TOWARDS THE VALIDATION OF A CONCEPTUAL DESIGN MANAGEMENT MODEL FOR REMOTE SITE PROJECTS

Linda Kestle¹, Bryan Storey² and Regan Potangaroa³

¹School of the Built Environment, UNITEC-NZ, PB 92025, Auckland, New Zealand
²GatewayAntarctica, University of Canterbury, P B 4800, Christchurch, New Zealand
³School of Architecture, UNITEC-NZ, PB 92025, Auckland, New Zealand

In the last decade or so there has been an increasing number of remotely located and often environmentally sensitive sites becoming the focus for development work involving potential investors / entrepreneurs / stakeholders or government and non-government agencies. Projects on remote sites are frequently government funded, making the approval processes, and timelines for example, subject to political influence(s), which means that the projects are potentially more difficult to manage, at all levels of involvement. The main objective of this research thesis was to develop and then validate a conceptual design management model for remote site projects, as there were no previously documented empirical examples, nor theoretical models, for remote site design management. The research aimed to also demonstrate the potential portability of the model, in terms of offering a basis for a relevant management framework for built environment projects, international scientific drilling projects and international humanitarian aid projects. Case study methodology was adopted as the primary method for developing and validating the design management model (Kestle & London, 2002), as it involved empirical enquiry that afforded investigation of the remote site design management phenomenon within a real-life context. Two case studies were conducted, one being an historical Antarctic Science Drilling Project, and the other a current UN Humanitarian Project in Sudan, and subsequently a post-disaster reconstruction project in Aceh managed by the JRS. The findings to date support the conceptual design management model as being relevant for a non-profit and/or Humanitarian Aid projects in the post – disaster reconstruction context, and for a commercially based Antarctic Science project.

Keywords: case studies, design, management framework, reconstruction, remote sites.

INTRODUCTION

The research topic is the resultant of research projects previously conducted, as a part of the requirements for a masters degree in architecture, and from subsequent further research endeavours in Australia and Antarctica, prior to 2002. After reviewing, and reflecting on the aims and results of the previously published research work that had been conducted by the doctoral student, and associate researchers in the areas of design and construction projects in Antarctica, the high altitude regions of National Parks in New Zealand, and Australia respectively, a further literature review was conducted prior to the submission of the formal research proposal in 2002. This review was undertaken in the areas of lean design management, design management and environmental sustainability. When read in conjunction with the previous

¹ email: lkestle@unitec.ac.nz
² email: bryan.storey@canterbury.ac.nz
³ email: rpotangaroa@unitec.ac.nz
research, this new work informed the first stages of the development of an exploratory conceptual design management model for remote sites, and an associated typology. The research topic was Remote Site Design Management and the following key terms associated with this research topic are identified, contextualised and briefly explained.

**Remote Sites**

These are typically located within environmentally sensitive regions primarily due to the region being previously undeveloped or under-developed. Sites can be categorised and considered to be ‘remote’ in relation to their environmental sensitivity; the distance to the site from continuously available logistical support; the hostility of the environment in terms of the climate; the difficulty of physical access to the sites; the lack of available local materials and labour resources, and be located in areas of hostile physical conditions.

Further, remoteness when based on a continuum related to the physical distance of participants from the site, falls potentially into three different categories:

1. where the project participants such as the design, construction and facility management personnel are not at, or adjacent to, the project site, instead being located in another city or town for the duration of the project,
2. where selected groups of the project participants are not initially located at or adjacent to the project site. For example, the design and construction management teams, or humanitarian aid consultants have their offices in other countries or regions, and may move to the project site’s region or install their agents within the region where the project site is located.
3. where the majority of the project participants are located adjacent to or actually at the project site, with the remainder being located remote from the project site. (Kestle et al 2002).

Remote sites pose unique challenges for the participants involved throughout the design, production and operational stages of a project. Increased global awareness of environmental issues and the emergent sustainability movement has created a focus for research and critical thinking in this area, however there is still a lack of fundamental research in the area of the development and management of remote, environmentally sensitive and frequently hostile sites (Kestle & London 2002).

**Design Management**

Design Management is regarded as an emerging field, and the discipline of design management is not focussed on design persé, instead design management is a complex process, that is fundamentally concerned with the integration of specialist knowledge, value generation, and the critical timing of key design and management decisions (Kestle & London 2002). The design and construction processes have become more complicated and fragmented over the last few years, and this has a series of differing, yet related impacts. One of the major impacts is the difficulty surrounding the development of a shared understanding of the objectives of a project amongst the various stakeholders (Tombesi 1997). Having a shared understanding that facilitates working toward the identification of what is valued in the project, impacts on how and when critical decisions are made on design and coordination issues. Poor integration of specialist user and producer stakeholder knowledge, can
result in an inappropriate synthesis of the needs analysis, leading to a lack of or a low level of value generation for the clients and stakeholders (Kestle & London 2002).

Design managers have emerged as new and valued specialists on projects, who integrate and coordinate the design process and in particular, have the responsibility for the interface with other organisations involved on the project(s). Design managers are process coordinators, who ensure that the process deadlines, reviews and consequentials are met, keeping the focus on the tasks and objectives to achieve the value criteria set down and agreed for the project. The design and development process frequently involves a range of informed to ill-informed decision-makers, and this process and the resultant outcomes are driven by the initial and therefore critical decisions made at that time (London & Ostwald 1996). Add the dimension of remote site projects and the complexity, and critical nature of the initial decision-making stages increases and diversifies even further.

**Environmental Sustainability**

One of the underlying concepts of ‘sustainability’ is that our relationship with the built and natural environments is permanent, and that there is an interdependent relationship between our activities and their effects on the planet. This is particularly relevant as many of the remote sites are pristine and therefore environmentally sensitive. The management of these environments has largely been associated with various legal instruments, such as international treaties and national acts, for example the Antarctic Treaty (1961) and the NZ Environmental Protection Act (1994). Any projects conducted in Antarctica have to go through rigorous and constraining Environmental Impact Assessment (EIA) procedures (Waterhouse 2001). At the initial stages of a project, consideration of the environmental sensitivity of remote sites may often be paramount to the overall pre-planning, design development, project development, and construction or operational stages.

**RESEARCH RATIONALE AND CONTEXTUALISATION**

In the last decade or so there has been an increasing number of remotely located and often environmentally sensitive sites becoming the focus for new or post-disaster development work involving potential investors/entrepreneurs/stakeholders or government and non-government agencies. Projects on remote sites are frequently government funded, making the approval processes, and timelines for example, subject to political influence(s), which means that the projects are potentially more difficult to manage, at all levels of involvement. Clients, stakeholders and construction organisations have been involved on projects in areas distant from their home base for many years, and have taken a largely logistical approach to these environmentally sensitive sites (Kestle & London 2003).

Research into remote sites rendered no previously documented empirical examples nor theoretical models for remote site management from published literature, and hence theory-building and model-testing was seen to be required in this field/discipline. The research community had yet to take up the challenge of developing theoretical models that explore the design and management processes for remote sites in an integrated manner. The research topic was therefore considered to be unique, given the lack of fundamental research in the area of design management (Ballard & Koskela 1998) and specifically, the design management of remote site projects that
were located on environmentally sensitive, and often hostile sites (Kestle & London 2003)

**Research Objectives and Methodology**

The objectives were set in terms of the overall research question, which is:

"What are the key factors and drivers that constitute a plausible theoretical conceptual design management model for remote site projects?"

The main objective of this research then was to develop a conceptual design management model for remote site projects. An associated objective was to develop a remote site typology. The final objective was to validate the conceptual design management model for remote sites. The objectives were achieved firstly by the development of the typology for remote sites (Kestle et al 2002), and a conceptual design management model for remote sites (Kestle & London 2002), in terms of reviewing and synthesising previously conducted and published research, and theoretical published ‘production principles’ (Huovila & Koskela 1998), and ‘sociological factors’ (Garnett 1999 and Huovila et al 1998), associated with design management, and lean design management (Koskela et al 1997 and Seymour & Rooke 2001). The theoretical basis for the model is Just in Time (JIT), Total Quality Management (TQM) and Lean Production theories.

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**THEORETICAL CONTRIBUTIONS**

- **Production oriented worldview**: 'Lear design'
  - value stream
  - process integration
  - workflow
  - waste minimisation

- **Sociological oriented worldview**: 'design methodology' & 'creitive/iterative design process'
  - value generation
  - knowledge integration
  - timely decision making

**CONTEXT**

REMOTE SITES
- proximity to urban areas
- regulatory framework
- physical environment
- functional/aesthetic and social aims
- environmental impact/sensitivity

**SYNTHESIS**

**VALUE GENERATION**
- client's value criteria
- stakeholders' value criteria

**KNOWLEDGE INTEGRATION**
- specialist site knowledge
- IT for remote site coordination

**PROCESS INTEGRATION**
- logistics & site accessibility
- construction planning/methodology
- alternative procurement strategies
- creativity and production interface

**DECISION MAKING**
- timely & critical
- performance criteria
- environmental sustainability
- economic constraints

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**Figure 1: Conceptual Design Management Model for Remote Sites (Kestle & London, 2002)**

The developed model was then tested and reviewed in terms of further case studies – one a retrospective review of an historical case study of an Antarctic Drilling Project involving interviewing selected personnel who had worked on the project (2003/4), another being a current UN Humanitarian Aid Project in West Darfur, Sudan (from 2004 onwards), and the third a current Humanitarian Aid Tsunami Relief Programme, in Aceh, Indonesia (2004). This research aimed to not only validate the theoretical design management model for remote sites, but also to demonstrate the potential portability of the model in terms of offering a basis for a relevant management framework for built environment projects, international scientific drilling projects and international humanitarian aid projects, in the post – disaster reconstruction context.
Case study methodology was adopted as the primary method for developing and validating the design management model (Kestle & London 2002), as it involved empirical enquiry that afforded investigation of the remote site design management phenomenon within a real-life context (Yin 1994). Two major case studies were conducted, one being retrospective, and of a historical Antarctic Science Drilling Project. The second, a current UN Sudanese Humanitarian Aid Project in West Darfur. The model has been applied and further tested on a third project being a Humanitarian Aid Tsunami Relief Programme in Aceh, Indonesia a project managed by the Jesuit Refugee Services (JRS) in 2004 (Potangaroa & Kestle 2008).

1. The Historical Antarctic Science Drilling Project at Cape Roberts, Antarctica

The selection of the case study at Cape Roberts, Antarctica, was made on its ability to represent the phenomenon of remote site design management. The Cape Roberts Drilling Project (1995-2001), was considered to be a remote site project as there was a lack of continuously available logistical support and the site was difficult to access in terms of geographical location, being approximately eight hours flying time to New Zealand, and several hours of hagglund and sledding time from Scott Base in the Ross Sea Region of Antarctica. In addition the site enjoyed a seasonally hostile local climate, and there was a complete lack of local materials and labour. All resources, whether materials or labour had to be shipped or air freighted into Antarctica’s Ross Sea Region, and then sledded with hagglunds to the drilling site.

The complexity of the project and the associated management of this internationally collaborative project, were strongly evident to the steering committee and subsequent management personnel, from the commencement of their engagement on the project. The complexity of managing the Cape Roberts Project stemmed in part from the fact that there were seven countries involved, with their associated stakeholders and scientific expectations set against a non-negotiable timeline to achieve the desired scientific outputs. In addition, Environmental Impact Assessment (EIA) procedures are required for every activity in Antarctica whether conducted by the USA, New Zealand, German or Italian Antarctic Programmes. This places significant and rigorous constraints on Antarctic projects, in terms of their inception, viability, methodology, implementation and overall monitoring of each and every potential environmental impact (Kestle & Storey 2005).

A report on the Cape Roberts Drilling Project was written by Peter Barrett, Jim Cowie and Alex Pyne, and subsequently edited by Jim Cowie (Cowie 2002). This report assisted the researcher’s overall understanding of the project, and assisted in the subsequent selection of participants for a series of retrospective semi-structured interviews, with nine of the key personnel on the project who represented a cross section of all the personnel involved on the Cape Roberts Drilling Project in terms of their official roles on the project. The interviews explored the project in its entirety. The data were then analysed within the context of the previously developed conceptual design management model for remote sites. The aim was to see how well the data matched, or added to the design management model in terms of the four key factors being: value generation; knowledge integration; process integration and timely decision making.

The drilling project, conducted from 1995 – 2001, was an international collaborative effort involving seven countries - Italy, Germany, Australia, UK, United States, New Zealand and the Netherlands. Each country contributed to the scientific, management and/or operational aspects of the project. This collaborative approach, created a
complex regime of project personnel and tasks, that needed to be sensitively integrated, coordinated, and managed. The Cape Roberts Project (CRP), comprised two quite distinct, yet parallel parts - one being science the other logistics, both sharing the same overall objectives but having differing timeframes and critical criterion to be met. The originally proposed management structure gave responsibility for the overall supervision of the project to the International Steering Committee (ISC). The logistical support for the Project was to be the responsibility of the Operations / Logistics Management Group (OMG). This management structure was problematic and was subsequently superseded by the CRP Operations Plan (1996), which was basically a refined version of the original Washington CRP Workshop Management Structure (1993). There was an emphasis on an operational management team with recognition of the two distinct parts of the Project (science and logistics/operational) and therefore recognition of the need for joint or bifurcated leadership. Those leaders each reported to the ISC and NZAP (Antarctica NZ), respectively. Further, each member of the management team had their roles and responsibilities clearly defined in the Operations Plan (Cowie 2002).

The Findings in terms of testing the model

The questions in the semi-structured interviews were seeking to establish whether the 'key factors' of the design management model for remote sites were supported by the Cape Roberts Drilling project personnel 'real -life' experiences on the project. Testing the collected data against the conceptual model under the four factors of value generation; knowledge integration; process integration and timely decision making, involved reviewing the responses specific to the Cape Roberts Antarctic Drilling Project. The results were extensive and generally consistent across all of the selected interviewees (Kestle & Storey 2005). The personnel interviewed unequivocally supported the four key factors of the design management model, as being valid for Antarctic remote sites generally, and accurately representing their experiences on the Cape Roberts Drilling project.

The following key points were drawn from the collected data:

*Value Generation* as perceived, or needing to be realised, on the Cape Roberts project was:

- in the technical and scientific aspects, and specifically the scientific outcomes from examining the cores, and the contributions on the international stage eg climate change, Kyoto protocol.
- in the 1.7km of core recovered at a very reasonable cost ie considered great value for money by the 6 nations involved with NZ.
- in the need for low environmental impacts on the part of the project and the associated personnel.

*Knowledge Integration* issues on the Cape Roberts and future Antarctic projects were seen to include:

- intellectual property issues preventing knowledge integration – seen as an inhibiting factor, eg problems that arose with 'patch-protection', where people did not want to share their valuable expertise with potential successors for fear of becoming dispensable.
• ‘risk’ - particularly in terms of the personnel selected for the project(s) - getting the wrong people may compromise the project outcomes.
• the situation where a pool of specialist remote site personnel is created within organizations to design and manage these particular project sites. The potential weakness though, is where this knowledge capital is not documented explicitly, and a successional framework of specialist personnel is not fully established within organizations.  

Process Integration as perceived, or needing to be realised, on the Cape Roberts project and future Antarctic projects, were seen to include:
• the consequences of no process integration was dis-satisfied staff, burn-out, budget blow-outs, and at times an incomplete project.
• operational logistics and information management needing to occur in a timely and realistic manner.
• pre-planning and being aware of the other team members needs and the consequences of all the actions proposed.  

Timely Decision Making issues on the Cape Roberts and future Antarctic projects were that:
• the key decision - makers have to be identified and recognised as having the appropriate authority to act and respond.
• fast, accurate and safe decisions were made in potentially dangerous situations. This was the result of having a very good management structure, that was responsive and responsible.
• everything revolves around the environment as far as Antarctic project sites go. The weather controls everything - what, when, and if you can do anything. You have no real control, it is often called the Antarctic Factor.
• a lack of timely and critical decision making may result in the loss of a whole year, (or more) of core production, as the supply ship only goes in to Antarctica once a year (Kestle & Storey 2005).  

The personnel interviewed supported the four key factors of the design management model, as being valid for Antarctic Remote Sites and as accurately representing their real-life experiences on the Cape Roberts Drilling Project in Antarctica.  

2. The UN Sudanese Humanitarian Aid (UN SHA) Project in West Darfur.

The selection of the case study at West Darfur in Sudan, was made on its ability to represent the phenomenon of remote site design and project management.

The ‘fit’ of the project with the theoretical design management model, was addressed in terms of how well the four key factors of the conceptual design management model for remote site projects, and secondly how the data collected from the selected participants, represented the realities of designing and project managing projects such as the UN SHA Project in West Darfur. The interviews that were conducted, explored the project in its entirety with the seventeen selected key personnel, in terms of their official roles. However, the selection of only eight of the seventeen interviewees’ transcripts, when testing the model against the realities of managing the aid project, was made on the basis that these people were the managers from each of the agencies, and therefore knew the big picture objectives, the strategies being applied, and the desired outcomes.

The UN SHA Project in West Darfur, being an international collaborative involved aid representatives from several international countries (such as the UN HQs in
Geneva and Khartoum, the USA, UK, European Union, NZ, and Australia), Each country contributed to the management and/or operational aspects of the project. This collaborative approach created a complex regime of project personnel, and tasks, that needed to be sensitively integrated, coordinated, and managed. The overall aim of the UN SHA Project in West Darfur, (and therefore the various agencies), as already noted, was ‘to make a difference’ to the lives of the beneficiaries of the aid, the Internally Displaced Persons (IDPs). The complexity of the UN SHA Project in West Darfur, and the associated management of this internationally collaborative project, were strongly evident to the planning committee, subsequent management personnel, and the field personnel from the commencement of their engagement on the project, according to virtually all of the participants. This stemmed in part from the fact that there were several agencies and several countries’ representatives involved, with all of their associated stakeholders and expectations. In addition there was a non-negotiable timeline to achieve the desired outcomes.

