of transforming the education of civil engineering would require that the training programme should encapsulate the four elements of the conceptual framework in the preparation of the students. These elements were the participation of people with disabilities, disability policy and legislation framework, the transformation of civil engineering practice and education, and the concept of UD.

The central statement which lies at the heart of this study relates to the fact that there are existing structures already in place within the respective stakeholders to enhance the preparation of undergraduate civil engineering students to contribute to an inclusive society that accommodates people with disabilities. Literature acknowledges South Africa as a society that is proactive in developing local **policies and legislations relating to disability**. Examples of these include building regulations *SANS 784:2008, Design for Access and Mobility, Part 4: Tactile indicators* (adopted 2008), and *The Accessible Public Transport Strategy 2011* (Draft). Moreover, South Africa's ratification of *the CRPD* in 2007 further committed the nation towards accommodating people with disabilities in society. In addition, the new *Constitution* in 1996 promotes and protects the development of an inclusive society where all citizens may participate free of discrimination (Howell et al., 2006; Mitra, 2008). Hence, the existing policies and legislation provide a context in which the civil engineering practice in the country should flourish in enhancing the **accommodation or participation of people with disabilities**.

Unfortunately, in spite of these polices and legislations, the experiences of people with disabilities described in this study generally relate to inhibitions in their participation in the society. In that sense, the **transformation of engineering practice** in the country to contribute to the participation of people with disabilities would require a t**ransformation of civil engineering education** to embrace **the concept of universal design**. A reflection on the study process and its outcomes points to some characteristics in the existing structures within the stakeholders that could contribute towards the transformation of civil engineering education at UCT. This study indicated that generally all the stakeholders, except in the case of ECSA, expressed positive attitudes towards disability issues as well as awareness about the policies and legislations relating to disability. However, there was little or no evidence that any of the stakeholders maximised the opportunities offered in the implementation of these policies. In addition, no single stakeholder had sufficient resources to contribute to the transformation of undergraduate civil engineering education at UCT. Unfortunately, it seems the university has not sufficiently tapped into available human resources provided by people with disabilities, civil engineers in the industry, and members of SAICE. These stakeholders expressed the willingness to contribute to the practical experiences of civil engineering students in UCT. Similarly, the academic staff in the university, people with disabilities, civil engineers in the industry, and members of SAICE were willing to partner with ECSA in refining the exit level outcomes for the training of civil engineers to explicitly include disability issues and the concept of universal design. Ultimately, the achievement of the goal of transforming undergraduate civil engineering education in UCT would require greater collaboration between all the stakeholders in this study (Dong, 2009; Hartenberger et al., 2013; Hitch et al., 2012).

The overall aim of this exploratory process was to obtain an overview of current experiences in the preparation of civil engineering students at UCT to contribute to an inclusive society that accommodates people with disabilities. The review of each of the stakeholders in this study provided a glimpse of the organisational routines within the stakeholders (Becker, Lazaric, Nelson, & Winter, 2005). The collaboration between all the stakeholders had been more on haphazard basis. It is proposed that the development of a formalized structure between the stakeholders should be informed by organization theory in order to identify common characteristics among the stakeholders that will contribute towards the transformation of undergraduate civil engineering education at UCT, and ultimately contribute to the development of an inclusive society that accommodates people with disabilities.

6.1.4 Limitations of the Study

Every effort was taken by the researcher to ensure that the methodology for this study was rigorous. However, the researcher encountered some limitations that could have impacted the outcomes of the study. While there was a review of ECSA's website and documents there were no interviews conducted with any representatives of ECSA. Such an interview would have required the researcher to fly up to Pretoria to conduct a one-on-one, in-depth interview with a representative of the Council. However, taking into account the previous difficulties that the researcher had experienced, this was not an option. In light of this, the possibility of a telephone interview was looked into. However, in light of the negative impact on the quality of information, as well as the poor quality of the researcher's voice as a result of his quadriplegia, this option was also not considered suitable. It is felt that the lack of an interview with a representative of ECSA may present a limitation to the study.
It is acknowledged as one of the key drawbacks to this study as the stakeholder did not get the chance to explain in greater detail, validated or invalidate some of the statements that exist on their website – particularly their stance on the concept of universal design, as well as accommodations for people with disabilities within the built environment. Furthermore, the researcher was unable to pick up on any of the attitudes of the representatives of ECSA towards people with disabilities as with the participants who were interviewed. In that regard, in the interest of validity of results as well as the interests of future research, follow up correspondence with ECSA regarding the findings of the study is recommended.

