

**The QUT Dean's Scholarship for the Developing World 2006 Activities Report
The Karigiri MCR Project**

By Timothy Mark O'Shea

The Dean's Scholarship for the Developing World provided a unique insight into Indian culture as well as the opportunity to gain valuable biomedical engineering experience in a hospital environment. However upon completion of the scholarship and quiet reflection it is the personal character transformation that I consider the most significant accomplishment. Before I left the comfortable surroundings of home in January I had little awareness or realisation of the social problems such as leprosy or poverty that exist in India as well as countless other developing nations. For me, life has never been much of a struggle. I have been fortunate enough to be given every opportunity to pursue a life of knowledge, prosperity and comfort. Yet, I never truly appreciated my life and its many virtues until I returned from my India experience, with a much clearer picture of the world.

The majority of the six week trip was spent at the Schieffelin Institute of Health Research & Leprosy Training Centre, Karigiri, located approximately 20 km from the town of Vellore. This hospital was established in 1955 as a facility to treat patients of Leprosy, but has since expanded into a 150 bed general hospital offering service from critical care to general medical services. However, there still exists a significant focus on Leprosy research and treatment, embedded within a strong Christian faith which has remained very prominent in the hospital throughout the establishment's fifty year history. The hospital also possesses a Prosthetics and Orthotics Department that employs engineers and other technicians that manufacture custom fitted rehabilitation equipment for patients. During my time at Karigiri Hospital I was an active member of a research team, as well as a consultant for projects involving the obstetrics and prosthetics & orthotics departments. Furthermore, the experience enabled me to visit other facilities associated with the hospital and broaden my knowledge of medical protocol in a developing world setting. I was also very fortunate to be able to work and converse with world renowned Doctors, Leprosy experts and Bioengineering professionals.

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The main focus of my work was the research project, which involved establishing quantitative data regarding the pressure reducing capabilities of the various types of Microcellular rubber (MCR) using the F-Scan Mobile System by Tekscan. The microcellular rubber product has been manufactured on site at the hospital for the past forty years, and has been used clinically to address the issues of foot ulceration prevention in Leprosy and Diabetic patients. This material, adapted from natural rubber, has demonstrated significant results for patients since its inception, however the pressure reduction potential of the material had not been analysed. Furthermore, although this product is readily used in clinical and commercial applications throughout India, discrepancies exist regarding the suitable hardness of the material. Therefore the research project also endeavoured to clarify this issue by examining three degrees of hardness for the MCR.

Throughout the project duration I was required to learn and master the F-Scan Mobile System, which uses in-shoe pressure sensors to establish a pressure map of a patient's foot throughout gait. During this time I was faced with many challenges that tested my engineering knowledge as well as forcing me out of my comfort zone as a person. During the testing trials we experienced significant problems with the equipment and protocol involved. Many of these issues required me to use innovation and ingenuity to apply engineering principles I had learnt to applications where the resources required were non-existent or where modifications to procedures were necessary. For example in our project, before testing, the F-scan system required initial calibration using a uniform pressure distributing device to activate the cells of the sensor. However due to the lack of available monetary funds this device could not be purchased from the manufacturer. Therefore, the research team incorporated basic equipment found at the hospital, which included a mechanical winding press and a tourniquet to achieve the same outcomes. Furthermore, the research project also allowed me to develop my research methodology skills, by way of literature review of an initially foreign topic, data collation and analysis as well as report writing. From an engineering perspective my time in India forced me to rely on my individual skills and knowledge, without the assistance of textbooks, teachers or computers.

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During patient trials, I worked with some significantly deformed people that had suffered for a life time from the complications of anaesthetic feet, despite being cured of Leprosy (See Figure One). Despite all the torment and stigma they had experienced throughout their lives, these patients were some of the nicest people I have ever met and their love for life and the compassion they showed towards me was extraordinary. I began to develop an understanding of Leprosy and its many complications, and although I was initially hesitant in my contact with these individuals, over time I grew to see the person behind the disease. In this light I feel the experience allowed me to push past my comfort zone, and see the world on a much more human level.



Figure One: *Preparing Sundramoorthy, a leprosy patient, for F-Scan trials.*

In consultation with the Karigiri Obstetrics department I also became involved in designing and manufacturing a basic baby incubator that was to be used for premature babies requiring a warm stable environment. The hospital had in its possession a similar apparatus that they had been using for several years. However the incubators size and condition was now inappropriate for continued use. By using the basic shape of the existing incubator, I designed and prepared a dimensioned technical drawing using appropriate geometrical calculations (see Figure Two).