The Findings in terms of testing the model

The following key points were drawn from the collected data:

**Value Generation** on the West Darfur Humanitarian Aid Project in Sudan, was singularly concerned with making a difference to the lives of the beneficiaries of the aid, the Internally Displaced Persons (IDPs). Provision of basic shelter and the necessaries of life, being at the core of the project’s aims, and as perceived, or needing to be realized, on the West Darfur Humanitarian Aid Project, in Sudan was seen to include:

- the effectiveness, (and therefore the value) of the project, measured by what was achieved eg how many built outputs. Value was measured quantitatively.
- making a difference to the living conditions, in terms of emergency water and sanitary assessments in the ‘Field’, acting on the recommendations, and timely implementation

**Knowledge Integration** as perceived, or needing to be realized, on the West Darfur Humanitarian Aid Project, in Sudan was:

- that there were definite gaps in the knowledge integration process. No-one wanted to trespass on others’ areas. This was perceived as a possible hinderance to finding the best solution(s), and there were basically, informal and formal systems of knowledge integration.
- that there was a problem with the planning and the reality. The specialised personnel who came in, could not do what they were best at, as they had to follow a particular plan, and therefore were not necessarily seeing the desired or potential ‘results on the ground’.
- the gaps in specialist knowledge, in terms of the experiences of the people in the field, versus those in the office were not always in-cinque, at times.
- that sometimes there was too much specialised knowledge on the project, and what was needed was a more holistic approach.
- a good knowledge of the IDPs’ cultural and value systems was needed, before commencing the on-site work.
- the high turnover rate of people in these roles, meant that key information was not fully recorded if at all.

**Process Integration** as perceived, or needing to be realized, on the West Darfur Humanitarian Aid Project, in Sudan was:
• trying set up the best processes and systems in response to the IDPs’ immediate and longer term needs.
• trying to achieve co-ordination at the camp level, and engage in meaningful and useful relationship-building with the International, and IDP Communities, whilst not always knowing the other agencies’ plans.
• about co-ordination of the various groups, on this project, and that little could have been achieved without the Sudanese people and their expertise, as they had valuable connections and networks within the community.
• making sure that assessments were correct, and then preparing a plan that was thorough and addressed the challenges within the timeframe, and the budget.

Timely Decision-Making as perceived, or needing to be realized, on the West Darfur Humanitarian Aid Project, in Sudan was:

• that decision-making on this project was reactive and prescriptive. The detailed, and bigger picture decisions were fed from the ‘Field’ back to central, where the tailoring occurred, and the decisions, and plans, were fine tuned.
• that at the organisational level, the decision-making needed to be decentralised. There were instances of considerable time and opportunities lost due to bureaucracy, set against instances of high levels of co-ordination between West Darfur, Khartoum and the agency’s head office where the staff were given almost total autonomy in the ‘Field’, and dedicated organisational finance project personnel.

The results from the analysed participants’ data were generally consistent across all of the selected interviewees, though some of the respondents on the UN SHA project appeared to have more autonomy than others, in terms of playing a real part in the decision-making processes. The personnel interviewed supported the four key factors of the design management model, as being valid for Humanitarian Aid project sites generally, and as accurately representing their real-life experiences, or those that were needed, on projects such as the West Darfur Humanitarian Aid Project in Sudan. The results from these two case-studies provided significant support to the validation of the conceptual design management model for remote sites, and to the associated typology (Kestle, Potangaroa and Storey 2006).

3. The Tsunami Relief Programme in Aceh, Indonesia
A subsequent and recent case study of the project managed by the Jesuit Refugee Services (JRS) extended the application of the conceptual design management model by Kestle & London, (2002) to identify where value was added (both perceived and actual) by the JRS as part of its Tsunami Relief Programme (TRP) in Aceh, Indonesia in 2004 (Potangaroa & Kestle 2008). Their programme had been running from 2001 with a focus on relief, emergency support and accompaniment of refugees and IDPs. As part of an evaluation of their two year tsunami programme in Aceh, JRS believed that they had “their own particular way of doing things” and this was considered by those in the field as being the main way in which JRS ‘added value to humanitarian programmes’. The field team believed that their added value was linked to the perceived flat organisational structure and its bottom-up management structure, that allowed rapid responses to changing circumstances in the field. JRS’ organisational structure comprised only three levels from their national office in Yogjakarta to the field staff. Semi-structured interviews were conducted with seven members of the JRS management team and their responses to each of the four key factors of the design management model for remote sites were summarised and tabulated into a contextual
spreadsheet, which afforded comparisons and allowed patterns to become more evident (Potangaroa & Kestle 2008).

**Findings in terms of applying and testing the model**

All seven managers were concerned about *value generation* and the need for flexibility in their management approach, whilst providing speedy responses to beneficiaries, as this was the 'main added value' that JRS believed that they provided.

The sense for the field was that *specialist knowledge and process integration* was and is required to ensure best design solutions and integrated processes, from the early stages of the project, followed by regular monitoring for the best end results. However, they believed that that did not in fact happen on the TRP project. The team instead relied heavily on the reporting of transactional narratives with beneficiaries for it's knowledge integration. Managers acknowledged the need for better systems, but they admitted to implementation difficulties, and that there were issues in attracting any staff, let alone specialist staff to their programmes.

*Process integration* was essentially ‘rule-based’ with a ‘go and see’ approach rather than any pre-planning or strategic operational planning being evident in their responses to the interview questions.

*Timely decision-making* was seen as centralised or decentralised dependent on the participant’s ‘distance from the field’. Those based in National office saw the process as decentralised, and those based in the field saw the process as centralised, and strictly controlled by processes and rules.

In applying the model, was the perceived sense that ‘flexibility and speed of response to beneficiaries was the main value – added service that JRS provided’, confirmed. JRS’ management approach was not in fact recognised as value-adding on the TRP project, in part because of the informal levels of knowledge integration, and the reliance on feedback and field reports from the beneficiaries, which also identified that a more flexible and responsive approach would in fact add value in any future programmes (Potangaroa & Kestle, 2008).

The interesting and somewhat unexpected outcome was the usefulness of Kestle & London’s (2002) conceptual design management model in analyzing JRS’ Tsunami Relief Project from a value-adding perspective, suggesting that the model was more robust and portable than perhaps originally thought, when it was initially developed and subsequently tested on the Antarctic Science and Sudanese Humanitarian Aid projects.

**CONCLUDING REMARKS**

The main objective of this research then was to develop a conceptual design management model for remote site projects. The secondary objective in association with the first objective was to develop a typology for remotely located construction projects. The final objective was to validate the conceptual design management model for remote sites. This research also aimed to demonstrate the potential portability of the model in terms of offering a basis for a relevant management framework for not only built environment projects, but also international scientific drilling projects and international humanitarian aid projects. These objectives and aims have been demonstrated to date on the two main case studies, which represent diversely different disciplines and remote site locations. Each has confirmed that the conceptual design management model for remote sites is effective in modelling and understanding the
issues related to the realities of managing those projects. The model provided a framework to compare what actually happened ‘in the field / on site’ versus that which was contained within the management plan(s), and was also effective when analyzing the JRS project, a third case study, where the aim was to establish the value added to humanitarian aid programmes.

**Future Research**

The UN Human Response Review (2005), that formed the basis for the Cluster Approach in managing humanitarian aid operations, will be compared with the overall case study research findings from the UN SHA project in West Darfur, in terms of the multi-disciplinary conceptual design management model for remote sites, in a later paper. In addition, a further research stage involving the development of a project planning framework specifically for Humanitarian Aid (HA), will be conducted.

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Sustainable post-disaster reconstruction projects in remote locations – Darfur revisited

Linda Kestle, School of the Built Environment. UNITEC – Auckland. New Zealand
e-mail: lkestle@unitec.ac.nz

Dr. Regan Potangaroa, School of Architecture. UNITEC – Auckland. New Zealand
e-mail: rpotangaroa@unitec.ac.nz

Introduction and background

Reconstruction projects, such as those conducted in Sudan since 2004, need an effective multidisciplinary planning and management framework, capable of responding to transitional and long-term reconstruction requirements. A preliminary multi-disciplinary framework design managers can use to develop better management and design practices, in the context of humanitarian aid and reconstruction projects in remote locations, was discussed in a previous paper (Kestle & Potangaroa, 2006). That paper presented the analysis of a selection of the data collected from semi-structured interviews with key decision makers working in West Darfur, Sudan. Analysis of a further selection of collected data from the same Sudanese research case study reviewed the realities and challenges of managing the pre-planning and operational stages of the UN Sudanese Humanitarian Aid project in West Darfur, in terms of managing the logistics, the camps, the stakeholders and communications. The findings offered a range of lessons learned and recommendations for managing future Humanitarian Aid projects, particularly those in remote locations.

The main challenges at the pre-planning and operational stages, according to the participants centred around the fact that whilst they knew of the emergency situation in West Darfur and of there being IDPs needing care and protection, they knew very few specifics on the scope or magnitude of the emergency before going there. They were basically advised to “assess and fix it”. The participants all noted that there was no real expectation of being briefed but that the briefings they did receive were of little relevance to the actual situation. Statistical information on IDP numbers, available resources and amenities varied, and were therefore unreliable. The situation in Darfur basically evolved and personnel were in catch-up mode rather than being able to pre-plan months in advance. Curiously, the participants noted that the most useful information was gained from watching the news on television and from reading media articles, before going to Darfur. The logistical pre-planning was almost impossible to organise given a complete lack of systems being in place beforehand, and were not easy to set up in fact, given the working environment. In addition there was the issue of the inaccessibility of the site from both political and geographical perspectives.
The pre-planning stages and the operational stages on this project tended to become blurred, given the short lead-time, and the unreliability of statistical data. The lack of pre-planning and organisation of resources, whether labour or materials or infrastructure / systems / processes, created barriers to achieving any meaningful outcomes initially. There was unanimous agreement amongst the participants that the remoteness of the site seriously impacted on the project and their roles. There was a view that “remoteness was the enemy of the programme”. The distance between Khartoum and Darfur added to the problems in terms of getting supplies through intact, if at all. The only realistic and relatively reliable form of transportation involved planes, given there were no properly formed roads, only marginally formed airstrips and no formal airport facilities. However, according to the participants, there was never any real certainty as to when the planes may arrive or leave, nor what resources would be on board, and materials not locally available would have taken 5 weeks by road, but there were no roads as such. The materials were frequently looted, or there were floods, or heavy rains washed out the roads / tracks damaging or completely destroying the resources. West Darfur is considered to be the most remote area of the three Darfur states (North, South and West) and this contributed significantly to the communications challenges noted by the participants. There was consensus amongst the participants that the management of communications' systems and processes were either non-existent initially, or were unreliable at best. The camps were inaccessible by vehicles and Darfur was not serviced by fibre-optic cable nor satellite technology, so phones were the only form of telecommunication, in association with a Pulse mailing system. Reporting systems to HQ in Khartoum relied on a mailing system, and given the ever-changing nature of the emergency, reported information was quickly outdated.

In terms of lessons learned and recommendations suggested by the selected participants for managing Humanitarian Aid projects future projects, four that are particularly relevant to the pre-planning and operations stages are noted here:

1. Simple operating systems be set up for say computers to respond more effectively with, given the primitive nature of the area.
2. There should be a clear plan of the area and an initial plan of action and priorities before or as the relief personnel are brought in for the Emergency and Recovery Phases.
3. The developed and planned future activities need to be recorded and available to the subsequent managers and groups of aid personnel, as there is a lack of institutional memory with people moving on, and the next group tend to re-invent the wheel each time.
4. Mobile offices are needed, such as converted containers or caravans that are self-contained modules with UHS radios and email systems that are already operational before the specialist technical, field operations and relief personnel are brought in for the Emergency and Recovery Phases.

References

Authors’ Biographies

Linda Kestle. Senior Lecturer in the School of the Built Environment, UNITEC – Auckland, New Zealand

Dr Regan Potangaroa. Associate Professor in the School of Architecture and Landscape Architecture, UNITEC – Auckland, New Zealand
Identifying Value Adding in Humanitarian Programs

Regan Potangaroa,
School of Architecture, Unitec, Auckland, New Zealand
(email: rpotangaroa@unitec.ac.nz)

Linda Kestle
School of the Built Environment, Unitec, Auckland, New Zealand
(email: lkestle@unitec.ac.nz)

Abstract

Earlier work by Kestle had established a management model for design management in remote areas [1]. That model was subsequently tested in the humanitarian aid context of West Darfur in June 2004 and found to be very effective in modeling and understanding the issues related to the provision of humanitarian aid in remote locations [4]. And in this paper, the authors extend the application of that model into identifying where value was added (both perceived and actual) by the Jesuit Refugee Services (JRS), as part of its Tsunami Relief Program in Aceh, Indonesia. It then suggests ways that this value could be enhanced. This need came about as part of an end of program evaluation of the TRP.

The mission statement of JRS is to “accompany, serve and defend” and it was interesting to see how this worked out in the field. Many/most of the JRS field team felt that their added value was linked to its flat organisational structure and its bottom up management structure that meant that JRS could respond rapidly to changing circumstances and beneficiary requests. The Kestle Model provided a framework to compare what was seen in the field against what was planned by management. And from that comparison and analysis demonstrate where value was being added.

Keywords: Added value, humanitarian, aid, management, framework

1. Background

How do different humanitarian aid organisations add value?

As part of an evaluation of their 2 year tsunami program in Aceh, it became clear that JRS believed that they did have their own particular way of doing things and moreover this was identified by those in the field as being the main way that JRS added value [7]. What was interesting for the evaluation team was that none of this “JRS way” was actually written down and this also appeared to be at difference to the organisation’s mission statement. The mission statement of JRS is to “accompany, serve and defend” and it had been doing that in Aceh since July 2001 with a focus on relief, emergency support and
accompaniment for refugees (those returning from countries outside Indonesia) and internally displaced persons IDPs (those returning from other parts of Indonesia) to Aceh in North Sumatra [6].

The imposition of Martial Law in Aceh in 2003 severely restricted the work of all humanitarian agencies and in particular the work of JRS. By 2004, JRS’s role in Aceh was to strengthen traditional coping mechanisms as a response to the impact of conflict and peace building. The earlier monitoring of human right abuses was still needed, and advocacy remained an important aspect with local authorities [2].

There was no change in the situation in Aceh when Martial Law ended in May 2004 and was replaced by a Civil Emergency period. And it was only the Indian Ocean Tsunami on December 26th, 2004 with its massive death toll and extent of destruction that the Government of Indonesia (GoI) re-opened the area for humanitarian aid. JRS returned to Aceh just days after the tsunami and rapidly set up their Tsunami Response Program (TRP) [3].

The assessment (that formed the basis of the TRP) determined specific areas of assistance that included the following:

- The replacement of boats and the construction of new houses for the Pulo Aceh people that lived on an island just out from Banda Aceh, the provincial capital of Aceh.
- In Banda Aceh, JRS set up a medical program for the IDP’s in various camps throughout the city, built permanent shelters and educational hostels.
- In Krueng Raya (a fishing port near to Banda Aceh) JRS set up a livelihoods program replacing lost fishing boats.
- In Lamno (usually an hours drive south along the West coast of Aceh) JRS supported logistics, education, livelihoods and health care.
- And in Meulaboh (the most southern city on the West Coast of Aceh affected by the tsunami) JRS built homes gave books and various basic needs for IDP children.

These programs were up and running well before those of the major International NGOs and UN Agencies. And it is the resulting program from this that is studied in this paper.

2. Methodology

The study used a conceptual design management model developed by Kestle [1][4][5]. The model was originally developed in terms of “reviewing and synthesizing theoretical published ‘production principles’ and ‘sociological factors’ associated with design management, and lean design management.” And has it’s theoretical basis in Just in Time (JIT), Total Quality Management (TQM) and Lean Production theories.

The model uncovers value generation within the design management process and the four areas of the model reflect the many stake holders participating in this value adding process. For example, developing
a shared understanding of what is valued on the project and identifying, and then agreeing the objectives for a project with the stakeholders. How this was achieved was critical to the original evaluation but was particular interesting in terms of the usefulness of the model. Much of the lean thinking research falls into the tactical category rather than strategic and theoretical, that is, until the work of researchers Koskela and then Seymour [8][9]. Seymour suggested a proposal for implementing lean construction at an organisational rather than just at the operational level. This work was then followed up two years later by Seymour and Rooke using an ethnomethodological approach in terms of setting up an organisational culture that established how people may perform their site work activities in a visibly orderly manner, by changing their mindset, for instance. Similar findings were published by Howell and Ballard stating that changes of the mental model needed to be made [both are reported in 5]. They further suggested that lean thinking (applied at the beginning, or alternatively applied midway on well run projects) revealed the weaknesses of the current systems by mapping the project value stream. The lean design principle of 'flow' is relevant from a sociological and environmental viewpoint, as it tends to be focussed on a more holistic approach for theoretical and project development work. The thinking and principles associated with lean design management, made a significant contribution in terms of informing the development of the Process Integration factor for the conceptual design management model (for remote sites) [5]. The key factors of design management for remote sites were therefore established as being - 'value generation', 'knowledge integration', 'process integration' and 'timely decision making'. These are discussed in more detail below.

2.1 Value Generation

Valuation - refers to the value that the client and stakeholders place on the project and will vary according to the differing clients' and stakeholders' expectations of the projects. And for example in the West Darfur Humanitarian Aid Project in Sudan, value was concerned with making a difference to the lives of the aid beneficiaries through the provision of basic shelter and the necessary of life [4]. The impression gained from the field as part of the evaluation was that flexibility and speed of response to beneficiaries needs was the main value added service that JRS provided and it was this view that needed to be reviewed as part of the evaluation. JRS's organisational structure consisted of only 3 levels from their National office in Yogjakarta to the field staff. And consequently there was some basis for what field staff were working to.

2.2 Knowledge Integration

Knowledge integration – is a complex process concerned with endeavouring to capture, and then integrate, the specialist knowledge of all those personnel involved on a particular project, prior to and during the project phases. To be successful, this requires that key personnel be involved with the pre-design briefing, pre-planning, and in the regular monitoring and review of the design and construction
processes, as the project progresses. Specialist knowledge is required to ensure the best design solutions and end results despite frequently working with non-negotiable timelines.

The sense from the field was that this was not happening.

2.3 Process Integration

*Process integration* – involves the timely and cost-effective co-ordination and planning of a range of processes across the total project, such as construction planning methodology, logistics, information management, and design/ production interface management. In certain instances this may require alternative procurement strategies. Logistical planning and implementation is complex, as well as critical, for remote sites. The timing, costs and restrictions associated with shipping, or air freighting building components, add to the complexities of the logistical aspects of a design management model for these remote sites.