The production line model by Tirkel and Rabinowitz (2013) that is utilised in the methodology of the study was originally focused on improving the manufacture of semiconductor wafers on a mechanized production line, whereas in this study, the model is used to explore the impact of stakeholders in the preparation of civil engineering students during their undergraduate degree. While the purpose of the use of the model may differ, it is felt that the shared aspect of a “quality assessment of items produced” (Tirkel and Rabinowitz, 2013, p. 38) validates the use of the model in the study. It is acknowledged however, that the difference in use of the model may provide a potential weakness to the study. It is helpful to continue the search for a more appropriate model.

The method of purposeful sampling was utilized in the study, where the participants invited were viewed as possessing the most knowledge regarding the research topic. In that regard, the key officials of UCT (the Registrar, the Deputy Vice Chancellor-Transformation Portfolio, Director of the Disability Service), the EBE Faculty (The Dean, The Transformation Officer, The Chairperson of the Undergraduate Education Portfolio), and the Head of the Department of Civil Engineering were specifically targeted and selected to participate in the study. The selection of academic staff, students (current and past), representatives of Industry and people with disabilities were all samples of convenience and small in number. Therefore, the views that they expressed may not be completely representative of their groupings. For example, only two students who had already graduated as “products” of the production line were interviewed. Although the interviews with them produced rich data, the fact that there were so few participants may represent a limitation to the study. However, while not applicable to other higher education institutions in South Africa, it was anticipated that the data collected will allow for conclusions to be drawn regarding the UCT's involvement in the preparation of civil engineering undergraduate students to contribute to an inclusive society for people with disabilities. Follow-up research involving larger samples is therefore recommended.

As this study is limited to only one site of the six sites for the training of civil engineering students, it is difficult to extrapolate the findings of this study to other training sites. In order to keep the study manageable the main site of location of the study was the Department of Civil Engineering at UCT. Further research in other South African universities is recommended.

6.1.5 Impact of the Outcomes from the Study

As indicated in the first chapter of this thesis, a major outcome of the study was the creation of a platform that provides an opportunity for key stakeholders of the undergraduate civil engineering programme at UCT to jointly reflect on the preparation of the students to contribute to an inclusive society that accommodates people with disabilities. It was assumed that this opportunity would lead to the building of shared knowledge on the preparation of the students, and to mutual trust and common understanding of the challenges encountered in the preparation of the students. The stakeholders in this study were ECSA, UCT, the Engineering industry, and people with disabilities. During the study, the South African Institute for Civil Engineering (SAICE) was identified as another stakeholder. The students and the graduates of the undergraduate programme also had opportunity to reflect on the preparation process. While the stakeholders have common interests in the preparation of the students, the study has identified the need for a more formalised collaboration between the stakeholders towards the achievement of the common interest in the preparation of the students.

The researcher is of the opinion that the outcomes of the study have individual and collective impacts on the stakeholders. Starting with ECSA, certain gaps have been identified in its functioning that present opportunities for collaboration to enhance their objectives and operations. Furthermore, the findings reveal that UCT, as well as industry, have an open-minded approach towards incorporating the concept of UD, but both have yet to include it in their functioning. They are both guided by legislation, which calls for incorporation of the concept of UD in *SANS 784:2008, Design for Access and Mobility. Part 4: Tactile indicators* (adopted 2008) .This is assumed to impact negatively on the development of an inclusive society. Last but not the least, people with disabilities forms a valuable but untapped resource group for the preparation of undergraduate civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities.

6.1.6 Recommendations for Immediate Implementation

Drawing from the impacts of the study above and taking into account the lack of collaboration between stakeholders and the consequent lack of a multidisciplinary approach to learning, it becomes necessary to find ways of formalising a platform that would enhance future communication, networking and coordination among the stakeholders.

The first recommendation is that ECSA host a conference with the stakeholders as well as the other 6 HEI's that offer undergraduate civil engineering programmes, to review the similarities and differences in their resources, approaches, and experiences in the preparation of civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities. This will help in developing an intersectoral approach in the preparation of the students.

Furthermore, it is recognised that the concept of an inclusive built environment is beneficial to all, including vulnerable groups besides people with disabilities (Burke, 2013; Connell & Sandford, 1999; Darcy & Dickson 2009; Hitch et al., 2012; ICSU, 2011; Imrie, 2004). In that regard, it is further recommended that the stakeholders and relevant HEI's jointly host a second conference in which they invite all vulnerable groups for the development of an inclusive society that accommodates everyone.

Moreover, besides the conferences suggested above, in reaction to the data and in the interest of addressing the lack of awareness of the accommodation of people with disabilities and the concept of UD expediently, the following actions are recommended:

1. ECSA establish a working group, under its Transformation Committee (one of its High Impact Committees (HIC)) to collaborate with the CBE, relevant higher education institutions (HEIs), Industry, SAICE and people with disabilities towards incorporating disability into its transformation agenda. This should include the accommodation of people in the built environment through the use of UD.