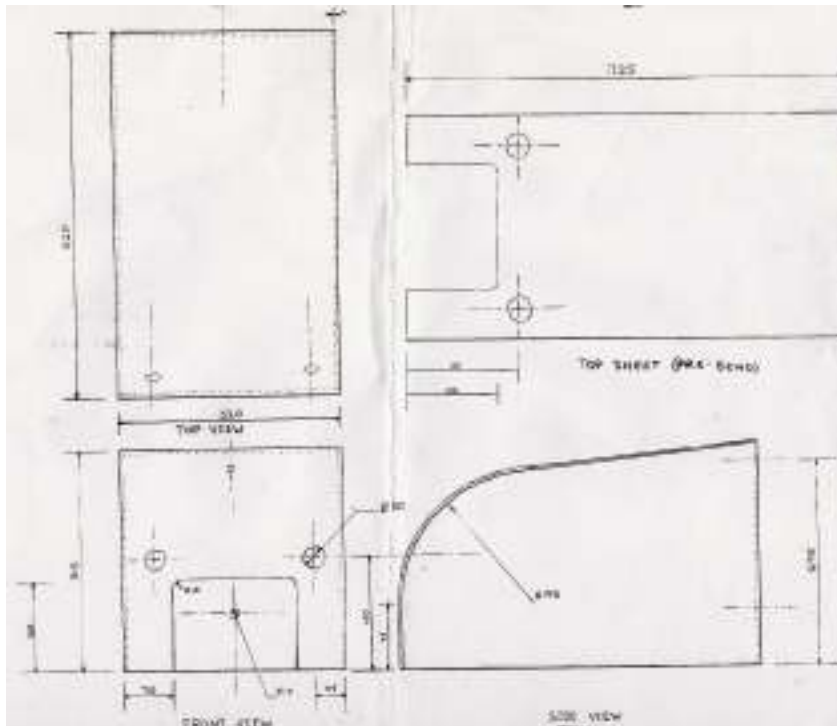


Figure Two: *The Technical Drawing of the Baby Incubator.*

The materials used for the incubator were a Perspex sheet, araldite adhesive, light bulbs and fittings, all of which were purchased from local shops in the Vellore area. During the manufacturing of the incubator the team was forced to make use of inappropriate tools and adapt methods of production accordingly. The final product was well received by the hospital and was put into immediate use (see Figure Three). The design, materials list and manufacturing procedure were documented and skills training performed in the hope that other mission hospitals in the Vellore area will benefit in the future.



Figure Three: *the first patient to use the new Incubator.*

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During my term at Karigiri I was involved in some other minor activities that tested my engineering knowledge and teaching skills. Firstly, I conducted capacity building sessions for the F-Scan system with some of the hospital staff. This allowed me to transfer the skills I had gained using the F-Scan system to qualified rehabilitation professionals so that continued clinical use of the equipment could be ensured after my departure. I also wrote up a detailed testing protocol for the F-Scan to act as a troubleshooting reference should the staff encounter any problems.

I thoroughly enjoyed being able to pass on the knowledge I had acquired and knowing that this resource would continue to provide assistance was particularly gratifying. Also, I was able to provide direction for a project involving the testing of the mechanical properties of MCR and developing suitable quality control guidelines. The hospital had acquired several engineering testing machines for such an application however they lacked the knowledge and focus required to initiate a suitable protocol. Therefore I established a template for the analysis of testing results in a hope it may lead to future use in a quality assurance strategy. Unfortunately, the MCR testing project was performed under significant time constraints and therefore was left uncompleted. The future success of the project will now depend solely on the willingness of Karigiri hospital staff to adopt the outlined practices.

My time in India also allowed me to see two other hospitals, both of which were very different to Karigiri but still facing the same health care challenges. The Christian Medical College (CMC), Vellore is one of the premium hospitals and medical teaching facilities in India. In fact it was the doctors at this facility that started Karigiri hospital. I spent a day at CMC observing the work conducted at their Bioengineering and Prosthetics & Orthotics departments. This facility encompasses the same principles of healthcare as Karigiri, however operates at a far more sophisticated level. I was also fortunate enough to visit Holdsworth Memorial Hospital in Mysore, where we toured the 350 Bed facility and spent time in the Medical Engineering department. Seeing both of these facilities allowed me to establish an understanding of the healthcare situation in India.

Although I thoroughly enjoyed the many projects and activities I was involved in throughout my time at Karigiri, the day I spent visiting local villages with a community health team was



the most significant experience of my life. In the space of this one long day I felt more varying emotions than I ever have in my entire life. The warm welcomes I received when entering villages, the excitement of the local children on their first glimpse of a white man, the anger I felt when seeing the disgraceful treatment of people with leprosy within certain communities and in contrast the overwhelming sense of compassion and family loyalty towards these people in other communities made this day the fondest memory of the trip. It was experiences like this that really exposed to me the reality of the world we live in.

Figure Four: *A little village kid quite amused about the prospect of having his photo taken by the strange white man.*

The time I spent in India opened my eyes to the real world, exposed me to circumstances I never thought existed and challenged my engineering and personal skills. I would like to thank the Built Environment and Engineering faculty, Executive Dean Martin Betts, Assistant Dean David Buisson and Professor Mark Percy for providing me with this extraordinary opportunity. Zim Solo was a tremendous mentor and friend during the experience and I'd like to thank him also for his support. For me, the India adventure represented a significant life changing period, an experience that has altered my perception on life and the world around me.