2.4 Timely Decision Making

*Timely decision making* - refers in the main to financial and design decisions, which are critical to the successful management of the design and construction of remote site projects. These decisions are made within the context of frequently non-negotiable windows of buildability, fixed budgetary constraints, and the need for “durable solutions” [10].

3. Interviews

Structured interviews were held with the 7 members of the management team and their responses for each of the 4 areas of the Kestle model summarised and then tabulated into a contextual spreadsheet. Such a spreadsheet (despite being a summary of the full interview) made comparisons and patterns more evident by being able to look across all the interviews at once and is included in Appendix A below.

4. Results

What did the spreadsheet show and how did that compare to what was happening in the field?

Value Generation for JRS was directed linked to outcomes for beneficiaries but these appeared to vary and fell into three areas namely:

- Direction and alignment (this appears to be intuitive and non personal)
• Team welfare (personal and intuitive)
• Reports (non personal and un-intuitive)

All managers were concerned about money flows, corruption and the accountability for both in their respective programs. Nonetheless, feedback from the beneficiaries through the management levels appeared to be driving programs. However, that feedback was not critically analysed and appeared to be accepted at face value. So that if beneficiaries requested boats they were supplied with boats if they were able to show they had a boat pre-tsunami. The pre-tsunami situation was not analysed as to whether the aid provided could not simply replace what was lost but better the village or community overall.

The team relied heavily on the reporting of transactional narratives with beneficiaries for its knowledge integration. Again, this was not analysed as part of the various meetings in the field, at the Aceh sub office and at the National office in Yogyakarta. All managers saw the need for a better system but also admitted that it would be difficult to implement such changes. And finally managers conceded that there were issues in attracting staff let alone specialist staff on to their programs. This reliance on almost “word of mouth” may have come from the sensitivity of the work that JRS is usually involved with, often in conflict situations [1][2]. It was clear from the interviews and the evaluation that there was a significant amount of trust between managers (mostly Jesuit priests) and that work orders and programme changes were often based on an email. Emails were heavily relied on for knowledge integration.

Process Integration appeared to be “rule based” with a strong “go and see” approach. Improvement of the system centred on staff capacity building with the main responsibility of HR being solely to provide staff. And not the training or capacity building of staff.

Timely decision making was centralised and depended on the “distance” from the field. Those based in the National office felt that the process was decentralised while those in the field felt it was centralised. Staffing and financial were centralised in the National office with other decisions made at sub office and field level. Both staffing and financial were strictly controlled by process and rule.

5. Conclusion

So where was the value that JRS added? And to what extent was the sense (as mentioned earlier in this paper) that flexibility and speed of response to beneficiaries needs was the main value added service that JRS provided, was this confirmed by the model?

The TRP had a strong and singular beneficiary focus. That clearly came through in the Value Generation and Knowledge Integration factors. But the flexibility and speed of response were not recognised as value adding. While it could be that both were treated as “givens” being evident in the reliance on feedback, field reports and the informal nature of the knowledge integration identified better value would have been realised by promoting flexibility and response in any future programs.
It is also evident from this analysis that there is the potential for further value adding to beneficiaries by the following:

- **Value Generation**- More emphasis on flexibility, response and the development of a stronger community of practice (COP) approach.
- **Knowledge Integration**- Analysis of the responses of beneficiaries
- **Process Integration**- Development of COP approaches.
- **Timely Decision Making**- Further decentralisation

This aside, the interesting (and surprising outcome) was the usefulness of the Kestle’s framework in analyzing such a situation suggesting that the model was more robust and portable than perhaps originally thought?

**References**


Appendix A: Contextual Spreadsheet Summarising Management Responses for the Four Key Factors of the Kestle Model.

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>Person 1</th>
<th>Person 2</th>
<th>Person 3</th>
<th>Person 4</th>
<th>Person 5</th>
<th>Person 6</th>
<th>Person 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VALUE GENERATION:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you know or measure the effectiveness of your role as it relates to Aceh?</td>
<td>Direction, alignment with JRS Regional and beyond. Staff resources</td>
<td>Direction and clarity</td>
<td>Difficult to get outputs without assessments</td>
<td>On time and finance report checked</td>
<td>Administration only</td>
<td>Difficult, probably how well the team is working esp. With staff changes</td>
<td>Based on reports and feedback from team.</td>
</tr>
<tr>
<td>Are there any rules of thumb that you intuitively apply?</td>
<td>Yes</td>
<td>Watch out for unbalanced verbal reports</td>
<td>Follow ups</td>
<td>None, but system is self checking</td>
<td>Not sure</td>
<td>Go where the need is, ensure beneficiaries talk to us?</td>
<td>Community pride with JRS</td>
</tr>
<tr>
<td>What and how do you get feedback from “clients”?</td>
<td>Feedback from regional, national and field staff</td>
<td>Oral and notes and reports from national office</td>
<td>Little and relies on stories</td>
<td>Feed back from Field</td>
<td>Mostly email and reports</td>
<td>Meetings discussions and field visits.</td>
<td>Meetings with beneficiaries</td>
</tr>
<tr>
<td>In what ways do you feel that you are accountable?</td>
<td>Money, no corruption and cash flow for projects.</td>
<td>Progress and openness</td>
<td>Not accountable no decision making power.</td>
<td>Responsible for money tracking</td>
<td>For system set up</td>
<td>Use of money for beneficiaries and helping beneficiaries</td>
<td>For project related matters.</td>
</tr>
<tr>
<td><strong>KNOWLEDGE INTRODUCTION:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How is what you have learnt on Aceh recorded and passed on to others?</td>
<td>Calling teams together for planning and future. Tacit knowledge.</td>
<td>Discussions informal, information transfer.</td>
<td>Narratives, write ups posted on web and international newsletters.</td>
<td>Not clear</td>
<td>Visits to field office</td>
<td>Difficult to ans. Emails and documents</td>
<td>Reports</td>
</tr>
<tr>
<td>How are you or would you like to improve your situation?</td>
<td>Character and spirit of JRS. Small and non bureaucratic.</td>
<td>Structured without being too formal.</td>
<td>Set up info reqd. and lists</td>
<td>Quality of reporting</td>
<td>Better management system and policy</td>
<td>Info officer and media</td>
<td>Capacity building of field staff.</td>
</tr>
<tr>
<td>And are such changes easy to implement?</td>
<td>Potentially difficult because they are obscure. Unique.</td>
<td>Hard to move towards written</td>
<td>Difficult to get outputs without assessments</td>
<td>Can be difficult</td>
<td>Not clear</td>
<td>Some are hard, no writing culture in Indonesia.</td>
<td></td>
</tr>
<tr>
<td>Are their gaps in the specialist knowledge that you are aware of?</td>
<td>Yes</td>
<td>Yes, staff good at transaction but not technical</td>
<td>Yes, knowledge on basic principles and rights</td>
<td>Accounting staff for rural area difficult</td>
<td>Difficult to compare JRS with other NGO’s</td>
<td>Engineer early on</td>
<td>Shelter</td>
</tr>
</tbody>
</table>
### PROCESS INTEGRATION:

<table>
<thead>
<tr>
<th>What methods or approaches do you employ to achieve your goals and fulfil your role?</th>
<th>Co-ordination, belonging, ownership of JRS. Share holder and family.</th>
<th>Structure and analysis,</th>
<th>Field visits and talking to staff.</th>
<th>Process set by rules</th>
<th>Through policy and system</th>
<th>In discussion with field, used a sweeper team</th>
<th>Personal approach, focus group discussions, being in the field, reporting chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>How have you tried to improve on this or the system?</td>
<td>Staffing, personnel policy mapping staff, identify their training needs</td>
<td>Evaluate and systemise work</td>
<td>Collaboration</td>
<td>Not much room for improvement</td>
<td>Setting up new system</td>
<td>Better info and report</td>
<td></td>
</tr>
<tr>
<td>What role does HR play or could play (for example in staff training, skills and experience)?</td>
<td>Yes</td>
<td>Yes, staff good at transaction but not technical</td>
<td>Yes, in terms of suitable people but advocacy is understood by all staff taken on.</td>
<td>Yes, suitable staff are hard to find.</td>
<td>Training</td>
<td>Selection of spirited people. HR could provide training.</td>
<td>Staff only</td>
</tr>
</tbody>
</table>

### DECISION MAKING:

<table>
<thead>
<tr>
<th>How are your decisions made? Is this decision making centralised or de-centralised?</th>
<th>Decentralised</th>
<th>Assessments are decentralised but ultimately decision of resources and staffing made by Nat. office.</th>
<th>Co-ordinate as a team based on what is reported from the field. Not considered important.</th>
<th>Centralised</th>
<th>Centralised</th>
<th>Centralised</th>
<th>Decentralised staffing centralised</th>
</tr>
</thead>
<tbody>
<tr>
<td>How are budgets maintained?</td>
<td>Level of trust but multiple signatories.</td>
<td>Monthly for each field officer.</td>
<td>No budget for advocacy in TRP</td>
<td>Through process and rules</td>
<td>Not clear</td>
<td>Rough drafts that are approved</td>
<td>Systems</td>
</tr>
<tr>
<td>How significant are sustainability issues in your role?</td>
<td>Accompaniment is important for JRS and while understood in a conflict situation may not be in a natural disaster.</td>
<td>Yes, cultural sustainability structure without strictness.</td>
<td>Yes, suggestions thru to program. Peace being the ultimate sustainable</td>
<td>Not clear</td>
<td>Not clear of application</td>
<td>Not greatly involved but some</td>
<td>Not clear</td>
</tr>
</tbody>
</table>
Sustainable post-disaster reconstruction projects in remote locations, and the fit with a conceptual design management model for remote sites

Linda Kestle
School of the Built Environment. UNITEC-Auckland. New Zealand.
Email: lkesten@unitec.ac.nz

Dr. Regan T. Potangaroa
School of Architecture. UNITEC-Auckland. New Zealand.
Email: rpotangaroa@unitec.ac.nz

Dr. Bryan Storey
Gateway Antarctica. University of Canterbury. Christchurch. NZ.
Email: bryan.storey@canterbury.ac.nz

ABSTRACT

Reconstruction projects, such as those conducted in Sudan since 2004, need an effective multidisciplinary planning and management framework, capable of responding to transitional and long-term reconstruction requirements. When these sites are in remote locations, the planning and management issues compound further.

A preliminary multi-disciplinary framework that design managers can then use to develop better management and design practices, in the context of humanitarian aid and reconstruction projects in remote locations, will be discussed in this paper. The future framework will be developed from a validation of a conceptual design management model for remote sites (Kestle & London, 2002), using Sudanese case study data collected from semi-structured interviews, with selected key design decision-makers working in West Darfur, Sudan.

The Kestle & London model (2002) was developed from a series of commercially-based case studies in the eco-tourism, and antarctic science sectors. This paper identifies how well the collected Sudanese data matched, or added to, the original design management model, in terms of the four key factors of value generation; knowledge integration; process integration and timely decision-making. The paper also investigates whether, and how, that
model may be developed into a relevant multi-disciplinary framework for reconstruction projects in a non-profit and/or humanitarian aid context. The analysis of the semi-structured interviews, suggests that the original conceptual design management model for remote sites (Kestle & London, 2002), is relevant in a non-profit and/or humanitarian aid context. In addition, the model allows for a blending of traditional and modern management methods. The impact of this aspect of the framework, would need to be developed further by future applications of the model, by practitioners in the post-disaster reconstruction field.

KEYWORDS: design: management: framework: remote: reconstruction projects: sustainable

INTRODUCTION

Project management is concerned with managing the overall project but is primarily concerned with managing the construction stages of the project. Design management is concerned with the management of the design process, and the designers, across all of the design stages and consultant specialists, leading to the commencement of the construction stages. Design management within the disciplines of the built environment is a complex process concerned with value generation; integration of specialist knowledge; critical timing of key decisions; process integration, and managing the overall design process across all affected disciplines.

The design process has become more complex and fragmented over the last few years, resulting in an increasing need for a shared understanding of the project objectives amongst the stakeholders. This becomes increasingly difficult when there is fragmentation, differing political and cultural agendas, and differing expectations of the project outcomes. What is valued in the project, impacts upon how decisions are made on design issues. In the design management field the integration of those who have knowledge that contributes to the design, construction and management, is critical to developing and achieving value on projects (Kestle & London, 2002).

The added dimension of remote site projects, increases the complexity, and makes early decision-making; knowledge integration; logistical implementation planning and implementation, absolutely critical and central to the potential success, or failure, of the project. The project team has to not only address the traditional management problems, but also those that specifically occur as a result of the remote locations of these often environmentally, and politically sensitive sites.

Remotely located sites range from islands several kilometres from the mainland, to thousands of kilometres from major urban concentrations, such as various Pacific Islands, mountainous areas, and deserts. These sites are typically located within previously undeveloped and environmentally sensitive regions (Kestle, London et al, 2002).
In this paper ‘remote sites’ refers, in particular, to West Darfur in the Sudan, and to:

1. the difficulty of physical access to the site in terms of geographical location, as Darfur is in a desertified region which lacks roads

2. the significant distance to the site from continuously available logistical support

3. the hostility of the environment in terms of seasonally strong winds, and a wide temperature range

4. the lack of local materials and specialist labour – virtually all resources needing to be trucked or air-freighted to the site(s)

5. remote site projects such as the West Darfur Humanitarian Aid Project in the Sudan require unique management processes, mainly because of the environmental, political, cultural and geographical considerations.

THE CONCEPTUAL DESIGN MANAGEMENT MODEL

The conceptual design management model was originally developed in terms of reviewing and synthesizing theoretical published ‘production principles’ and ‘sociological factors’ associated with design management, and lean design management. The model was then developed further by reviewing the ‘characteristics of remote site projects’ from historical case studies in Australia (Fraser Island), New Zealand (Tongariro National Park and Antarctica (Scientific Bases, and the Dry Valleys of the Ross Sea Region).

Design management is fundamentally concerned with value generation, however understanding what constitutes value is a difficult process, particularly where there are numerous stakeholders involved on a project. One of the main challenges is developing a shared understanding of what is valued on the project and identifying, and then agreeing the objectives for a project with the stakeholders. What constitutes value on the project impacts upon how the critical decisions are made on the design and management issues. Further, integration of those who have knowledge that can contribute to the design, construction and management is critical to developing and achieving value on projects, (Kestle & London, 2002).

Much of the lean thinking research falls into the tactical category rather than strategic and theoretical. That is, until the work of researchers Koskela,(1997) and Seymour,(1999). Seymour (1999) suggested a proposal for implementing lean construction at the organisational level rather than just at the operational level. This work was then followed up two years later, by Seymour and Rooke (2001), using an ethnomethodological approach in terms of setting up an organisational culture that established how people may perform their sitework activities in a visibly orderly manner, by changing their mindset, for instance. Similar findings were published by Howell and Ballard (1998), stating that changes of the mental model needed to be made (Kestle & London, 2002). The lean design principle of ‘flow’ is relevant from a sociological and environmental viewpoint, as it tends to be focussed on a more
holistic approach for theoretical and project development work. In addition, remote sites which are frequently environmentally sensitive, need a more holistic approach. The thinking and principles associated with lean design management, made a significant contribution in terms of informing the development of the Process Integration factor for the conceptual design management model for remote sites (Kestle & London, 2002).

The key factors of design management for remote sites were therefore established as being - 'value generation', 'knowledge integration', 'process integration' and 'timely decision-making'.

Figure 1. Conceptual Design Management Model for Remote Sites (Kestle & London, 2002)

Value generation - refers to the value that the client and stakeholders place on the project and site. Value will vary according to the differing clients' and stakeholders' expectations of the projects. Value generation on projects and sites set within an environmentally sensitive context, is primarily concerned with the environmental protection of the site.

Knowledge integration – is a complex process concerned with endeavouring to capture, and then integrate, the specialist knowledge of all those personnel involved on a particular project, prior to and during the project phases. Knowledge capital can be either explicit or tacit knowledge, the latter being the knowledge gained from experiencing previous projects, but which remains undocumented. Explicit knowledge is that knowledge that has been documented in some way, and which can be read, or reviewed in operations manuals, or books or project reports and databases.

Knowledge integration, to be successful, requires that all key personnel on the project be involved with the in-depth pre-design briefing, detailed pre-planning, followed by regular monitoring and review of the design and construction processes, as the project progresses.
Specialist knowledge associated with designing for, and working on, remote and often hostile sites is essential on these remote site projects, to ensure the best design solutions and end results, even though frequently working with non-negotiable timelines. Essentially this means that the project that the client has commissioned is delivered on time and to budget, irrespective of the fact that the site is for example, remotely located, and in a climatically hostile environment. How this knowledge is integrated, and effectively managed varies from cryptic handwritten memos from verbal conversations, to hardcopy documentation, to specialist IT software programmes installed in the project personnel’s offices.

Process integration – involves the timely and cost-effective co-ordination and planning of a range of processes across the total project, such as construction planning methodology, logistics, information management, and design / production interface management. In certain instances this may require alternative procurement strategies, for example, design-manage or alliancing arrangements. Logistical planning and implementation is complex, as well as critical, for remote sites. The timing, costs and restrictions associated with shipping, or air-freighting building components, add to the complexities of the logistical aspects of a design management model for these remote sites (Kestle & London, 2002).

Timely decision making - refers in the main to financial and design decisions, which are critical to the successful management of the design and construction of remote site projects. These decisions are made within the context of frequently non-negotiable windows of buildability, fixed budgetary constraints, and the need for environmentally sensitive development of these remote, and often hostile sites. The developed exploratory conceptual design management model aims to respond to the need for well integrated specialist design and construction processes. The model has already been examined using three historical case studies, using data from previously conducted research and published secondary data. (Kestle & London, 2002). Case study methodology has been identified and adopted as the primary method for validating and developing the design management model and associated typology, as it involves empirical enquiry that investigates a phenomenon within a real-life context (Kestle & London, 2003).

The testing of the conceptual model’s validity, in terms of the realities of managing remote site projects, has commenced. The Cape Roberts Drilling Project in Antarctica (1995-2001), has been examined and retrospectively reviewed, as a result of the data collected from semi-structured interviews conducted with nine of the key personnel on the project. The collected data was tested against the conceptual model under the four factors of value generation; knowledge integration; process integration and timely decision-making, involved reviewing the responses specific to the Cape Roberts Antarctic Drilling project. The results were extensive and generally consistent across all of the selected interviewees. The personnel interviewed unequivocally supported the four key factors of the design management model, as being valid for Antarctic remote sites generally, and accurately represented their experiences on the Cape Roberts Drilling project. The testing and
validation of the conceptual design management model for remote sites, in terms of representing the realities of managing the Cape Roberts Drilling Project in Antarctica has been published (Kestle & Storey, 2005).