2. ECSA also establish a working group with its Education Committee, HIC to collaborate with industry, relevant higher education institutions (HEIs), SAICE and people with disabilities towards:
   a) Reviewing their accreditation processes towards producing civil engineering graduates who can better contribute to an inclusive society that accommodates people with disabilities;
   b) Incorporating the concept of UD and the accommodation of people with disabilities into the civil engineering undergraduate training programme (specifically within the Exit Level Outcomes and/or Complementary Studies), as well as the candidacy phase of the graduate's careers;
   c) Introducing the concept of UD and the accommodation of people with disabilities as a Continued Professional Development (CPD) course run by SAICE as part of the lifelong learning experience of professional civil engineers.

3. EBE Faculty at UCT, with support and backing of UCT, collaborates with the Centre for Higher Education Development (CHED) to conduct workshops to explore the challenges to adopting a multidisciplinary approach (such as: staff attitudes, issues related to heavy workload and extra admin, resource issues related to PBL, territorial barriers between departments and faculties, etc.) and devise meaningful and practical ways to incorporate such a multidisciplinary approach and begin the trial implementation of them within a designated timeframe. It's recommended that UCT fund this project to make it successful and sustainable.

4. Linked closely to point 3 above; UCT assemble a working group to make multidisciplinary courses such as Social Infrastructure mandatory, instead of being electives only, and incorporate them into all the faculties at UCT.

5. UCT should collaborate with, and capacitate, the Disability Service to lecture on disability issues across all disciplines and faculties. The Disability Service should be in a position to liaise with each department/faculty as to their needs regarding awareness of disability in their undergraduate training programmes, and could outsource appropriately to bring in guest and regular lecturers with disabilities. Once such a system is estimated, it could develop the capacity of departments, the Disability Service and people with disabilities in a reciprocal manner. It would also help UCT fulfil its goal of incorporating disability into its undergraduate programmes (UCT, 2011) and furthermore, it would be using and developing in-house resources.

6. The Department of Civil Engineering at UCT and Industry form a working group to develop a much greater collaboration between them including; regular guest and part-

time lecturers from Industry, joint research ventures and joint strategy teams to determine and refine graduate skills and attributes required of the South African engineering industry. This relationship with Industry should extend to the whole EBE Faculty.

7. The Department of Civil Engineering at UCT collaborate with the Disability Service to conduct a survey camp each year for the 2nd year students. Students must design n accessible route across campus (using the principles of UD) for people who blind or deaf or wheelchair users. The camp should include role playing where students are blindfolded, wear ear-muff and/or use wheelchairs as part of their surveying strategy. Furthermore, the camp should involve interactive talks /presentations with people who have each of the three disabilities mentioned. Suh a camp would be similar to previous years and would not be difficult to run and would go a long way towards increasingly awareness of UD and the accommodation of people with disabilities.

8. Similar to the recommendation above, all undergraduate design projects linked to urban design should have a UD component to them.

9. EBE Faculty at UCT establish the concept of UD as a dedicated subject and focus of (or part of) a postgraduate degree.

10. Department of Civil Engineering at UCT to establish regular feedback sessions with their graduates so that they can monitor and refine the BSc Eng (civil) programme regarding graduate attributes and skills.

11. Industry, in collaboration with the other stakeholders of this study, promotes the concept of UD and the accommodation of people with disabilities through shared initiatives and campaigns.

12. Acknowledging that the design of a built environment “is a critical factor in facilitating people’s participation within their respective communities, regardless of individual age, gender, abilities or capacities” (Hitch et al., 2012, p. 357); the CBE invite and include a representative of the governing board of occupational therapy onto its council (along with representative of people with disabilities) in the interest of adopting a multidisciplinary approach towards community mobility (ibid). The inclusion of an occupational therapy point of view will bring greater understanding and expertise on “an integrated view of the person, task and environment along with the conditions which may impact upon function” (Hitch et al., 2012, p. 379).

13. SAICE promote and form close relationships with learned societies and associations not only of other engineering disciplines but of all other professions involved with the built environment towards developing a common understanding of the concept and implementation of UD

6.2 Conclusion

The research question for this study was: How are the undergraduate Civil Engineering students at UCT being prepared to contribute to an inclusive society that accommodates people with disabilities? The primary aim was to explore the preparation of undergraduate students in the civil engineering programme at UCT to contribute to an inclusive society that accommodates people with disabilities. Seven secondary objectives were set to address the research questions, and these objectives have been fulfilled, as described below. In addressing each of the seven objectives, it should be noted that each participant expressed a positive attitude toward issues of disability.