PRESENT MANAGEMENT SITUATION IN HUMANITARIAN AGENCIES.

There appear to be significant gaps in the understanding of disaster management within the humanitarian aid community. Fitz-Gerald et al (2002), reported that “The humanitarian aid community is also a 'slow follower' in the adoption of management tools and techniques. In some ways this can be explained or defended on the basis that humanitarian aid is delivered in an environment where no two situations are the same. Consequently there is no single model that can be applied and the absence of effective lessons-learned mechanisms that ensure positive and negative experiences are addressed throughout all levels of the organisation encourages reinvention with each deployment.”

Therefore, humanitarian aid organizations are not only slow learners, but also do not have the basis for a learning culture thus giving credibility to the adage that “a humanitarian worker is only as good as their last assignment”.

In addition, the United Nations High Commissioner for Refugees (UNHCR) guidelines, for example are circumspect and state that (UNHCR, 1999) “There is no single blueprint for refugee emergency management; each refugee emergency is unique. However, experience shows that emergencies tend to evolve according to certain recognizable and documented patterns.”

Thus, the management process applied to each disaster is different, but disasters themselves do have discernable patterns. One would expect there to be a link between the management process and the disaster pattern but this and the identity of the patterns is not explicitly explained. The Handbook works by setting up desired outcomes and then leaves it for the reader to select the management processes required to achieve those outcomes.

The UNHCR Handbook does goes on to say that “… ‘While emergency management shares many of the characteristics of good management in general, there are a number of distinguishing features:

• The lives and well-being of people are at stake;
• Reaction time is short;
• Risk factors are high and consequences of mistakes or delays can be disastrous;
• There is great uncertainty;
• Investment in contingency planning and other preparedness activities is crucial;
• Staff and managers may be under particularly high stress because of, for example, security problems and harsh living conditions;
• There is no single obvious right answer” (UNHCR,1999).
Thus, the present literature tends to be strong on objectives but weak on how that is achieved and what management processes could be used. Moreover, it suggests that each disaster is different and that there perhaps is no single answer. This paper sets out to ascertain whether that is the case and what if anything can be 'borrowed' from management research in related areas.

THE RESEARCH QUESTION

The aim of this paper, is to test the validity of the conceptual model's four key factors by focussing on selected aspects, only, of the data collected, from the Sudanese project, in order to answer the following question:

"How well do the four key factors of the conceptual design management model for remote sites represent the realities of managing projects such as the West Darfur Humanitarian Aid Project in Sudan?".

CONTEXT

Darfur consists of 3 states and occupies the western area of Sudan. It is a large area of approximately 256,000 square kilometres with an estimated population of 5 million people made up from a complex tribal mix. Large parts of Darfur are prone to drought and desertification that intensifies demands on its more fertile lands. In recent decades, areas of Darfur have been subject to sporadic inter-tribal clashes over the use of such resources.

From early 2003, fighting intensified in the region following the emergence of two armed groups, the Sudan Liberation Army (SLA) and later the Justice and Equality Movement (JEM), and the commencement by them of hostilities against the Government (Human Rights Report, 2004).

Following a string of SLA victories in the first months of 2003, the Government sponsored a militia composed of a loose collection of fighters, apparently of Arab background, from the Darfur region. This militia become known as the ‘Janjaweed’ or men on horse back. In certain areas of Darfur, the Janjaweed have supported the regular armed forces in attacking, and targeting civilian populations suspected of supporting the rebellion, while in other locations it appears that the Janjaweed have played the primary role in such attacks with the military in support.

The humanitarian fallout of this situation in Darfur (and the border regions of Chad) was an estimated one million Internally Displaced Persons/People (IDPs) by May 2004, (compared with 250,000 in September 2003) with over half of these (some 570,000) being located in West Darfur. The rest were divided between North and South Darfur (290, 000 and 140, 000, respectively). By July 2004, this had increased to 601,096 in camps in West Darfur (based on estimates from the UN Agency OCHA Organisation for Humanitarian Aid).

Such a large displacement of people also impacts on the 'host' community. Scarcity of water, firewood and animal feed before the crisis inflamed tensions and fighting. Against such a back drop UN Aid Agencies and NGO’s work to get aid into remote locations.
The organisation and inter-relation of players within the aid community is complex and this is shown in figures 2 and 3 below (Willitts-King & Harvey, 2005). Figure 3 shows the more operational / field relationships that can exist (Manfield, 2001). It underlines the complexity of the organizational structure that aid is provided through. Moreover, the legal and political status of those to whom aid is directed in conflict situations is critical (compared to natural disasters), in the determination of what aid assistance can or cannot be given.

Thus, with this context interviews of key people involved in both UNHCR, OCHA, and several International NGO’s was undertaken, and the same methodology as used earlier by Kestle & Storey, (2005), was applied.
METHODOLOGY

The selection of this case study at West Darfur, in Sudan, was made on its ability to represent the phenomenon of remote site design management. The West Darfur Humanitarian Aid Project in Sudan, was considered to be a remote site project as there was a lack of continuously available logistical support; the site was difficult to access in terms of geographical location, and the site enjoys a hostile local climate. There was also a lack of specialized local labour, and materials. All of the major resources, had to be trucked, or air-freighted into to the camp site(s).

Case study methodology is considered an enquiring and exploratory method that provides rich and descriptive data for analysis (Yin, 1994), therefore Interviews were conducted over a period of two months, in 2004. Seventeen senior, middle management, and operational staff were interviewed in terms of their official roles on the West Darfur Humanitarian Aid Project in Sudan, to give a rigorous and representative cross-section of the personnel involved on the project. For the purposes of this paper, the focus was specifically on data collected from eight key interviewees. The aim was to establish whether there was support for the four key factors of the conceptual design management model for remote sites. The four key factors were, ‘value generation’, ‘knowledge integration’, ‘process integration’ and ‘timely decision making’. The data were then transcribed, collated and analysed in terms of the paper’s research question.

ANALYSIS OF THE ‘KEY FACTOR’ FINDINGS

Testing the collected data against the conceptual model under the four factors of value generation; knowledge integration; process integration and timely decision making, involved reviewing the responses specific to the West Darfur Humanitarian Project in Sudan. The results were generally consistent across all of the selected interviewees, though some of the respondents appeared to have more autonomy than others, in terms of playing a real part in the decision-making processes.

The personnel interviewed supported the four key factors of the design management model, as being valid for humanitarian aid project sites generally, and as being representative of their experiences, or those that were needed, on projects such as the West Darfur Humanitarian Aid Project in Sudan. The following key points were drawn from the collected data.

Value Generation on the West Darfur Humanitarian Aid Project in Sudan, was singularly concerned with making a difference to the lives of the beneficiaries of the aid, the Internally Displaced People (IDP’s). Provision of basic shelter and the necessaries of life, being at the core of the project’s aims.

Therefore Value Generation as perceived or needing to be realized on the West Darfur Humanitarian Aid Project, in Sudan was:
• the effectiveness, and therefore the value was measured on the project, by what was achieved, how many people (IDP's) have been saved and fed; what the mortality rate was. Value was measured quantitatively.
• about keeping a reliable, continuous supply line of food to the displaced people, from a distant donor to the NGO's in the field.
• about making a difference to the living conditions, in terms of emergency water and sanitary assessments in the 'Field', acting on the recommendations, and their timely implementation
• measured in how many built outputs will be achieved, and then seeing the re-collection of people; putting the 'village' back together again.

Knowledge Integration as perceived or needing to be realized on the West Darfur Humanitarian Aid Project, in Sudan was:

• that there are definite gaps in the knowledge integration process. No-one wants to trespass on others' areas. This is perceived as a possible hinderance to finding the best solution(s).
• that there's a problem with the planning and the reality. The very specialised personnel who come in, cannot do what they are best at, as they have to follow a particular plan, and therefore one does not necessarily see the desired or potential 'results on the ground'.
• that there are consultants, who are not in the UN system, who need to be advised of the potential pitfalls, when involved on these types of projects.
• that there are basically, informal and formal systems of knowledge integration.
• the gaps in specialist knowledge, in terms of the experiences of the people in the field, versus those in the office - they were not always in-line at times.
• that sometimes there is too much specialised knowledge on a project, and what is needed is a more holistic approach.
• a good knowledge of the IDP’s cultural and value systems is needed, before commencing the on-site work.
• the high turnover rate of people in these roles, so things were not recorded as much as they could have been. Important though, to understand the context of the project.

Process Integration as perceived or needing to be realized on the West Darfur Humanitarian Aid Project, in Sudan was:

• to try and understand how the IDP's think, and will act / respond, and then to try and set up the best processes and systems.
• in trying to achieve co-ordination at the camp level, and engage in meaningful and useful relationship-building with the International, and IDP Communities. Knowing the other agencies' plans, means better facilitation.
• that little could have been achieved without the Sudanese people and their expertise. They had valuable connections and networks within the community.
• about co-ordination of the various groups, on this project, and helping working groups focus on the task in hand.
• to make sure that assessments are correct. That a thorough, logical and sensible solution to the assessment findings is made. Then prepare a plan to address the challenges within the timeframe and the budget.

**Timely Decision-Making**

The worst case scenario of late, or ineffectual decisions, on remote site projects, such as the West Darfur Humanitarian Aid Project in Sudan, would be the lack of basic shelter, and the necessaries of life, potentially resulting in increased mortality rates. There are also political implications and drivers associated with these environmentally sensitive sites that can, and do impact on the decision-making process. Therefore, ‘Timely Decision-Making’ as perceived, or needing to be realized on the West Darfur Humanitarian Aid Project, in Sudan was:

• that decision-making on this project was quite reactive and prescriptive. The detailed, and bigger picture decisions were fed from the ‘Field’ back to central, where the tailoring occurred, and the decisions, and plans, were fine tuned.

• a tiered system of decision-making. Consultative decisions were made. The people with the on-the-ground, or with the bigger picture knowledge, worked together to work out the best answers, and decide what was feasible.

• that decision-making involved a group of managers, one manager for each of the programmes, and it was essentially de-centralised.

• that at the organisational level, the decision-making was decentralised. There were considerable levels of co-ordination between West Darfur, Khartoum and the agency’s head office. The staff were given almost total autonomy in the ‘Field’, and dedicated organisational finance personnel to work with.

There was consensus amongst the respondents, that the clients were the IDP’s on the West Darfur Humanitarian Aid Project in Sudan, and the agencies' aim was “to make a difference”. Measuring the ‘differences’ made is problematic, as it involves both a level of quantitative, clinical monitoring, and also a range of qualitative, cultural, and psycho-social observations and measurements.

How then do these aid agencies know when they have made an acceptable ‘difference’ in their clients’ lives? And has the ‘plan’ been achieved once implemented? Has the value been generated?

One of the notable outcomes, from the collected data, was the diversity of views held by the respondents as to who they considered to be the stakeholders of the project, and what contributed to value generation on this project. A range of views also emerged in terms of the preferred and actual process integration in practice on the project, and whether the respondents had to slavishly follow the plan from ‘Central’ or that local decision-making opportunities existed on the project. There was recurring criticism of the centralised decision-making process of some of the agencies, and how this hindered progress, timely communications, and the potential for on-the-ground, and informed and improved / relevant, local decisions
being able to be made. Others believed, that they had some autonomy in terms of the decision-making, having had the authority delegated to them by their agency(s). This lack of consistency of decision – making and delegated authority, across the range of agencies, and the ever-changing personnel in the Field and offices, was challenging, frustrating and disorientating for a number of the respondents. The respondents, almost unanimously, (7/8), noted that, there were significant gaps in terms of specialist knowledge and knowledge integration on the West Darfur Humanitarian Aid project.

This resulted from a range of contributing factors, in their view, being:

1. mis-matches between the knowledge and experience of personnel in the agency offices, and that of the personnel specifically brought in for the on-the-ground work associated with the project.
2. no-one wanted to trespass (or offend) other agencies’ areas of responsibility, which in reality probably puts limits on achieving the much needed knowledge integration, on these projects.
3. too little time being spent on the pre-planning stage(s). Realistic strategies and implementation plans and processes are regarded as essential, even though these are emergency projects.
4. continually changing staff, in all areas, means that record keeping, as well as status and improvement report writing (by the specialist consultants in particular), should be an essential part of the central and local portfolio resource pool and the pre-briefing / training of affected personnel.

A commonly, and strongly held view was that there was insufficient pre-briefing and associated training, before going into the ‘Field’. There was consensus amongst the respondents, that there was a significant lack of effective and timely communication equipment, and systems available for project staff, in the Field and in the offices at the start of the ‘in Field’ project work. Reliable and timely communications are considered to be critical on these remote sites, yet mis-communications do occur at times, between the various stakeholders, on and off site, caused perhaps by different interpretations of the issues, or decisions being made remotely from the site itself, and from each other (Kestle & Storey, 2005).

APPLICATION AND DEVELOPMENT POTENTIAL OF THE MODEL TO A MULTI-DISCIPLINARY FRAMEWORK

The first stage of the conceptual design management model validation work, involved a retrospective historical case study of the Cape Roberts Antarctic Drilling Project, conducted in 2003/4 and subsequently published, (Kestle & Storey, 2005). The next stage of the validation process involved the collection and analysis of data in 2004, for a case study related to West Darfur Humanitarian Aid Project in Sudan. Therefore the research question, for this paper was specifically concerned with whether the four key factors of the conceptual design management model for
remote sites represented the realities of managing projects such as the West Darfur Humanitarian Aid Project in Sudan.

The analysis of the selected data findings from the semi-structured interviews on the Sudanese Humanitarian Aid project, suggests that the original conceptual design management model for remote sites (Kestle & London, 2002), is relevant in a non-profit and / or humanitarian aid context. The conceptual model allows for a blending of traditional and modern management methods, and the impact of this aspect of the framework, needs to be developed further, by future applications of the model, by practitioners in the post-disaster reconstruction field.

Following on from this paper's particular research question, and the associated data collection and analysis, the next question becomes, "Could a project planning framework based on relatively conventional issues of remoteness and sustainability, be applied to such a context?" If such research could be used and extended into, what must be considered, an 'extreme' context, then there would be the potential to provide aid workers with guidance in a situation of apparent 'chaos'. The validation of the conceptual design management model for remote sites, supports a further stage of this research, being the development of a project planning framework specifically for humanitarian aid projects. The proposed humanitarian aid framework would be developed from the conceptual design management model for remote sites (Kestle & London, 2002), and the analysis of the total case study data collected in 2004. The development process would need to ensure that the significant 'gaps' identified by the respondents, and interpreted from the data collected the West Darfur Humanitarian Aid Project in Sudan, are addressed. These 'gaps', and a proposal for a project planning framework will be the subject of future research papers.

**CONCLUSIONS**

The primary aim of this paper was to focus on selected aspects only of the total case study data collected, in order to answer the question of "How well do the four key factors of the conceptual design management model for remote sites represent the realities of designing and managing projects such as the West Darfur Humanitarian Aid Project in Sudan?". The detailed answers to the question are to be found in the analysis of the selected data. The respondents / interviewees supported the four key factors of the design management model, as being valid for humanitarian aid project sites generally, and as being representative of their experiences, or those that were needed, on projects such as the West Darfur Humanitarian Aid Project in Sudan. The selected data findings validate, and support the conceptual design management model for remote sites, which lends significant support to the model and to the associated typology for remote sites. Further analysis of all of the data collected from the West Darfur Humanitarian Aid Project in Sudan interviewees, will provide further insights into the lessons learned and this will have implications for the management and operational personnel involved on future remote site projects In particular, and as a further stage of this research, the development of a project planning framework specifically developed for
humanitarian aid projects, on remote sites is planned. Moreover, it is also interesting that the recent major management changes signal by the UN based on what happened in West Darfur also makes this research timely (Humanitarian Response Review, 2005), (IASC, 2005). The Humanitarian Response Review and the consequent adoption and roll out of the Cluster approach in all humanitarian aid situations (including refugee, IDP conflict and IDP natural disaster) as the management framework runs contrary to what has been suggested in this paper. Perhaps the old saying mentioned earlier in this paper that “a humanitarian worker is only as good as their last assignment” will still hold true for the future?

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The complexities of an Antarctic drilling project and the fit with a conceptual design management model for remote sites

Linda Kestle¹ and Bryan Storey²

ABSTRACT

Design management is concerned with value generation, and the integration of knowledge from the design and management disciplines. The design process has become more complex and more fragmented in recent years resulting in more actors, who have design knowledge, requiring integration. This fragmentation impacts upon a number of factors, including the difficulty of developing a shared understanding of the objectives, and identifying what is valued in the project among stakeholders, impacting upon how critical decisions are made on design issues. Remote sites are typically environmentally sensitive and located in areas of hostile physical conditions. Therefore they pose unique challenges at the various design phases. Strategic decisions made during the briefing and conceptual design stages, in particular, can significantly impact upon construction, logistics and sustainability. There is a lack of fundamental research in the area of designing and managing remote site projects in environmentally sensitive regions. The overall research project aims to develop and validate a theoretical conceptual model and associated typology for remote site projects. An exploratory conceptual model has been developed, from a selected review of design management literature, and an analysis of three historical case studies in environmentally sensitive and remote areas. The fourth, and most recent historical case study involves an Antarctic drilling project and is the focus of this paper. The historical Antarctic drilling case study data were collected from selected key players on the project, and analysed within the context of the previously developed conceptual design management model for remote sites. The aim was to see how well the data matched, or added to the design management model in terms of the four key factors-value generation; knowledge integration; process integration and timely decision making. The analysis indicates that the conceptual design management model for remote sites is supported.

KEYWORDS: remote sites, value generation, design management, environment, Antarctica, case study

¹ School of Built Environment. Unitec-NZ. PB 92025. Auckland. New Zealand
² Gateway Antarctica. University of Canterbury. PB 4800. Christchurch. New Zealand
INTRODUCTION

Design management is an emerging discipline that has developed over the last decade, as a sub-set of project management. Project management is concerned with managing the overall project but is primarily concerned with managing the construction stages of the project. Design management is concerned with the management of the design process across all of the design stages and consultant specialists, leading to the commencement of the construction stages. Design management within the disciplines of the built environment is a complex process concerned with *value generation; integration of specialist knowledge; critical timing of key decisions; process integration*, and managing the overall design process across all affected disciplines.

The design process has become more complex and fragmented over the last few years, resulting in an increasing need for design knowledge and process integration. A shared understanding of the project objectives is imperative amongst the stakeholders. This becomes increasingly difficult when there is fragmentation, differing political and cultural agendas, and differing expectations of the project outcomes. What is valued in the project, impacts upon how decisions are made on design issues. In the design management field the integration of those who have knowledge that contributes to the design, construction and management, is critical to developing and achieving value on projects (Kestle & London, 2002).

The added dimension of remote site construction increases the complexity, and makes early decision making; knowledge integration; logistical implementation planning and implementation, absolutely critical and central to the potential success, or failure, of the project. The project team has to not only address the traditional design and construction problems, but also those that specifically occur as a result of the remote locations of the often environmentally sensitive sites.

CHARACTERISTICS OF REMOTE SITES

Remotely located sites range from islands several kilometres from the mainland, to thousands of kilometres from major urban concentrations, such as various Pacific Islands, mountainous areas, deserts and Antarctica. These sites are typically located within previously undeveloped and environmentally sensitive regions (Kestle, London et al, 2002)

In this paper ‘remote sites’ refers, in particular, to Antarctica and to:

- the difficulty of physical access to the site in terms of geographical location (flying and shipping access limited to approximately four months per year).
- the distance to the site from continuously available logistical support (over 3000km to NZ)
- the hostility of the environment in terms of ice, seasonally high winds, and darkness for up to six months per year
- the lack of local materials and labour – all resources need to be shipped or air-freighted to the site(s) from NZ
• Remote site projects such as the Cape Roberts Drilling Project in Antarctica involve unique design, construction and management processes, mainly because of the environmental and geographical considerations.

THE CONCEPTUAL DESIGN MANAGEMENT MODEL

The conceptual design management model was set up in terms of reviewing and synthesizing theoretical published ‘production principles’ and ‘sociological factors’ associated with design management, and lean design management. The model was then developed further by reviewing, the ‘characteristics of remote sites’ from historical case studies in Australia (Fraser Island), New Zealand (Tongariro National Park and Antarctica (Scientific Bases and the Dry Valleys of the Ross Sea Region).

The focussed thinking associated with lean design management, which is concerned with streamlining and adding value to the construction production processes, made a significant contribution in terms of process integration to the conceptual design management model for remote sites (Kestle & London, 2002). The key factors of design management for remote sites were therefore established as being - ‘value generation’, ‘knowledge integration’, ‘process integration’ and ‘timely decision making’.

Theoretical Contributions

- Production oriented worldview: ‘Lean design’
  - value stream
  - process integration
  - workflow
  - waste minimisation

- Sociological oriented worldview: ‘design methodology’ & ‘creative/iterative design process’
  - value generation
  - knowledge integration
  - timely decision making

Synthesis

- Value generation
  - client’s value criteria
  - stakeholders’ value criteria

- Knowledge integration
  - specialist site knowledge
  - IT for remote site coordination

- Process integration
  - logistics & site accessibility
  - construction planning/methodology
  - alternative procurement strategies
  - creativity and production interface

- Decision making
  - timely & critical
  - performance criteria
  - environmental sustainability
  - economic constraints

Figure 1. Conceptual Design Management Model for Remote Sites (Kestle & London, 2002)

Value generation - refers to the value that the client and stakeholders place on the project and site. Value will vary according to the differing clients’ and stakeholders’ expectations of the projects. Value generation on projects and sites set within an environmentally sensitive context for example, Antarctica, is primarily concerned with the environmental protection of the site. This includes the environmental impacts of the project(s) on the site, given the restricted public access to selected sites, and their global value. The Antarctic Treaty sets the guiding principles for all activity in Antarctica. The Treaty “establishes freedom of scientific investigation, cooperation
and access to all areas” (Waterhouse, 2001). The Madrid Protocol on Environmental Protection to the Antarctic Treaty was first adopted in October 1991, and was then ratified by all of the countries operating national science programmes in the Ross Sea Region by January 1998. Under New Zealand law, the Environmental Protection Act (1994) implements the (Madrid) Protocol, and regulates the environmental aspects of all New Zealand’s activities in Antarctica (Waterhouse, 2001). “Environmental principles contained in the (Madrid) Protocol make protection of the Antarctic, including its intrinsic and research value, fundamental considerations in the planning and conduct of all activities in the Antarctic” (Waterhouse, 2001). Therefore, for the projects on Antarctic sites, in particular, value tends to be predominantly focused around the scientific outcomes, and minimizing the short and long-term environmental impacts of the scientific projects on the sites.

Knowledge integration – is a complex process concerned with endeavouring to capture, and then integrate, the specialist knowledge of all those personnel involved on a particular project, prior to and during the project phases. Knowledge capital can be either explicit or tacit knowledge. The latter being the knowledge gained from experiencing previous projects, but which remains undocumented. Explicit knowledge is that knowledge that has been documented in some way, and which can be read, or reviewed, in operations manuals, or books or project reports and databases.

Knowledge integration, to be successful, requires that all key personnel on the project be involved with the in-depth pre-design briefing, detailed pre-planning, followed by regular monitoring and review of the design and construction processes, as the project progresses. Specialist knowledge associated with designing for, and working on, remote and often hostile sites is essential on these remote site projects, to ensure the best design solutions and end results, even though frequently working with non-negotiable timelines.

Essentially this means that the project that the client has commissioned is delivered on time and to budget, irrespective of the fact that the site is for example, remotely located, and in a climatically hostile environment.

How this knowledge is integrated, and effectively managed varies from cryptic handwritten memos from verbal conversations, to hardcopy documentation, to specialist IT software programmes installed in all of the project personnel’s offices.

Process integration – involves the timely and cost-effective co-ordination and planning of a range of processes across the total project, such as construction planning methodology, logistics, information management, and design/production interface management. In certain instances this may require alternative procurement strategies, for example, design-manage or alliancing arrangements.

Logistical planning and implementation is complex, as well as critical, for remote sites. For example in Antarctica, where access to sites is limited to a four month window approximately, and life threatening situations are the norm, logistical resources and their deployment have to be preplanned up to a year ahead of implementation.

In response to the tight timeline and frequently adverse weather conditions, the projects are largely prefabricated into their various components prior to despatch to the site(s). The timing, costs and weight restrictions associated with shipping, or air freighting building components, add to the complexities of the logistical
aspects of a design management model for these remote sites (Kestle & London, 2002).

Timely decision making - refers in the main to financial and design decisions, which are critical to the successful management of the design and construction of remote site projects. These decisions are made within the context of frequently non-negotiable windows of buildability, fixed budgetary constraints, and the need for environmentally sensitive development of these remote, and often hostile sites. The worst case scenario of late or ineffectual decisions on remote site projects, would be the postponement of the work to the ‘next season’ or financial year, or even indefinitely. Then there are the political implications and drivers associated with these environmentally sensitive sites that can impact on the decision-making process.

The developed exploratory conceptual design management model aims to respond to the need for well integrated specialist design and construction processes. The testing of the model’s validity has commenced. The model has already been examined using three historical case studies, using data from previously conducted research and published secondary data. (Kestle & London, 2002). Case study methodology has been identified and adopted as the primary method for validating and developing the design management model and associated typology, as it involves empirical enquiry that investigates a phenomenon within a real-life context (Kestle & London, 2003).

The latest historical case study to be examined involves an Antarctic Drilling Project at Cape Roberts (1995-2001). This project has been examined and reviewed retrospectively, as a result of data collected by the researcher from semi-structured interviews conducted with nine of the key personnel on the project.

THE RESEARCH QUESTION

The aim of this paper focuses on selected aspects, only, of the data collected, in order to answer the following question:

“How well do the four key factors of the conceptual design model for remote sites represent the realities of designing and managing projects such as the Cape Roberts Drilling Project?”.

Methodology

Case study methodology is considered an enquiring and exploratory method that provides rich and descriptive data for analysis (Yin, 1994). The selection of this case study at Cape Roberts was made on its ability to represent the phenomenon of remote site design management. The Cape Roberts Drilling Project in Antarctica, was considered to be a remote site project as there was a lack of continuously available logistical support; the site was difficult to access in terms of geographical location, being approximately eight hours flying time to New Zealand, and several hours of
hagglund and sledding time from Scott Base in the Ross Sea Region of Antarctica; the site enjoys a seasonally hostile local climate, and there was a complete lack of local materials and labour. All resources, whether materials or labour had to be shipped or air freighted into Antarctica’s Ross Sea Region and then sledded with hagglunds to the drilling site.

A report on the Cape Roberts Drilling Project was written by Peter Barrett, Jim Cowie and Alex Pyne, and subsequently edited by Jim Cowie (Cowie, 2002). The examination of this report assisted the researcher’s overall understanding of the project, and assisted in the subsequent selection of preferred interviewees for a series of retrospective semi-structured interviews. The interviews explored the project in its entirety with nine selected key personnel.

The Cape Roberts Drilling Project was initiated by New Zealand as an extension of a series of drilling programmes in Western McMurdo Sound (1974-1986), and was conducted from 1995-2001. The Cape Roberts Drilling Project was an international collaborative involving seven countries - Italy, Germany, Australia, UK, United States, New Zealand and the Netherlands, with each country contributing to the scientific, management and/or operational aspects of the project. This collaborative approach created a complex regime of project personnel, and tasks, that needed to be sensitively integrated, coordinated and managed.

The overall aim of the Cape Roberts Project was to recover sedimentary core from 500 m beneath the sea floor off Cape Roberts (Barrett, 1993), to improve the understanding of the climatic and tectonic history of the region for the period 17-34 million years ago, and ice sheet behaviour under differing global climatic conditions. The aims were further defined and announced by the International Steering Committee in 1994 as being:

To investigate the early history of the East Antarctic ice sheet and the West Antarctic Rift System by drilling off Cape Roberts (77.0°S, 163.7°E) and then to completely drill a 1500m thick sedimentary succession into the western margin of the Victoria Land Basin (Barrett, 1993). The detailed results from the individual drill holes were published in the Terra Antarctica Journal (Cowie, 2002).

The complexity of the project and the associated management of this internationally collaborative project, were strongly evident to the steering committee and subsequent management personnel, from the commencement of their engagement on the project. The complexity of managing the Cape Roberts Project stemmed in part from the fact that there were seven countries involved, with their associated stakeholders and scientific expectations. In addition there was a non-negotiable timeline to achieve the desired scientific outputs. Environmental Impact Assessment (EIA) procedures are required for every activity in Antarctica. These environmental impact procedures are in place for the USA, New Zealand, German and Italian Antarctic Programmes, and as such put significant and rigorous constraints on the Antarctic projects, from their inception, viability, methodology, implementation and overall monitoring of each and every potential environmental impact, when conducted in Antarctica.

Interviews were conducted over a period of ten months, with nine senior and middle management, and operational staff in terms of their official roles on the Cape Roberts Project to give a rigorous and representative cross-section of the personnel involved on the project. For the purposes of this paper, the focus is specifically on the data
collected from the nine interviewees relative to the four key factors as established in the conceptual design management model for remote sites. The four key factors were, 'value generation', 'knowledge integration', 'process integration' and 'timely decision making'. In collecting this particular data, the aim was to establish how well the gathered data supported or added to the four key factors of the conceptual design management model.

The Findings

The questions in the semi-structured interviews were seeking to establish whether these ‘key factors’ were supported by the Cape Roberts Drilling project personnel ‘real-life’ experiences on the project. The pertinent data from the nine interview transcriptions has been tabulated under the four ‘key factor’ headings of the conceptual design management model.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Value Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>Client</strong> was whoever was paying for / driving the project ie Antarctica NZ (funded to support science), and the scientists (ie government); <strong>Stakeholders</strong> were the 7 nations’ governments. <strong>Value</strong> was in the technical and scientific aspects, and specifically the scientific outcomes from examining the cores. <strong>Value Generation</strong> definitely a key factor.</td>
</tr>
<tr>
<td>B</td>
<td><strong>Client</strong> was Antarctica NZ. <strong>Stakeholders</strong> were the various organisations with a direct interest in the science obtained from the project eg Victoria University of Wellington, who in turn may have been a client of Antarctica NZ. <strong>Value</strong> was in the scientific outcomes from the cores. <strong>Value Generation</strong> definitely a key factor.</td>
</tr>
<tr>
<td>C</td>
<td><strong>Clients</strong> were the scientists. <strong>Stakeholder</strong> was Antarctica NZ. <strong>Value</strong> was in the scientific outcomes from the rock cores, and the need for low environmental impacts by the project and its personnel. <strong>Value Generation</strong> definitely a key factor.</td>
</tr>
<tr>
<td>D</td>
<td><strong>Clients</strong> were the scientists. The project involved drilling a sequence of rock core holes over a 3 season period for the international scientific project. <strong>Stakeholders</strong> were the 7 nations’ governments’. <strong>Value Generation</strong> definitely a key factor.</td>
</tr>
<tr>
<td>E</td>
<td><strong>Value Generation</strong> definitely a key factor for remote site projects in Antarctica. Scientific value criteria, is the science, and the client / stakeholders value criteria being the value for money of the project.</td>
</tr>
<tr>
<td>F</td>
<td><strong>Clients</strong> were the scientists. Antarctica NZ in turn sees the university scientists as the client. <strong>Stakeholders</strong> are the NZ economy and society; the Minister for the Environment (eg climate change); the Minister of Research, Science and Technology; NZ government. <strong>Value Generation</strong> is the value added through scientific outcomes of the project, and the contributions on the international stage eg climate change, Kyoto protocol. USA saw NZ technology as great value for money. <strong>Value Generation</strong> a key factor, absolutely.</td>
</tr>
</tbody>
</table>
| G          | **Client** was Antarctica NZ and the NZ government. **Stakeholders** were the 7 nations’ governments. **Value Generation** was in the 1.7km of
core @ $12 million. This was considered great value for money by the 6 nations involved with NZ.

**Respondent**  
**H**  
**Client** was the ISC (International Science Committee). **Stakeholders** were the OMG (Operations Management Group) who funded the logistics (primary stakeholders); Antarctica NZ; and NZ Ministry of Foreign Affairs. **Value Generation** for the client was the scientific value gained from the rock cores, and the need for low environmental impacts. **Value Generation** definitely a key factor for Antarctic sites.

**Respondent**  
**I**  
**Clients** were the scientists who wanted ice core of a particular nature and it had to be high quality. **Stakeholders** were numerous, ranging from the 7 nations governments' involved, to all of the Antarctic Treaty partners They all wanted to ensure that the project was good value for money, had low environmental impacts, and realised globally relevant scientific data. **Value Generation** definitely a key factor for Antarctic sites. The Cape Roberts project would not have run if the Value Generation criteria could not be seen to be able to be met.

Table 1. Key Factor – Value Generation

<table>
<thead>
<tr>
<th>Knowledge Integration</th>
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<tbody>
<tr>
<td><strong>Respondent A</strong></td>
</tr>
<tr>
<td><strong>Respondent B</strong></td>
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<tr>
<td><strong>Respondent C</strong></td>
</tr>
<tr>
<td><strong>Respondent D</strong></td>
</tr>
<tr>
<td><strong>Respondent E</strong></td>
</tr>
<tr>
<td><strong>Respondent F</strong></td>
</tr>
<tr>
<td><strong>Respondent</strong></td>
</tr>
</tbody>
</table>
real specialist knowledge needed, but then I have worked on several Antarctic and other 'remote' projects. Good co-operation definitely needed with the other team members, and a good knowledge of what their (trade practice) needs were on the project, and their abilities.

Respondent Knowledge integration is a pivotal and fundamental need on remote sites and particularly in Antarctica. Another aspect is ‘Risk’ - this is big in terms of the personnel selected for the project(s). Get the wrong people and it can break up the project. Understudies are needed for people with key intellectual capital. Problems can arise though (as with any organisation) with ‘patch protection’, where people may not want to share their valuable expertise for fear of becoming dispensable.

Table 2. Key Factor – Knowledge Generation

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Process Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>It took place through the meetings of the associated groups and just actually responding to the real situations. Definitely an essential factor.</td>
</tr>
<tr>
<td>B</td>
<td>Yes its definitely a key factor and is all about the team effort between inventors and experienced technicians.</td>
</tr>
<tr>
<td>C</td>
<td>Pre-planning is the answer to good process integration and a successful project. That is an optimistic view, as challenges occur on site that any amount of pre-planning may not have been able to predict. Yes process integration is an absolutely key factor to these Antarctic remote site projects.</td>
</tr>
<tr>
<td>D</td>
<td>How can you run a project without good processes and good integration of those processes? Absolutely agree. Without it there are going to be setbacks, cost problems and misunderstandings between project personnel. The secret is pre-planning and being aware of the other team members needs, and the consequences of all the actions proposed.</td>
</tr>
<tr>
<td>E</td>
<td>The consequences of no process integration is dis-satisfied staff, burn-out, budget blow-outs and an incomplete project. Science gets funded in a particular round or year and the work has to be done, or the money is forfeited. This impacts on the whole project team. There is an absolute need for good process integration. Involves risk analysis too.</td>
</tr>
<tr>
<td>F</td>
<td>This is all about operational logistics and information management. Critical that this occurs in a timely and realistic manner. Process integration is concerned with not only data management but also operational tasks and their lead times, impacts of non-performance, or completion on time.</td>
</tr>
</tbody>
</table>
| G          | The process has to be flexible. “there is no book out there on how to
G: "Drill holes into the Antarctic sea floor from a floating platform". It's about previous Antarctic experience, knowledge, seismic information, logistics and communications.

Respondent H: Communication is absolutely critical. The project management team has to do it right from the beginning of the project, whether that is the science, the drilling expertise or the operations tasks. Needs a variety of specialist knowledge across all of the different disciplines to succeed.