Objective 1: To gain an insight into the vision, practice and operations of ECSA

ECSA has a transformation agenda that does not explicitly identify issues about disability. Similarly, the exit level outcomes for the training of civil engineering undergraduate students do not explicitly include issues about disability. However, there is opportunity to incorporate issues about disability in the Exit Level Outcomes, as well as in the area of Complementary Studies. There are also opportunities to incorporate the issue of disability within the transformation agenda of ECSA. In addition, ECSA relies on informal collaboration with professional associations like SAICE to carry out its functions. To ensure sustainability, it is essential to formalise these relationships. Finally, it should be noted that there were no face-to-face interviews with participants from ECSA and this poses a possible limitation to the findings of study.

Objective 2: To identify the resources available to UCT, People with disabilities and Industry

The three stakeholders identified legislation around disability as a major resource for the training of undergraduate civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities. In addition, UCT has a strong transformation policy and agenda in place, and these are supported by committed leadership. The University has made significant strides with regard to its transformation objectives and disability policy. It has substantially increased the number of staff and students with disabilities, as well as increased accessibility for people with disabilities on campus. The leadership, academic staff, and students of the Department of Civil Engineering in the University agreed that there are opportunities in the undergraduate programme for the preparation of the students. However, the engineering industry and people with disabilities perceived themselves as under-utilised resources in the preparation process.

Objective 3: To identify the approaches available to UCT, People with disabilities and Industry

There was a similarity in the approaches of UCT and the engineering industry in that both shared an open mind approach to the incorporation of the concept of UD in the preparation of the students. However, a difference in approaches was observed in that, while UCT reported a strong and committed approach to graduateness and social responsiveness, ECSA and the industry did not did not appear to hold any particular stance regarding graduateness or social responsiveness.

Objective 4: To identify the experiences of UCT, People with disabilities and Industry

What was common in the experiences of the stakeholders was a lack of collaboration between ECSA, UCT and Industry. It was also found that ECSA was over-reliant on SAICE for its functioning. Furthermore, while the University of Cape Town has strong transformation policies in place, there were challenges encountered within the Department of Civil Engineering in the implementation of the transformation policies. While UCT struggles to adopt a multidisciplinary approach to learning, there are opportunities to incorporate the topic of disability, as well as concept of UD, into the undergraduate civil engineering programme.

Objective 5: To explore available documents on transformation and social responsiveness of UCT, People with disabilities and Industry

The University of Cape Town has very strong transformation and social responsive policy and agendas in place. It is committed to addressing issues of the past and rising to the challenges relating to the development of a new democratic South Africa, including developing an African voice within the University itself. UCT has also established an extensive social responsiveness policy and operation which is considered very successful. UCT was conscientious of its commitment to the broader community, including people with disabilities. There were many projects on the go every year and their achievements were encapsulated in the annual Social Responsiveness Reports. Projects related to engineering included Engineers without Borders. It is unknown how many, or if any, projects were involved with people with disabilities.

Objective 6: To explore the outlines of the courses of the undergraduate civil engineering programme at UCT to identify which of them may influence the preparation of civil engineering students

That there are a number of the Exit Level Outcomes, as well as the area of Complementary Studies, which may be used to incorporate the concept of UD. Furthermore the course outlines also refer to surveying camps at various stages of the degree. Currently, the surveying camp alternates between focusing on wheelchair accessibility of a car park or the establishment of a bicycle track along the campus. There is an opportunity here to incorporate the aspect of accessibility, and/or the concept of UD every year. Finally, the elective known as Social Infrastructure generally taken in third year focuses on civic engagement and has recently incorporated the topic of disability as well. Aspects of this course relating to issues on disability could become mandatory.

Objective 7: To identify key issues of interest from the interviews of the stakeholders towards the preparation of civil engineering students

Several key issues of interest have been identified that may help in the preparation of civil engineering students. Most notable is the need for collaboration amongst all the stakeholders and the fact that there are existing structures already in place within their respective organisations to enhance the preparation of civil engineering students to contribute to an inclusive society that accommodates people with disabilities.

6.2.1 Recommendations for Further Research

The thesis has fundamentally been about two components of engineering, namely engineering practice and engineering education. Referring to the production line analogy, the main site of inspection for this study was UCT, where more in-depth inspection was carried out in comparison with other sites. In light of this strong leaning towards engineering education, the researcher is only making recommendations regarding engineering education.

One of the challenges in the preparation of undergraduate civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities related to limited opportunity for multidisciplinary engagement in learning. This was earlier raised as a concern to a group of chemical engineering graduates (Martin et al, 2005). Hence, it is recommended that research be conducted on the factors impacting on introducing a multidisciplinary approach to learning within civil engineering at UCT.

Previous research has alluded to students feeling uncomfortable at having to interact with people with disabilities (Amosun & Taukobong, 2010; Bizjak et al., 2011; Brown et al., 2009; Symons et al., 2014). The development of an inclusive society that accommodates the needs of people with disabilities would require professional engineers to interact and consult with people with disabilities. In light of this it is recommended that research be conducted regarding the interaction between undergraduate civil engineering students and people with disabilities during their training programme. This may be similar to the opportunity created for medical students in the same university (Amosun, Volmink, & Rosin, 2005).