Respondent I: The logistics system on the Cape Roberts project was often fraught with disruptions to progress. This was mainly due to a joint logistics arrangement that had not been specifically designed for Cape Roberts' specific needs. Accessibility was a major issue, as was the trial and error method needed to produce construction gear. Despite plenty of pre-planning issues came up during the construction stages. This was certainly true on the Cape Roberts project, where there was a lack of timely and sufficient resources at times, and there were unforeseen technological challenges that impacted on the whole project. This sort of work was cutting-edge. New Zealanders though were and are highly regarded as project managers by the USA and the other partner nations.

Table 3. Key Factor – Process Generation

<table>
<thead>
<tr>
<th><strong>Timely Decision Making</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respondent A</strong></td>
</tr>
<tr>
<td>The key decision – makers have to be identified and recognised as having the appropriate authority to act and respond in certain situations. Need to establish who is responsible for what and a clear timeline of needs. When deadlines are missed that can mean that the outcomes are not realised for at least another year, if at all!! Timely decision making is a critical factor for Antarctic projects such as Cape Roberts. Linked strongly to value generation as well.</td>
</tr>
<tr>
<td><strong>Respondent B</strong></td>
</tr>
<tr>
<td>Most important!, and the process has to be absolutely transparent.</td>
</tr>
<tr>
<td><strong>Respondent C</strong></td>
</tr>
<tr>
<td>Everything revolves around the environment as far as Antarctic project sites go. The weather controls everything - what, when, and if you can do anything. You have no real control. We call it the Antarctic Factor ie it will take three times as long to complete the tasks and will cost considerably more than any non-Antarctic equivalent project.</td>
</tr>
<tr>
<td><strong>Respondent D</strong></td>
</tr>
<tr>
<td>Timely decision making is one of the keys to the success or failure of Antarctic projects such as the Cape Roberts Drilling project. So many people have to be involved and make timely decisions that in turn impact on everyone else’s decisions and subsequent progress. One delay and it can spell disaster for the ‘season’s anticipated drilling and scientific outcomes.</td>
</tr>
<tr>
<td><strong>Respondent E</strong></td>
</tr>
<tr>
<td>Suggest the wording should be ‘realistic decision making’. Poor and mis-timed decisions can lead to tension right across the board. Good environmental sensitivity was evident amongst the drillers on the Cape Roberts project and this in turn drove technical and practical on-site decisions. Risk analysis is definitely linked to timely decision making, as expectations amongst the project team will be very different at times.</td>
</tr>
</tbody>
</table>
Respondent F
The fact that fast, accurate and safe decisions were made in potentially dangerous situations, was the result of having a very good management structure, that was responsive and responsible.

Respondent G
Remote sites require timely and critical decision making. A lack of these decisions may result in you losing a whole year, or more, of core production, as the ship can only go in to Antarctica once a year.

Respondent H
If you do not get it right, there are far more consequences on Antarctic projects than any other sort of project. It is great training for the young scientists because they have to plan ahead to ensure that they get it right. Next year may not be an option for them!! So many countries, with differing processes, and ways of deciding on logistic support, funding and timing of the various aspects of the project(s), significantly impacts on decision making and the progress of any of these projects.

Respondent I
The USA recognised NZ as being able to procure good quality contractual arrangements and personnel for the Cape Roberts project, and therefore NZ project managed the Cape Roberts project from day one. When there are people in the US, Rome, Christchurch and down on the ice, who have to be a part of a consensus decision, there are going to be delays. You have to reset deadlines to allow a coordinated group response. This particularly applies when awarding money to the project, or where there are political considerations.

Table 4. Key Factor – Timely Decision Making

**ANALYSIS OF THE ‘KEY FACTOR’ DATA**

Testing the collected data against the conceptual model under the four factors of value generation; knowledge integration; process integration and timely decision making, involved reviewing the responses specific to the Cape Roberts Antarctic Drilling project (refer Tables 1-4). The results were extensive and generally consistent across all of the selected interviewees. The personnel interviewed unequivocally supported the four key factors of the design management model, as being valid for Antarctic remote sites generally, and accurately represented their experiences on the Cape Roberts Drilling project. The following key points were drawn from the collected data.

**Value Generation** as perceived or needing to be realised on the Cape Roberts project was:

- in the technical and scientific aspects, and specifically the scientific outcomes from examining the cores.
- the value added through the scientific outcomes of the project, and the contributions on the international stage eg climate change, Kyoto protocol.
- in the 1.7km of core at a very reasonable cost. This outcome was considered great value for money by the 6 nations involved with NZ.
- in the fact that USA saw NZ technology as great value for money.
- in the need for low environmental impacts on the part of the project and its personnel.
Knowledge Integration issues on the Cape Roberts and future Antarctic projects were seen to include:

- Intellectual property issues preventing knowledge integration happening – seen as an inhibiting factor.
- Successional planning – the need for understudies for the people with key intellectual capital.
- ‘Risk’ - this is big in terms of the personnel selected for the project(s) - get the wrong people and it can break up the project.
- Problems that arise with ‘patch protection’, where people may not want to share their valuable expertise with potential successors for fear of becoming dispensable.
- The situation where a pool of specialist remote site personnel is created within organizations to design and manage these particular project sites. The potential weakness though, is where this knowledge capital is not documented explicitly, and a successional framework of specialist personnel is not fully established within organizations.
- Knowledge management using centralised data bases and consequent data management makes the creation of a website essential on future projects.

Process Integration as perceived or needing to be realised on the Cape Roberts project and future Antarctic projects:

- The consequences of no process integration is dis-satisfied staff, burn-out, budget blow-outs and an incomplete project.
- This is all about operational logistics and information management. Critical that this occurs in a timely and realistic manner.
- The secret is pre-planning and being aware of the other team members needs and the consequences of all the actions proposed.

Timely Decision Making issues on the Cape Roberts and future Antarctic projects were that:

- The key decision – makers have to be identified and recognised as having the appropriate authority to act and respond
- The fact that fast, accurate and safe decisions were made in potentially dangerous situations, was the result of having a very good management structure, that was responsive and responsible.
- Everything revolves around the environment as far as Antarctic project sites go. The weather controls everything - what, when, and if you can do anything. You have no real control, it is often called the Antarctic Factor.
- A lack of timely and critical decision making may result in the loss of a whole year, (or more) of core production, as the ship only goes in to Antarctica once a year.

One of the interesting outcomes, was the range of views held by the interviewees regarding who they believed were the stakeholders, and the client(s) on the Cape Roberts Project. Views were diverse, with the majority believing the scientists were their client, whilst others held the view that Antarctica NZ or the university, and hence the government were their clients. There was consensus however,
regarding what the value generation criteria were for the Cape Roberts Drilling Project. The primary purpose was to drill and recover high quality, specific sedimentary cores to create globally significant (climatic) scientific outcomes. Another finding was the suggestion that knowledge integration can be inhibited, to some extent, on these scientific projects, by the issue of intellectual property which may, and possibly does, work against the sharing of intellectual or knowledge capital nationally, and internationally. The scientific findings from the Cape Roberts Project have been fully published though, as a series, in Terra Antartica (1998-2001), and also reported via poster and oral presentations to the international research community at the American Geophysical Union in Washington DC (May, 2000), and at the European Union of Geosciences in Strasbourg (April, 2001). The international significance of the collaborative scientific research, innovative technical expertise and knowledge capital associated with the Cape Roberts Project has helped place New Zealand in a position of strength in terms of influencing the Antarctic Treaty partners, and future collaborative international scientific endeavours. Reviewing the collected data regarding process integration, there was strong support for clear, effective, regular communications, and the centralized storage and management of data, on future projects. Communications were considered critical on remote sites. Miscommunications occur at times between the various stakeholders on and off site, caused perhaps by different interpretations of the issues, or decisions being made remotely from the site itself, and from each other. Time delays in terms of decision making, whether in terms of the design or financial commitment cause a flow on affect across all disciplines and tasks. In the case of remote sites this can mean a delay of up to twelve months, until the site becomes accessible again.

Conclusions

The aim of this paper was to focus on selected aspects only of the data collected, in order to answer the question of “How well did the four key factors of the conceptual design management model for remote sites represent the realities of designing and managing projects such as the Cape Roberts Drilling Project?”.

The answer to this question is to be found in the tabulated data under the headings of the four key design management model factors, and in the analysis of that data. The interviewees unequivocally supported the four key factors of the design management model, as being valid for Antarctic remote sites, and accurately representing their experiences on the Cape Roberts Drilling project. The validation of the four key factors of the conceptual design management model for remote sites lends significant support to the model and to the associated typology for remote sites. Further analysis of all of the data collected from the Cape Roberts interviewees, will provide insights into the lessons learned, and this, in turn, will have implications for the management and operational personnel involved on future remote site projects.

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Remote Site Design Management – the application of case study methodology

Linda Kestle¹, Kerry London²

ABSTRACT
Remote sites are typically environmentally sensitive and located in areas of hostile physical conditions. They are increasingly attractive to investors and entrepreneurs for their scientific, tourism and resource exploration development potential. These sites pose unique challenges for the early phases of design. Strategic decisions made during the briefing and conceptual design stage can significantly impact upon construction logistics and sustainability. Design management is concerned with value generation, and the integration of knowledge from the design, construction and management disciplines, however understanding what constitutes value is a difficult and complex process. This paper describes and illustrates the current and future stages of the research process associated with the development of the theoretical conceptual model for remote site design management. The research process began by conducting preliminary literature reviews, which indicated that there is little research in the area of remote site design management. However, more and more projects are being constructed in remote locations. Theoretical models for these particular projects are a means of simulating the various ways of managing the design and construction processes before and after the projects commence on these often sensitive sites. The next stage of the research process involved the development of a conceptual model for the design management of remotely located construction projects. The data for the model was drawn from a selected review of design management, environmental sustainability and lean design management literature. An important part of the model requires a clear definition of what constitutes a remote site. Towards this definition, a typology was developed across two dimensions: environmental sustainability and the process of design management. The model was then examined and refined, using historical remote site case studies based on secondary data, and personal experiences of researchers who had been involved in design management of these sites, or who had experienced the remote localities. The key design management factors identified as unique to remote sites in the model were, process integration, value generation, knowledge integration and decision making. Case study methodology has been identified as an appropriate method for developing the model, primarily because the reviewed literature has not yielded any theoretical models that completely address remote site design management. Further, case study methodology involves empirical enquiry that investigates a phenomenon within a real-life context, and is a research strategy that comprises an all encompassing method of enquiry.

KEYWORDS
remote sites; design management; lean design management; environment; sustainability; case study methodology;

INTRODUCTION

¹ Faculty of Architecture and Design. UNITEC. Auckland. New Zealand
² Senior Lecturer. Faculty of Engineering and Built Environment. University of Newcastle. Australia
Design management is fundamentally concerned with value generation, however understanding what constitutes value is a difficult process. The design process has become more complex and more fragmented in recent years resulting in more actors, who have design knowledge, requiring integration (Tombesi, 1997). This impacts upon a number of factors, not the least being the difficulty of the development of a shared understanding of the objectives for a project among stakeholders. This shared understanding towards identifying what is valued in the project impacts upon how critical decisions are made on design issues. This is an important point in the development of the design management field as it is the integration of those who have knowledge that can contribute to the design, construction and management, which is critical to developing and achieving value on projects (Kestle et al, 2002).

In the last decade there has been an increasing trend toward managing construction projects remotely. In addition, remotely located and often environmentally sensitive sites are becoming more accessible and therefore increasingly valuable to potential investors, entrepreneurs and designers. The emerging environmental movement in recent years, though, has focused worldwide attention on the need for sustainable development for these sites as opposed to the pragmatics of getting the job done, on time and to budget.

For years, construction companies have built in areas distant from their home base and have taken a mainly logistical approach to these sensitive sites. The clients, and design and construction industry involved with developing these remote sites, have an increasing duty of care in a global sense, to these often-pristine environments and their ecosystems.

There are a few key studies in the field of design management, but essentially, there is a lack of fundamental research in the area of designing and managing projects remotely, and more particularly the development of remote, environmentally sensitive, and frequently, hostile sites. To date, the mainly sociological and qualitative research has resulted in the development of a typology for remote construction projects, and conceptual design management model for remote sites (Kestle et al, 2002).

RESEARCH RATIONALE, STRATEGY AND PROCESS

This section of the paper summarises the main reasons for conducting the research, and discusses the research strategies and process being adopted.

Rationale
The research topic is the resultant of research projects previously conducted as part of the requirements for a masters degree in architecture, and subsequent research endeavours in Antarctica. The official starting point of the research was December 2001, when the PhD research topic was agreed with the senior supervisor, and the research proposal approved. The thesis entitled, 'Remote Site Design Management' was formally lodged by the Dean of Postgraduate studies at the University of Canterbury, New Zealand in August 2002.

An initial literature review was conducted in early 2002 in the areas of lean design management, design management and environmental sustainability, as the first stage in the development of an exploratory conceptual design management model for remote sites.

The following, summarises the characteristics of this research area, and therefore the reasons for conducting the research:

- Design management is a relatively new field and the specifics of remote sites is still largely uncharted territory
- Remote site management has become more widespread as project participants are able to access these projects using advanced information technology
• The literature review indicated that there was very little research on remote site design management.
• There are no previously documented theoretical models of remote site management.
• There are very few empirical examples of remote site research.
• Theory building and model testing is therefore required in this field as there is little developed.
• Remote sites are difficult to physically access.
• Projects on remote sites are often politically sensitive and therefore the participants are difficult to access.
• Projects on remote sites frequently have extremely limited operational windows, due to the extremes in local climatic conditions.
• Remote site projects are frequently government funded and therefore the approval process can be subject to political influence.
• Remote site projects offer a distilled and concise snapshot of the issues facing every construction project in varying degrees.

**Strategy - the application of case study methodology**
Since the design management field and the specific topic of remote sites is still in its infancy, exploratory methods are useful. Case study methodology is often considered an inquiring and exploratory method that provides rich and descriptive data for analysis (Yin, 1994). The reviewed literature has not yielded any theoretical models that specifically or completely address remote site design management. Personal access to live remote site projects is also limited. Therefore, case study methodology has been adopted as an appropriate and valid research approach, in the development stages of the theoretical conceptual design management model for remote sites.

Case study design and selection are two of the most critical aspects of this methodology (Yin, 1994). The selection of the case is based upon its ability to represent the phenomenon. The phenomenon to be studied is remote site design management. This phenomenon includes the study of projects on sites that are remotely situated, and conversely, project personnel who are geographically isolated from the project(s) that they are responsible for.

Case studies have been, and will continue to be, selected to test and validate this research because they relate to remote site projects in one of two ways: either the sites are remotely situated or the project designers or managers are remotely located from the site(s) for varying timeframes.

The case studies used in the research so far, were drawn from previously conducted research data and published website data, related to sites situated in Antarctica, Tongariro National Park, New Zealand and Fraser Island, Australia (Kestle & London, 2002). These data highlighted the key factors for consideration in the development of a conceptual design management model, and assisted in the synthesis of the theoretical and practical contributions. The sociologically oriented design management model and the production-oriented worldview of design management applied to all three sites, in varying degrees.

Having begun to explore the number of possible cases that this approach could involve, the exact nature of the required selection criteria has to be more clearly defined. This is where the development of a typology becomes useful, as it categorises the attributes and dimensions of the selected sites, and establishes patterns of similarities and differences between the various stakeholders in terms of, for example, how value is generated on these remote site projects.
process - data collection when studying past projects
This part of the process has, and will continue to include, access to published and historical records as well as contact with the project designers and managers. The development of an exploratory conceptual design management model for remote sites and an associated remote site typology, that was undertaken in 2002, drew data from a selected literature review of design management, lean design management and environmental sustainability literature. The model and associated typology were further developed using secondary data and the personal experiences of the researcher(s), and subsequently refereed and published (Kestle et al, 2002 and Kestle & London, 2002). A summary of those papers follows:

**Exploratory conceptual design management model for remote sites** (Kestle & London, 2002)

Through a selected review of design management, environmental sustainability and lean design management literature, an exploratory conceptual design management model was developed for remote sites. The validity of the model was further examined using three historical case studies using data from previously conducted research and published secondary data.

![Figure 1 Exploratory Conceptual Design Management Model for Remote Sites](source: Kestle & London, 2002)

A design management model that responds to the need for well-integrated specialist design and construction actors is essential, in order to properly address the key factors identified and described in Figure 1. The key remote site design management factors drawn from the literature and the historical case studies were those of value generation, process integration, knowledge integration, and timely decision making.

The value generation factor was derived from design management literature related to the sociological oriented worldview of design methodology, design sociology and the iterative design process, and from the published historical case study data. Value generation is primarily concerned with the value that the client and stakeholders place on the particular project and site, and it will alter with each site, the differing clients and the differing stakeholders.

The process integration factor was primarily derived from exploring literature associated with the production-oriented worldview of lean design management and also from the published historical case study data. Process integration involves construction planning methodology, logistics, information management and the creative design stages of the project, and the effects that each stage of the process can have on the overall management of the total project. Logistical planning and
Implementation is particularly complex for remotely located sites, and this calls for a well-integrated process. Knowledge integration for remote sites is a combination of relevant specialist knowledge, in-depth pre-design briefing, pre-planning of all the construction phases and the use of specialised IT for information management. Timely decision-making refers in the main to financial and design decisions. These decisions are frequently critical within the context of non-negotiable operational windows, fixed budgetary constraints and environmentally sensitive development of these remote, pristine and frequently hostile sites.

**Typology for remote construction projects** (Kestle et al, 2002)

These sites are typically located within environmentally sensitive regions, primarily due to the region being previously undeveloped or underdeveloped. Most construction projects have a degree of remoteness and the term 'remote' can be based upon a continuum related to the physical distance of participants from the site, where:

1. All project participants are initially not located adjacent to the project site, i.e., all design, construction and facility management actors are located in another city/urban area.

2. Selected groups of project participants are initially located distant from the site, for example, the design team and project/construction management teams have their offices in other countries, regions etc., but they may move to the region or have agents in the region.

3. The majority of project participants are located adjacent to the site and a selected few are located remote from the project site, for example, construction materials and components suppliers are required to transport their products to the site from other regions; or conceptual design teams win international design competitions and are located primarily in other countries.

The majority of construction projects typically fall within the third category. Remote sites can also be considered in relation to:

(a) the distance to the site from continuously available logistical support;

(b) the difficulty of physical access to the site;

(c) the hostility of the environment in terms of climate;

(d) the extent of the availability of local/imported materials or labour resources

(e) the environmental sensitivity

The historical remote site case studies selected (Kestle et al, 2002), and subsequently described typologically, were relevant examples because of their contrasting physical attributes and differing developmental priorities. All of the selected sites were in environmentally pristine regions; all were listed as World Heritage sites. However, the value generators were very different for the clients and stakeholders for each site. One of the sites was an eco-tourism resort off the east coast of Australia, another involved the building of huts/lodges within Tongariro National Park in New Zealand and the third site was in the Ross Sea Region of Antarctica where scientific bases and historic huts have been built.

The selected sites have a range of attributes that include: pristine environment; governmental monitoring; government as client; evolving and mature ecosystems; commercial value; design
stakeholders; scientifically investigative activities; global impact; historical conservation; resource-rich; hostile climate; and indigenous history.
To create a clearer definition within the model of what constitutes a remote site, a typology was developed across two dimensions: environmental sustainability and the process of design management. The typology that has been developed is empirical, i.e grounded in observations from the real world and from literature concepts. The model has been developed to the stage of determining and comparing the dimensions and attributes of three historical remote site case studies, in order that links could begin to be made with the key factors of the design management model (Kestle et al, 2002).

CURRENT RESEARCH STRATEGY AND PROCESS

Strategy
Following the publication two refereed papers (Kestle et al, 2002 and Kestle & London, 2002), the research is now focusing on furthering the literature review, in the areas of design management and sustainable development, and examining an historic Antarctic drilling project case study.
In the immediate future, though, it is anticipated that by continuing to use multi-case study methodology, that data may be collected from a current Antarctic project for analysis and consequent model and typology refinement.
Where possible, historical case studies will be drawn from past projects undertaken by stakeholders with links to live projects currently being studied, to give continuity and a valid comparison with the gathered data. Alternatively the cases may address certain issues that have been raised in respect of remote site design management, that are as yet unanswered.

The multi-case study approach that has been adopted includes, but is not solely restricted to, Antarctic case studies, as this would be too limiting and too specific. The remote site design management model has to be robust and yet responsive, so the cases need to be representative of both current and past projects, to validate the process and the model.
The multi-case study approach (Yin, 1994), allows valuable comparisons and contrasts to be made with the varying remote sites across the differing key dimensions, as identified in the design management model (Figure 1) and the associated typology.
Observational case studies will also be undertaken that offer the opportunity to document current practice. Observations related to some of the case studies may, however, focus only on certain parts of the model, because they offer valuable and specific ranges of data.

Approval for an active participatory role in this Antarctic project is currently being negotiated. If permission is granted then action research may also be used as a part of this research, in addition to observational case studies, as action-research contributes to practice, and also to the creation of theory.
Action research begins with real life observations that raise currently unanswerable questions when compared to current or informal theories. Theories are then validated through practice, rather than being validated independently and applied to practice. Participants in the action being considered are integrally involved in all of the activities (Lewin, 1951).

For the proposed Antarctic project research, about to be undertaken, the action-research component would involve three stages: diagnostic, action steps and evaluation.
The diagnostic stage would occur at each of the project phases and include an analysis of the project preplanning phase, the design and construction phases and the project completion phase.
The action steps would occur at the project preplanning, construction and project completion phases, and would involve interviews and observational data collection.
As each phase of the project is completed, an evaluation of the design and management procedures, based on the data analysis, would be conducted and documented.

**Process - data collection from current projects**

The data about to be gathered from a proposed project in Antarctica will be preliminary and observational, as it is currently at the project design stage and not scheduled to commence on-site work for at least another two years. This part of the process will include gathering observational data from project meetings and access to project planning documents. Data available for analysis from the Antarctic project design stage will include the various financing scenarios; intended project outcomes; value generation for the stakeholders and the operational window (i.e. the few weeks, or months, of a year when building, or access to the site to carry out work, on the project can actually occur). Data will also be available on the process of discussion and negotiation between the various stakeholders at the project design and operational stages.

To identify the issues and lessons learned for future projects, a series of structured interviews will also be conducted. The data gathered from such a project is valuable because it offers current practice information on a large scale remote project that involves up to four collaborating partners / stakeholders from the initial project feasibility and preplanning stages.

**Process - Data Analysis**

The analysis will be conducted from varying perspectives:

Firstly, the historical and current case studies data will be analysed within the context of the previously developed remote site typology in terms of their dimensions and attributes, to establish the extent to which the data matches or adds to the typology. Then the historical and current case studies data will be analysed within the context of the remote site design management model to see how well the data matches or adds to the model.

Finally, the design management model and associated typology will be analysed in terms of the gathered data from current projects. This will establish whether there are any gaps or anomalies in the model, and enable further development of the model and typology as required. A detailed analysis of the gathered data will be made in terms of the four key factors as determined in the development of the model (refer Figure 1). These factors were value generation; knowledge integration; process integration and timely decision making.

Subsequently, the data gathered at the operational stages of the project will test the validity of the preplanning decisions and strategies regarding the design and management of the various stages, and processes within them. Finally, the data collected at the conclusion of a phase or phases of the live project will be compared with the data from the preceding stages and evaluated in terms of the individual phases and the overall management plan as prepared at the project design stage(s).

**CONCLUSIONS**

The research to date has involved a selected literature review in the areas of design management, lean design management and environmental sustainability literature, and the adoption of multi-case study methodology. The design management literature review, to date, has indicated that much of the lean design management research has been primarily concerned with sequential production whilst a few authors are exploring a more sociological design management research approach. The production oriented and sociological theoretical world-views on design management have informed the development of a conceptual design management model for remote sites. Case study methodology has been adopted as an appropriate method for validating and developing the conceptual remote site design management model and associated typology,
primarily because the reviewed literature has not yielded any theoretical models that completely address remote site design management. Further, case study methodology involves empirical enquiry that investigates a phenomenon within a real-life context, and is a research strategy that comprises a range of differing yet complimentary methods of enquiry. The results of the data analysis, from the current Antarctic project, will be valuable because it will offer current practice information on a large scale remote project that will in turn challenge, inform and potentially validate the conceptual design management model for remote sites.

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ABSTRACT
Remote and environmentally sensitive sites present unique challenges for participants involved in the design and construction process. Worldwide advances in information technology coupled with improved site accessibility and manageability has enabled the construction industry to undertake such projects with greater ease. Furthermore, research on information technology in construction has begun to focus our attentions on our increased ability to work virtually in distributed teams. These remote sites have a range of development potential as clients have varied interests including; tourism, scientific investigation and resource exploration and processing which impact upon the management of the design process. These sites pose unique challenges to the project teams and in particular for the management of project design. The conceptual design phase is often marked by an iterative and creative process, which tends to be a sociologically oriented world where designers respond to a range of functional, aesthetic, environmental and even spiritual concerns. Strategic decisions made during the briefing and conceptual design stage may impact upon construction logistics and sustainability. Detailed design for construction tends to be a production oriented world. There is a significant body of literature that addresses the application of lean thinking to improving the interface between detailed design and construction production. There is little literature that takes a holistic view of design management for remote sites. The lean design management field of research has much to contribute to the design management of these projects. The review of the literature indicated that much of the lean thinking has been primarily concerned with sequential production. However, lean thinking is based upon principles of flow and value, which is also conducive to the complex process involved in design management for remote sites. A conceptual model is developed that considers both the production and sociological approaches to design management, in response to the peculiar demands of the site and their project teams.

KEYWORDS
remote sites, design management, lean design, lean production, design sociology
INTRODUCTION
The management of design is a complex process requiring integration of a variety of disciplines. It has been well established that this is largely caused by a process that attempts to fuse various aesthetic, functional, social, political, economic and technical objectives from potentially numerous parties, with at times fundamentally conflicting objectives (London, 1997). The problem of design management is further exacerbated when we acknowledge that design is often regarded as a search without a predetermined outcome whereas the design process is often about defining that predetermined outcome of performance expectation. It is a quest for innovation by the design and construction teams with each new design scenario setting new parameters and constraints, albeit in some cases only slightly altered.

The design and development process is frequently a team effort involving multiple, informed and ill-informed decision makers and is a complex natural system dependent upon initial decisions. Complex design management scenarios suggest that as areas of professional responsibility become fluid, the manner in which decisions are made by design teams becomes critical for understanding the resultant building performance (London and Ostwald 1996).

The added dimension of remote site construction increases the complexity and criticality of early decision making. The project team is required to address the traditional design problems, but also those that occur as a result of the location of the site and the team’s lack of familiarity with the often uniquely social, physical, economic and sometimes spiritual criteria.

The emerging field of design management and the more focussed thinking associated with lean design management will inform the development of a model for design management for remote sites. The topic of remote sites brings with it a range of other fields that could contribute to our understanding; for example international construction, online management and procurement and sustainable development. The field of international construction has in recent years emerged as a growth area, precipitated by the growth of multinationals and lowering of trade barriers which has increased globalisation of construction (Mawwhinney, 2001). However this paper is limited to lean thinking and design management fields.

CHARACTERISTICS OF REMOTE SITES
Remotely located sites are most commonly thought of as those that are on an island distant from the mainland, or simply hundreds or thousands of kilometres from major urban concentrations, such as various Pacific Islands or Antarctica. These sites are typically located within environmentally sensitive regions, due to the region being previously undeveloped or underdeveloped. Increasing global awareness of environmental issues and the emergent sustainability movement has focussed awareness, however, there is still very little evidence of research work conducted on remote site design management. Clearly most construction projects have a degree of remoteness and once we accept this notion we begin to view projects through the proxemics lens and explore difficulties associated with remoteness.

Remoteness can be based upon a continuum related to the physical distance of participants from the site:
• All project participants are initially not located adjacent to the project site, i.e. all design, construction and facility management actors are located in another city/urban area.

• Selected groups of project participants are initially located distant from the site, for example, the design team and project/construction management teams have their offices in other countries, regions, etc., but they may move to the region or have agents in the region.

• The majority of project participants are located adjacent to the site and a selected few are located remote from the project site, for example, construction materials and components suppliers are required to transport their products to the site from other regions; or conceptual design teams win international design competitions and are located primarily in other countries or international clients commission new projects in various locations.

The majority of construction projects typically fall within the third category, however in this paper the first category of remoteness, which is the most extreme situation, is considered in detail. Within this type of remote site there are a range of types of projects and there are three predominant property markets including:

• Commercial projects, tourism, ecotourism

• Government/quasi government/ngo projects: scientific investigation, space exploration, earth evolution

• Civil infrastructure: mineral resource exploration and processing, oil/gas rigs, pipelines, dams

CONSEQUENCES OF POOR DESIGN MANAGEMENT FOR REMOTE SITES

The potential consequences of a lack of or poor design management are as follows:

• Design errors which are costly and may be irretrievable until, for example, the next accessible Antarctic summer building season (October to February).

• Rework of design or construction processes due to poor communication during construction. This can be caused by a lack of full-time on-site supervision or monitoring of the remote sites or regular physical interaction between participants.

• Delays in the construction project commencing because of varying levels of prioritisation in terms of providing finance, obtaining the necessary approvals or site labour.

• Damage and corrosion of materials/products when mishandled or unfinished construction processes, particularly on marine, geothermal or active volcanic sites.

• Logistical errors caused by inaccurately measured or selected materials and their delivery are exacerbated.

• Logistic difficulties caused by inaccurate transportation capability assumptions, particularly when, for example, all of the materials have to fit on one site specific shipment.
• Poor communication between the various stakeholders on and off site, caused perhaps by different interpretations of the issues or decisions being made remote from the site itself, and from each other, for example, lack of site supervision by construction organisation, lack of monitoring by design team or the client team.

• Time delays in terms of decision making, whether in terms of the design or financial commitment causes a flow on affect across all disciplines and tasks, which in the case of remote sites may mean a delay of up to twelve months, until the site becomes accessible again.

In order to understand the reasons, and the need, for good design management of remote sites, two case studies are detailed here, but only in terms of their urban proximity, regulatory frameworks, physical attributes, functionality and environmental impacts/sensitivity. These sites offer very unique challenges to those involved in the design, construction and management process. These challenges are frequently unique to the particular site and project, however, there are increasingly generic characteristics that can be strategically viewed (refer Table 1).

CASE STUDIES -

The following remote site case studies were selected because of their contrasting physical attributes, and the very different developmental priorities set by the two sets of clients. The first remote location is Antarctica (the Ross Sea region and the South Pole in particular), and the second is Fraser Island, Australia. Antarctica has primarily been an exploratory investigation base for the world’s scientists. Investors and entrepreneurs have also realised the increased potential and value of remote sites. Antarctica has potential for three property markets, including commercial tourist projects, government scientific bases and civil projects for minerals exploration, and is experiencing growth pressure. The number of bases across Antarctica has now increased to 26 and they range in size from 100m$^2$ to approximately 500m$^2$.

Scientific and tourism projects are organised and managed within the governance structures determined by the Antarctic Treaty, which is a unique legal agreement ensuring that all member countries work together in Antarctica for only peaceful and scientific purposes (Waterhouse, 2001). There is no minerals exploration allowed currently under the CRAMRA agreement (Convention on the Regulation of Antarctic Mineral Resource Activities) and the Antarctic Treaty (1961).

Base stations have been built to support scientific activity. The first of these bases in the Antarctic Ross Sea region, (which comes under the stewardship of New Zealand), was built in 1956/7, to coincide with the ‘International Geophysical Year’ (IGY) and the associated British expedition. Of special interest to the built environment in the Ross Sea Region is the Protocol on Environmental Protection (1991).

Currently, considerable construction and maintenance activity is taking at the South Pole of Antarctica (‘Amunsden’ station’), where US$200 million is being spent over a 5 year period on building a completely new scientific base station; construction began two years ago. Over the last 10 years, New Zealand and the USA have spent approximately $US9 million on new buildings at the two Ross Island bases (Scott and McMurdo), (OPUS,1998) and several hundred thousand on the maintenance of the historic huts in the Ross Sea region and which are now a significant tourist attraction.(Waterhouse, 2001).
The second case study is the ‘Kingfisher Bay Resort’ on Fraser Island. This island is 122 km long and is the largest sand island in the world. It lies along the eastern coast of Australia. Fraser Island is one of 14 Australian sites on the World Heritage List of which there are some 700 properties listed worldwide. It was listed in 1992 because of its unique geological, geographical and historically cultural significant features (ICOMOS, 1999).

The Kingfisher Bay Resort was opened in 1992 as a fully integrated large scale ecotourist resort. It was designed to give visitors a nature based tourism experience whilst creating minimal environmental impact. The resort has various architectural design features based upon sound sustainable principles for design, construction and operation and has won 35 Australian and international awards for this commitment (ICOMOS, 1999). Tourist numbers to Fraser Island have increased rapidly since 1975 and it is currently estimated to receive around 300,000 visitors a year. During 1993/1994, approximately 82,000 camper nights were recorded on the island (Australian Bureau of Statistics, 1997).

The sites at Ross Sea Region Antarctica, and Fraser Island Australia, offer very unique challenges to those involved in the design, construction and management process. These challenges are frequently unique to the particular site and project, however it is proposed that there are common characteristics across all remote sites. Table 1 summarise some of the more significant of these characteristics including:

- Proximity to urban areas
- Regulatory framework
- Physical environment
- Functional, aesthetic and social aims
- Environmental impact / sensitivity
Table 1: Remote Site Comparisons (Kestle, London et al, 2002)

<table>
<thead>
<tr>
<th>Site</th>
<th>Proximity to major urban areas</th>
<th>Regulatory Framework</th>
<th>Physical Environment</th>
<th>Functional, aesthetic &amp; social aims</th>
<th>Environmental Impact/Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antarctic sites-Ross Sea Region</td>
<td>Isolated. Distances to major areas: South America: 1000km Australia: 2500km NZ: 3850km Africa: 4000km</td>
<td><strong>Antarctica Treaty:</strong> 42 nations - of which 26 are the core, within the Treaty there is Protocol on Environmental Protection (Madrid Protocol 1991) Treaty designed for peaceful and scientific endeavours (US space program) and to protect the resources from commercial gain and to keep it a continent free from military arms. Emerging regulations governing environmental sites. (Waterhouse, 2001)</td>
<td>Hostile climate, extreme cold temps, Coldest and highest continent. World’s lowest temp, -89.6°C. limited daylight hrs for 6 months and extended daylight hrs for other 6 months. No access during winter months due to ice, high winds, extremely low humidity, no rain. Ancient landmass. 2% exposed rock. Ice sheet covers majority of continent- 87% and 11% ice shelf.</td>
<td>Primarily scientific investigations- emerging Eco and Historical tourism Aesthetics have been of secondary importance. Little thought to the human experience and the built environment except purely on a basic human needs basis related to physical survival. Previous threat of mineral resources exploitation.</td>
<td>Predevelopment: Largely pristine and highly sensitive Mature ecosystem Heroic Age: approx 1903-1917, explorers Post development: limited access to 6 months of the year, highly restricted access to certain sites designated as scientifically significant. Access to other locations is based upon the scientific program team leader and the nature of the program</td>
</tr>
<tr>
<td>Fraser Island, Australia</td>
<td>Adjacent to Australian landmass. 270km north of Brisbane</td>
<td><strong>World Heritage</strong> listed site due to unique sand ecosystem/ dune lakes geology (world’s largest sand island: complex dune systems) etc.- Coupled with other natural and cultural significance reasons. eg fauna (rare frogs, bats and glider species, as well as marine life) and flora (‘wallum heaths’ are of particular evolutionary and ecological significance, complex peat swamps), and indigenous culture. UNESCO 1972, ICOMOS: 1999 <strong>Australian Burra Charter</strong> - governed by Qld and Australian Heritage Council.</td>
<td>Subtropical, mild winters, hot and wet summers, high humidity, cyclonic zone etc Conditions are maritime subtropical with mean annual temperatures ranging from 14.1°C minimum to 28.8°C maximum. Rainfall is high, reaching 1,800mm on the highest dunes in the centre of Fraser Island (DASET, 1991; Sinclair and Morrison, 1990)</td>
<td>EcoTourism Aesthetics is critical to the resort development as is the relationship between the built environment and the total human experience. Threat of sand mining, mineral resources exploitation and various introduced fauna/flora species.</td>
<td>Predevelopment: Pristine, evolving ecosystem and highly sensitive. Indigenous peoples: 1,200-2000 years ago Post development: Only limited by accommodation and limited restrictions on public access</td>
</tr>
</tbody>
</table>
There are clear regulatory regimes that govern and restrict the development of these sites. It is interesting to note that both are governed by international law, with the Australian site being governed by the 1999 Australian Burra Charter which is a national framework endorsed by International Council of Monuments and Sites (ICOMOS) - the UNESCO advisory council on preservation of world heritage sites, of which there are 107 member nations. The climates are quite different, with Antarctica having the harshest climate in the world (coldest, driest, windiest), whilst Fraser Island is in a cyclonic zone and can be subject to extremes. These factors impact upon the design and the construction of buildings and infrastructure, particularly in that both have seasonal extremes of weather. In Antarctica shelter, warmth, fail safe heating and water services are essential in such a life threatening environment. Currently the prefabricated base station buildings are permanently positioned, however, there is a trend emerging for mobile bases which will have a direct impact on design, construction and design management (Kestle et al, 2002).