Besides the important research above, the researcher feels there is cause to follow up in two other areas, namely, that:

1. Further research should be conducted to explore the graduate attributes of all types of engineers in South Africa, particularly from other universities in the nation.

2. Further research should be conducted to explore the potential knowledge, skills and attributes that people with disabilities can contribute towards undergraduate programmes linked to the built environment and other disciplines.

6.3 Summary of Chapter Six

This chapter discussed the findings of this study within the four elements of the conceptual framework developed for the study. The limitations to the study were highlighted. This was followed by the impact of the study and then recommendations. Thereafter, the conclusion to each of the objectives was provided and the chapter ended with recommendations for further research

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APPENDICES

Appendix A: Medical letter Vic McKinney - quadriplegic

Dr N.Wellington & Associates No. 53 Incorporated

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MEDICROSS MEDICAL CENTRE

NW/imv

18th February 2016

SUID-AFRIKAANSE POLISIEDIENS
CSC
2016 -02- 18
COMMUNITY SERVICE CENTRE
CLAREMONT W.C / C.P.
SOUTH AFRICAN POLICE SERVICE

To whom it may concern:

Dear Sir/Madam

RE: VICTOR J MCKINNEY: DOB 31-08-1968

Mr Victor Mckinney has been a patient of mine since 2003.

He is a quadriplegic and has been since being involved in a road accident in 1987. He is a C4 quadriplegic and as a result he is paralyzed from the shoulders down. This means that he does not have the use of his arms or legs and therefore he totally relies on assistance for everything that he does.

Mr McKinney has a motorized wheelchair which he controls by moving his chin.

Yours faithfully

DR N WELLINGTON

Kenilworth Medicross

EK SERTIFISEER DAT HIERDIE DOKUMENT 'N WARE AFDRUK (AFSKRIF) IS VAN DIE OORSPRONKLIKE ... IS. EK SERTIFISEER ... VOORGELÊ WYSIGING OF ... DAAR NIE 'N ... DOKUMENT AANGE-BRING IS NIE.

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llington M.B.Ch.B.(UCT.)DCH (SA),PGDD(Cardiff)
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Bosch M.B.Ch.B.(Wits)
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Dr. G. Schwartz BA (Hons)M.B.Ch.B(UCT.),Dip.PEC (SA),FCFP (SA)
Dr. M. G. Kiessig M.B.Ch.B. (Stell.)M.Phil (Sport Medicine) (UCT)
Dr. Geoff Baron M.B.Ch.(UCT)M.Fam.Med.(Medunsa)
Dr. C. Miller

Appendix B: Experiences of the researcher 1

Image: Researcher being carried off the plane due to absence of a PAU

Appendix C: Experiences of the researcher 2

Image: Special needs elevator not accommodating for electric powered wheelchair

Appendix D: The Blue Train is inaccessible

Weekend Argus

Wheels come off for man on Blue Train trip of a lifetime

BIANCA CAPAZORIO

A DISABLED Cape Town man had to forgo the trip of a lifetime last weekend after he discovered that the prestigious Blue Train was not able to accommodate his wheelchair, despite claims that it could.

Guy Davies, a disability consultant who has been involved in making the Cape Town and Port Elizabeth World Cup stadiums accessible, said he and his friends had been offered the opportunity to travel on the train, taking the place of a German tour group delayed by volcanic ash. He and his wife, and several of their friends, had booked to travel from Cape Town to Pretoria last weekend to celebrate his birthday. Fares are around R10 000.

Davies initially had reservations about the trip because of his wheelchair, but the tour operator double-checked that the train was accessible to wheelchairs.

Davies realised there might be a problem when he was heading towards the train and staff asked him, "So, how far can you walk?"

Due to a spinal injury Davies cannot walk at all, and after discovering that his wheelchair did not fit through the train doors, and there was no ramp, he "bum shuffled" on to the train and pulled himself up into the "tatty" and slightly narrower wheelchair offered by the train staff.

"Not a dignified way of entering a five-star establishment," he said.

Wheeling himself down the corridors, he found them to be so narrow that his knuckles grazed against the walls and he could not turn around at all, making it difficult to get into his cabin.

He was then told that someone would be able to assist him with this whenever he needed help.

Inside the cabin, furniture had to be removed to allow Davies room to manoeuvre.

All the while he kept telling himself he would make it work, but the final straw was when he was unable to enter the bathroom, even in the narrower chair.

Davies disembarked before the train left Cape Town station, leaving his wife and friends to make the trip without him.

Davies has written a letter of complaint to the management of the Blue Train.

Acting executive manager of the Blue Train, Hanlie Kotze, said the train had in the past been used by disabled clients and that their accessible cabins had been specially designed by a wheelchair-bound consultant.

She said the tour operator had contacted them regarding the wheelchair but she had not indicated that her client was "completely dependent on wheelchair use".

The tour operator had been told that Davies would have to use their wheelchair, which was specially designed for the train.

"I would like to bring to your attention that we do have specially designed ramps for boarding or disembarking of wheelchair-bound guests which the butlers who assisted the client should have used," Kotze told Weekend Argus.

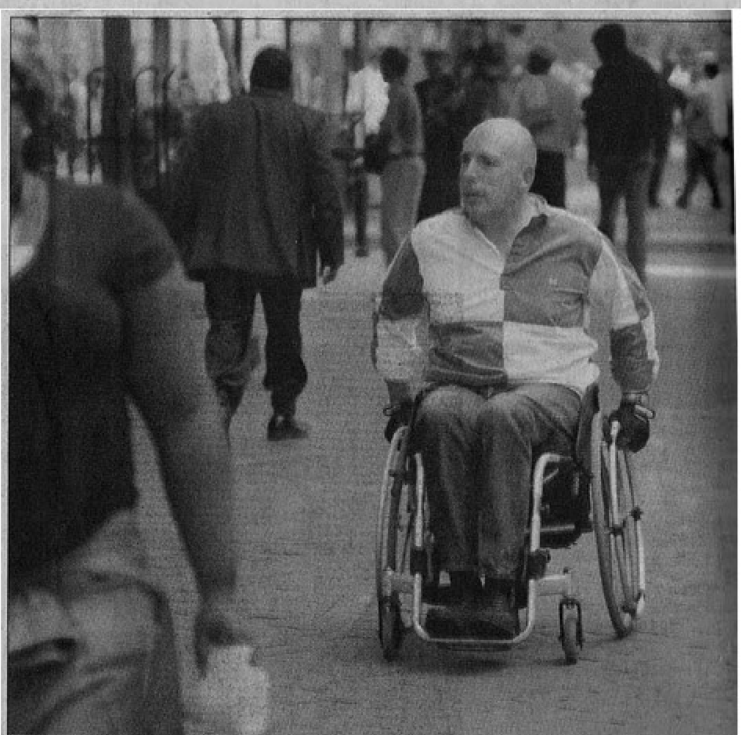
While the Blue Train understood "the client's need for independence" a butler was always assigned to take care of guests in wheelchairs as they would "need assistance to travel throughout the train". The butler would also be available to help the passenger get into the en-suite bathroom.

"But I don't want to have to call someone every time I want to leave my cabin," Davies said.

Kotze said they had never had complaints from wheelchair-bound users before.

"One complaint for us is one too many.

"We however appreciate the points that have been brought to our attention which serve as an eye-opener and will assist us in improving our communication with our tour operators," she said.



NO GO: Guy Davies got off the Blue Train because he said it was inaccessible.

Appendix E: Recruitment Advertisement

School of Health and Rehabilitation Sciences

Faculty of Health Sciences

Divisions of Communications Sciences and Disorders, Nursing and Midwifery, Occupational Therapy, Physiotherapy

F45 Old Main Building, Groote Schuur Hospital,

1 August 2013

Mr Mrs XX XXXX

(position)

(company/organisation)

Dear (Sir / Madam)

Invitation to participate in research

My name is Vic McKinney (Student No. MCKVIC002). I am a Doctoral student in Disability Studies in the Faculty of Health Sciences at the University of Cape Town. For my thesis, I am currently conducting a study entitled *An exploratory process on the preparation of undergraduate Civil Engineering students at the University of Cape Town to contribute to an inclusive society that accommodates people with disabilities – A case study* (ethics approval reference number HREC REF:165/2011).

In view of one of the exit level outcomes of the Engineering Council of South Africa that the engineering graduate should be sensitive to the wider social and economic contexts in which engineering is practiced, the overall aim of this exploratory process is to obtain an overview of existing opportunities and challenges in the preparation of undergraduate civil engineering students at the University of Cape Town to contribute to an inclusive society that accommodates people with disabilities. Within your role as the (position with organisation), you have been identified as a key stakeholder with regard to the preparation of undergraduate civil engineering students.

This letter serves to invite you to participate in this study, which involves an interview lasting approximately 2 hours. The interview will include questions focusing on three main areas:

- What resources are available to you/your organisation in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?
- What approaches do you/your organisation adopt in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?
- What barriers do you/your organisation experience in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?

I attach the information sheet and the letter of consent.

Regards

Vic McKinney

Information Sheet

My name is Vic McKinney. I am a Doctoral student in the Faculty of Health Sciences at the University of Cape Town. I am currently conducting a study entitled;

An exploratory process on the preparation of undergraduate Civil Engineering students at the University of Cape Town to contribute to an inclusive society that accommodates people with disabilities – A case study

The study sets out to examine the approaches, resources, and barriers relating to issues about disability in the Civil Engineering undergraduate programme as experienced by each of the major interest groups. In addition, the research aims to identify key issues of interest from the interviews of the stakeholders. These will inform the future preparation of undergraduate civil engineering students in the university. The major interest groups in this study are the University of Cape Town (UCT), the Engineering Council of South Africa (ECSA), the employers of graduates of the Civil Engineering programme as well as the Disability Sector of South Africa, who are viewed as "consumers" of the Civil Engineering programme at UCT. You have been chosen to participate in the research because of your affiliation with one of these groups.

In the Civil Engineering degree, the outcomes set out by the Engineering Council of South Africa require that the engineering graduate is expected to be sensitive to the wider social and economic contexts in which engineering is practiced. The aim of this is to produce graduates who will address the needs of all citizens in society, thus helping to develop an inclusive society. However, from a disability point of view, most people with disabilities feel that there are environmental barriers which prevent them living as an integrated member of society. Many of these barriers are directly related to engineering practices.

You will be requested to take part in an interview lasting approximately 2 hours. The interview will include questions focusing on three main areas:

- What resources are available to you/your organisation in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?
- What approaches do you/your organisation adopt in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?

- What barriers do you/your organisation experience in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?

The focus groups will entail the same procedure and questions above. There will be two focus groups consisting of four lecturers each, and another four focus groups consisting of four students each.

In the long term, this study hopes to be beneficial to people with disabilities through creating a platform for stakeholders to jointly reflect on the preparation of the students to contribute to an inclusive society that accommodates people with disabilities. It is anticipated that the data gathered in the process will lead to the building of shared knowledge on the preparation of the students, and to mutual trust and common understanding of the challenges encountered in the preparation of the students. There are no perceived risks to your participation in the study. Ethics approval (Ref No) for the study has been obtained from the Faculty of Health Sciences Human Research Ethics Committee.

With your permission, I will tape record the interviews to ensure that the information is recorded accurately. You may refuse to have the interview recorded and may request to switch off the tape at any time or remove any data from the tape. Your identity and personal information will be kept entirely confidential and will not be included in any written reports. The results of the study will be written in the form of a Doctoral thesis and may be published in a scientific journal. Please note there will be no remuneration for participation in this study. Your participation in this study is entirely voluntary. You may refuse to participate or withdraw your participation at any time. Should you experience distress or become upset about any issue during the interview, the interview will stop immediately and you may then decide whether to carry on or cease your participation altogether. Should you require additional professional assistance, you will be duly referred after consultation with my supervisor.

The rights to privacy and confidentiality of the participants will be respected. All data collected will be kept in a safe and secure place to which only the researcher will have access. There will be no link between the interview data (tapes, transcripts) and any identifying data about the research participants. Furthermore, where necessary, pseudonyms will be used to protect the identity of the research participants.

Any questions on the ethics of the research may be directed at the Faculty of Health Sciences, Human Research Ethics Committee University of Cape Town. The contact details of the chairperson are:

Marc Blockman (Chairperson)
Room: E52.24
Old Main Building, Groote Schuur Hospital
Tel: 021 406 6492   Fax: 021 406 6411

Should you have any further questions regarding the research, please do not hesitate to contact my supervisor, Professor Seyi Ladele Amosun

Phone: 021 406 6444   Email Seyi.Amosun@uct.ac.za

My contact details:

Cell: 072 609 0080   Email: victor.mckinney@uct.ac.za

Yours sincerely,

Vic McKinney

(Letter of Consent below)

Appendix F: Consent Form

<u>Letter of Consent</u>

Institution and name of participant

I ___________________________ have read (or had read to me by __________________) the Information Sheet. I understand what is required of me and I have had all my questions answered. I do not feel that I am forced to take part in this study and I am doing so of my own free will. I know that I can withdraw at any time if I so wish and that it will have no bad consequences for me. I have been guaranteed that confidentiality will be maintained during this study.

Signed:

_____________________________________ _____________________________

Participant Date and place

_____________________________________ _____________________________

Researcher Date and place

_____________________________________ _____________________________

Witness (if necessary) Date and place

Appendix G: Attitudinal Survey

<u>Disability324Solutions: Management Attitudinal Survey (MAS)</u>

Compiled by Jackie Opperman, Disability Solutions.

December 2003.

<u>Key Question format</u>

1. What if anything needs to happen or change to attract people with disabilities and want them to be placed and remain in your organization.
2. If you were to employ a person with a disability, how would this impact on you, the team and the university?
3. Would your expectations of a person with a disability be different?
4. Are there some jobs/courses you would label as "disability friendly"?
5. What, if anything, needs to happen or change to allow people with disabilities to want to be placed/study at UCT?
6. What has hampered the employment/enrolment of people with disabilities at this faculty?
7. Is employing a person with a disability a risk? Is it worth entertaining this risk and how can it be minimized?
8. Would there be positive or motivating factors to employing people with disabilities?
9. Do you think reasonable accommodation is a fair requirement? Is it a burden? What would the person with a disability expect?
10. Have you experience of disability? If yes what has the impact been?
11. How would you define disability?
12. How can your organization become included in the disability arena?
13. How can you commit to this process?

Appendix H: Interview schedule for UCT Representative

This was the Interview schedule with a representative of UCT: Outside the Civil Engineering Department. The schedule served predominantly as a guideline with the majority of questions being used. Some questions are similar in nature and their use would depend on previous responses to other questions

1. How has UCT embraced a disability friendly environment?
2. What, if anything, needs to happen or change to allow people with disabilities to be accommodated within the UCT community?
3. Does the university promote inclusion of all learners? If so, in what way?
4. Is there any place on campus (e.g. Resource centre, Disability service unit) that supports people with disabilities?
5. Does your office hold meetings about disability on a regular basis ? Who else in the process?

5.1 Within your role as XXXX XXXXX, how do you ensure that UCT policy on disability is being followed ?

5.2 How is the process of transformation carried through from your office to the faculties and departments at UCT?

5.3 do you have input as to what disability policy should be at UCT, or is it only your duty to make sure it is carried out?

5.4 Is there anything you disagree with or are concerned about regarding UCT policy on disability?

5.5 What are the challenges you face in rolling out disability policy at UCT—new disability policy in March, what is your comment/opinion of the new policy ? (why was it necessary?)

5.6 There is a concern that disability is overshadowed by the issues race and gender in the transformation process, what would your viewpoint be on this?

6. Do you think there may be a lack of knowledge surrounding disability within your department/office and the university?
7. have you and your office ever held meetings with a disability consultant? In what context -- what was it for?
8. How is the transformation agenda within UCT linked to that of Social Responsiveness? How are they similar and different?
9. How would you define disability?

10. Have you any interaction with people with disability? (If yes, what has the impact been?)
11. What has hampered the accommodation of people with disabilities within the UCT community?
12. Are there or has there been negative attitudes toward disability within UCT?
13. Do you think it is necessary to have sensitisation workshops or disability training within departments at UCT?
14. Would there be positive or motivating factors to accommodate people with disabilities in this community
15. in terms of `Graduateness` -- What approaches has UCT adopted in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?
16. Do you think reasonable accommodation is a fair requirement in any community? Is it a burden? What would the person with a disability expect?
17. Is your office accessible? If not, have any steps been taken to make it accessible?
18. Is employing a person with a disability a risk (financial, more work?) Is it worth entertaining this risk and how can this risk be minimized?
19. Does the department/university employ anyone with a disability?
20. How successful has this process been? What are the challenges?
21. Is inaccessible environment (e.g. lecture theatres, no parking for disabled, negative attitudes) hindering the inclusion of staff with disabilities within the university?
22. Do you think there should be there any aspects of the undergraduate course that deal with the topic of disability?
23. What resources are available to UCT in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?
24. What barriers do UCT experience in preparing civil engineering students to contribute to the development of an inclusive society that accommodates people with disabilities?
25. How would you commit to a process of ensuring that people with disabilities are integrated within the UCT community *and broader society*?
26. Is there anything else you would like to add?

Appendix I: Interview Schedule with the Person with a Disability

1. How has South Africa, embraced a disability friendly environment?
2. How successful has the policy been?
3. Do you think reasonable accommodation is a fair requirement in any community?
4. Is it a burden?
5. What would the person with a disability expect?
6. 7. Is employing a person with a disability a risk (financial, more work?) Is it worth entertaining this risk and how can this risk be minimized?
7. Would there be positive or motivating factors to accommodate people with disabilities in this community? (If you imagine a community in which people with disability are fully integrated and accommodated, what would make it a positive community to live in? What are the positive or motivating factors that would encourage the accommodation people with disabilities in this community?)
8. 3. How would you define disability?
9. 4. In your experience what has been the impact of interaction of PWD?
10. What, if anything, needs to happen or change to allow people with disabilities to be accommodated within the community?
11. Do you have any opinion or experience with UCT- How has it embraced a disability friendly environment?
12. In the study, the Disability Sector is regarded as the `consumer` -- in a sense that it is on the receiving end of what UCT produces as students . The study is exploring how UCT is preparing its students to contribute to an inclusive society.
13. What approach would you expect the university to adopt to achieve that?
14. What resources do you think they have?
15. What barriers/challenges do they face?
16. With regard to engineering as a discipline, do you they should have knowledge on disability incorporated into their curriculum? In what way? What would you expect? there anything you think