The Antarctic is primarily a continent dedicated to scientific investigation (Waterhouse, 2001). However, the Antarctic in recent years has emerged as a tourist destination, particularly along the Antarctic Peninsula where there are attractions including seals, penguins and pristine ecosystems. As well, there are the historical sites of the Ross Sea region which relate to the early ‘heroic’ explorers. Tourism in the Ross Sea region is, however, restricted to on board visitors, with only 385 tourists actually landing in the Ross Sea region in the 2000/2001 season. Fraser Island has become a world renowned ecotourist resort focussed on environmental education and ecologically responsive aesthetics, whereas the built environment in Antarctica is utilitarian and focussed on basic human survival in such a harsh climate. Both of these sites are highly sensitive environments where impact is strictly controlled.

Strategic decisions are demanded by both sites with regard to sustainability and the logistics of the construction of the project. Information technology advances are enabling greater accessibility globally in terms of telecommunication access to an increasing number of ‘remote sites’. The extremes experienced on these projects distinguishes these sites from the more traditionally urban site when developing a design management model. It is useful to now consider design management literature to provide a framework for these sites and therefore a selected review of both design management and lean design management literature is undertaken.

SELECTED REVIEW OF LEAN DESIGN MANAGEMENT LITERATURE

It is well documented that ‘Toyota’ first introduced the concept and then the implementation of lean production (Howell, 1999). There are five key lean design management principles being Value, Value Stream, Pull, Flow and Perfection (Womack and Jones, 1996).

These early principles were considered further by Garnett et al (1998), who postulated that several different value strategies need to occur within single projects as the client may have one definition of value, whereas the end user or the stakeholders may have others. This is not dissimilar to previous design and value management literature.

Howell and Ballard (1998), determined that: “Lean is a value seeking process that maximises value and continually redefines perfection”, and that “the goals of lean thinking redefine performance against three dimensions of perfection.
(1) a uniquely custom product,
(2) delivered instantly, and
(3) nothing in stores’.

This, in their view, essentially maximises value and minimises waste. This third dimension of perfection certainly has relevance for the Antarctic sites in particular, as discussed later in this paper. They further suggest that “Lean thinking forces attention on how value is generated rather than how any one activity is managed” (Howell and Ballard, 1998)

In exploring the literature on lean thinking to date, much of the research falls into the tactical category rather than being strategic and theoretical, that is until the work of researchers Koskela, (1997) and Seymour, (1999). Seymour (1999) suggested a proposal for implementing lean construction at the organisational level rather than just at the operational level. This work was then followed up two years later by Seymour and Rooke (2001) using an ethnomethodological approach in terms of setting up an organisational culture that established how people may perform their sitework activities in a visibly orderly manner, by changing their mindset, for instance.

Similar to findings by London’s research (1997), were suggestions by Howell and Ballard (1998), that changes of the mental model needed to be made. They further suggested that lean thinking, applied at the beginning or alternatively applied midway in well run projects, revealed the weaknesses of the current systems by mapping the project value stream, and hence reinforced the power of lean thinking.

The manner in which the design process stage is handled has a significant, and often deleterious effect on all of the subsequent stages of construction project production, (Huovila, 2000, Ballard, 1998, Formoso (1998). These researchers recently put forward a range of propositions to minimise the problems for the production personnel, including integrating the design and construction processes, and changing mental attitudes. The separation of design and construction had long been identified as one of the key problems of construction, and that whilst design and build goes some way toward organisational integration, Huovila (2000), Ballard and Koskela (1998), and Formoso (1998), still believe that there is significant room for improvement in terms of the design process.

In lean design management, others have sought to explore not simply value as an important part of design management but other models which include conversion and flow. Further to the work of Formoso et al (1998), Ballard and Koskela (1998), Alarcon and Freire (2000), again concluded that three distinct models - conversion, flow and value generation - comprise the process of lean design but added that the principles of lean design are generally unknown to the general public. An analysis of the application of some of the lean construction principles to design management from the point of view of design as conversion, flow and value generation was made in a paper by Tzortzopulos and Formoso (1999). The two Brazilian case studies in their paper found some gaps in the knowledge of the application of theory in design and in particular the value generation view of design concepts and principles.

The lean design literature primarily focusses on the production approach and processes, but a few of the researchers, for example (Garnett, 1999, Huovila et al 1998 ) adopted a more sociological approach to lean design. The lean design principle of ‘flow’ is relevant from a sociological and environmental viewpoint, as it tends to be focussed on a more holistic approach for theoretical and project development work. In addition, remote sites which are frequently environmentally sensitive, may need a more holistic approach.
An ethnographic case study was made of the partial implementation of the value stream approach on a construction project by Garnett (1999), and the model created was tested to develop a target baseline for improvement throughout the entire process. The results to date suggest that the UK construction industry is challenged by the cultural change, whilst several US companies have witnessed significant gains by employing lean thinking. Garnett (1999) believes that her research will contribute to new theory on lean thinking by taking a social constructivist methodological approach to the process work, "through ethnographic case-based research".

The question of how to use lean production philosophy to promote the necessary changes in the design process is significant. The essential lean construction principles of integration and minimising design procedure conceptual changes, would increase buildability and lower the production costs of a project. (Melhado, 1998).

The implications of lean thinking and production show that it is worth reflecting on how lean thinking coordinates action (Howell and Ballard, 1998). Specifying value by product to the customer shapes all actions around customer requirements and managing the work flow at the design phase of the projects. Focussing on the design phase is one of the challenges for this new discipline (lean construction). Historically in construction, specifying value has often come before design (Ballard, 2000).

Lean thinking is based upon principles of flow and value within the context of a production oriented world and can contribute to remote site design management. Also of increasing importance, is the acceptance of a sociological oriented worldview of design management.

SELECTED REVIEW OF DESIGN MANAGEMENT LITERATURE

Design management from within the disciplines of the built environment is a complex process concerned with:

- Value generation
- Integration of specialist knowledge
- Critical timing of key decisions

These are now explored in more detail. Firstly design management is fundamentally concerned with value generation however understanding what constitutes value is a difficult process. The design process has become more complex and more fragmented in recent years resulting in more actors who have design knowledge that require integration (Tombesi 1997). This impacts upon a number of factors, not the least being the difficulty of the development of a shared understanding of the objectives for a project among stakeholders. This shared understanding towards identifying what is valued in the project impacts upon how critical decisions are made on design issues. This is an important point in the development of the design management field as it is the integration of those who have knowledge that can contribute to the design, construction and management, which is critical to developing and achieving value on projects.

It is suspected, though, that the process is not simple and straightforward, instead, design management is a complex social situation as value can be a socially constructed phenomenon and decision making to that end can be inherently unpredictable. Design decision making is often negotiated amongst groups and teams – it is an iterative process.
The stakeholders of value can also change through the various stages of the design, construction and occupancy stages and each group of actors may differ in perspective based upon their worldview. The power to negotiate and guide design decisions and assist with establishing building performance criteria changes at different times of the process – in many cases their voice is not heard at critical times (London, 1997, London, 2002).

Poor integration of specialist user and producer stakeholder knowledge can have far reaching consequences, such as inappropriate synthesis of the needs analysis leading to low value generation for the client and users. In many cases identifying value is a socially constructed process between the stakeholders, who incidentally are not just design and construction teams but are those actors who can contribute to improved design and construction building performance (London, 2002).

In recent years the need for the role of design manager has become more apparent—that is a specialist who integrates and coordinates the design process. Gray and Hughes (2001) discuss design management and identify two levels of responsibility for the design and its production, the associated authority for decision-making, and responsibility for the interface with other organizations. They maintain that the task of the design manager is to ensure that the organisation of the design process is structured appropriately, to ensure that there are sufficient integrative and coordinating mechanisms for the work to progress meaningfully. They claim that a framework has to be established which keeps the focus on the tasks and objectives to achieve the value criteria set down in the initial stages.

An alternate position was taken by Green (1994) when researching in the value management field. He adopted the approach of placing value generation at the centre of the design process rather than employing outside consultants to carry out a series of value engineering critiques throughout the various development stages. This is not unlike the study conducted by London (2002) whereby she tested a design management model for the development of performance based briefing and analysed group interaction between stakeholders. The premise was that there was no need for an external chief decision maker, however there was a need for a design manager to integrate and manage knowledge that is within the stakeholder groups. The nature of complex group dynamics affects design and building performance criteria.

When there is a strict timeline for the completion of a project, for example, a restricted window of constructability and accessibility to the remote site due to climate or other reasons, the timing of the decision to proceed toward the concept design stage and financially commit to the project is absolutely critical to the subsequent design and construction stages and completion of the project on time. The resultant of delays in making key decisions can mean that the entire project becomes unviable on remote sites, particularly where accessibility is limited by seasonal weather conditions.

Ballard and Koskela (1998) suggest that there is very little literature on design management theory, and claim that the way forward for design management is to have “a management philosophy and tools that fully integrate conversion, flow and value perspectives.”

CONCEPTUAL DESIGN MANAGEMENT MODEL FOR REMOTE SITES

In developing a conceptual model for remote sites, an exploration that draws on the key concepts and principles of design management and lean design management literature, has been initiated.
One of the significant outcomes of the review of lean design management and design management literature is the important contribution of process integration to a design management model for remote sites.

This model has been set up in terms of reviewing design management ‘production principles’, ‘sociological factors’, restating the ‘characteristics of remote sites’, and then developing a preliminary model that identifies the key factors of design management for remote sites (refer to Figure 1).

The traditional lean design management principles of value stream, process integration, workflow and waste minimisation can be applied to remote and often hostile project sites in Antarctica. These project sites are closely aligned to lean and functional production processes, as the main priorities for the client are shelter, a strict budget, tight timelines and a process driven construction programme. The development of these sites, then, potentially fits with the ‘traditional lean thinking design management model’, in terms of the sequential process and flow approach. However, under the Antarctic Treaty (1961) and the related Protocol for Environmental Protection (1991), all development projects on Antarctic sites also have to fully comply with the Protocol, particularly in terms of minimising environmental impact. This means in effect that the traditional lean design management approach does not fully address all of the factors associated with remote site design management.

The more holistic approach to lean design management as explored by a few researchers over the last few years identifies additional significant design management factors. These researchers refer to the importance of and the means to achieve sustainable development. They believe that whilst traditional design and construction focusses on cost, performance and quality objectives, sustainable design and construction by comparison, focusses on value generation, minimization of resource depletion, minimization of environmental degradation and the importance of information flow management.

Clear and effective communications, whilst important on any project, become critical on remote sites. The following design management factors should therefore be included when discussing remote site projects: ‘information management’, ‘knowledge integration’, and ‘timely decision making’.

Information management can be considered from a sociological viewpoint. However it has a significant effect on production factors/processes, if planned or implemented ineffectively. The decisions made, and the successful implementation of those decisions, by all personnel, depend on regular and clear communications, whether verbal, digital or in the form of hardcopy documentation.

On remote sites, in particular, miscommunications can be critical to the viability and completion of the whole project, given limited physical accessibility in many cases. Poor information management can create confused site/office personnel, resulting in mistakes requiring rework on an already tight timeline, costly overruns, lack of task completion on/off site and value degeneration from the client’s and stakeholders’ perspective.

Given the characteristics of remote sites (refer Figure 1), the principles and concepts of ‘value generation’, ‘knowledge integration’, ‘decision making’ and ‘process integration’ become key factors of this exploratory design management model for remote sites.

Value generation refers to the value that the client and stakeholders place on the project and site. Value generation in this context is primarily concerned with the
environmental protection of the site, given public accessibility to the site, and the site’s
global value. Value generation from the perspective of the project itself occurs mainly as
because of the manner in which the overall environmentally sensitive design approach is
applied to the site.

Specialist knowledge of remote and often hostile sites is essential on these
construction projects. Knowledge integration, therefore, involves in-depth pre-design
briefing by and of all the specialist personnel involved on the project, and detailed pre-
planning of all the construction phases.

Timely decision making refers in the main to financial and design decisions, which
are critical to the successful management of the design and construction of remote site
projects. These decisions are made within the context of non-negotiable windows of
buildability, fixed budgetary constraints, and the need for environmentally sensitive
development of these remote, pristine and often hostile sites.

Process integration, involves several aspects, ranging from construction planning
methodology, logistics, and information management, to the influence that the creative
design stages can have on the overall process management of the total project. Logistical
planning and implementation is complex and critical for remote sites. For example, in
Antarctica, where access to sites is limited to a four month window, and life threatening
situations are the norm, logistical resources and their deployment have to be preplanned
up to a year ahead of implementation. In response to the tight timeline and frequently
adverse weather conditions, the antarctic construction projects are largely prefabricated
into their various components prior to despatch to the site(s). The timing, costs and
weight restrictions associated with shipping or air freighting building components, add to
the complexities of the logistical aspects of a design management model for remote sites.
A design management model that responds to and reflects the need for a well integrated
specialist design and construction actors is essential. To achieve an integrated process,
alternative and unique procurement strategies may be required.

THEORETICAL CONTRIBUTIONS

Production oriented worldview: ‘Lean design’
- value stream
- process integration
- workflow
- waste minimisation

Sociological oriented worldview: ‘design methodology’ &
‘creative/iterative design process’
- value generation
- knowledge integration
- timely decision making

VALUE GENERATION
- client’s value criteria
- stakeholders’ value criteria

KNOWLEDGE INTEGRATION
- specialist site knowledge
- IT for remote site coordination

PROCESS INTEGRATION
- logistics & site accessibility
- construction planning/methodology
- alternative procurement strategies
- creativity and production interface

DECISION MAKING
- timely & critical
- performance criteria
- environmental sustainability
- economic constraints

Figure 1 Exploratory Design Management Conceptual Model for Remote Sites
CONCLUSION

This paper presents two exploratory case studies to highlight the factors that need to be considered in the development of a conceptual design management model for remote sites. The literature review, to date, indicated that much of the lean design management research has been primarily concerned with sequential production and that a few authors are exploring a more sociological design management approach. The production oriented view can assist the sociological view to develop a conceptual design management model for remote sites. Both of the investigated sites (Ross Sea region bases in Antarctica and Fraser Island, Australia) would fit the sociologically oriented holistic design management model in varying degrees, and both draw from the production oriented worldview of design management (refer Figure 1). However at this early stage of developing a conceptual model, a further literature exploration needs to be undertaken to determine the exact extent to which management of the design process for remote sites can be informed by lean thinking and a more developed model created for testing and eventual implementation.

REFERENCES


Remotely located sites have become more accessible and therefore more valuable and profitable to investors and entrepreneurs. Typically these sites are environmentally sensitive. For the designer, these sites offer a unique challenge conceptually, in terms of the physical and cultural constraints. The built environment research community has yet to seriously take up the challenge of developing theoretical models for the management of the design and construction processes for remotely located projects. Such models would explore efficiency and efficacy management for projects in remote and often hostile areas, in an integrated and sustainable manner. There are varying degrees of remoteness experienced in nearly all construction projects and therefore a clearer definition of the characteristics of remote sites is required. Towards this definition, a typology is initiated for the concept of remotely located construction projects related to environmental sustainability and the management of the design process. The characteristics of the typology are drawn from a selected literature review of the fields of design management and environmental sustainability, and from an exploratory investigation of two case studies.

Keywords: design management, environment, remote sites, sustainability

INTRODUCTION

The design and construction of projects at remote sites is not a new phenomenon. For example, major infrastructure projects such as canals, dams, power stations, roads and bridges, oil and gas rigg platforms, mines, tourist resorts, defense and scientific bases have been built for decades in remote areas. The emerging environmental movement in recent years, though, has focused worldwide attention on the need for sustainable development for these sites as opposed to the pragmatics of getting the job done, on time and to budget. For years, construction companies have built in areas distant from their home base and have taken a mainly logistical approach to these sensitive sites. The clients, and design and construction industry involved with developing these remote sites, have an increasing duty of care in a global sense, to these often-pristine environments and their ecosystems. Very little research in
the past has considered theories related to this specific topic from the design and construction management perspective. The research community has yet to take up the challenge of developing theoretical models that explore the design and construction processes in an integrated and sustainable manner for these remote sites. It is suspected that the current design and construction management models do not address the unique aspects of these sites and neither do the sustainability models. The concept of remote sites refers to a number of different, and complex, dimensions and properties, and can therefore be developed in a categorical and comparative typological manner.

**TYPOLOGIES**

A typology is a form of categorisation of theoretical and analytical data. Qualitative social research has benefited significantly as a result of using the construction of typologies to clarify concepts. The introduction of empirical social sciences, and the concept of types and their construction have assisted in the explanation, comprehension and understanding of complex social realities (Kluge, 2000).

There are different concepts of type, ranging from ideal types, empirical types, structural types and prototypes. Regardless of the typological construct, each typology is the result of a grouping process which can then be further defined as “a combination of attributes” (Kluge 2000). Typologies are comprised of a combination or grouping of attributes, generally supported by tables that can range in their scale of dimensions from a simple tabulated format to a complex and multilinked model, which give a visual overview of all the possible combinations and/or issues that are theoretically possible. At this stage of the development of this typology for remote sites, the concept is an empirical type, i.e. one that is grounded in observations from the real world and from literature concepts.

Kluge (2000) refers to Weber (1972), Becker (1968) and Kelle (1998) who believe that there is a need for both analysis and theoretical knowledge when conducting empirical investigations (Kluge, 2000). She therefore concluded, “It is only when empirical analyses are combined with theoretical knowledge that ‘empirically grounded types’ can be constructed.”

Once the particular concept of type has been decided on for a particular research project, four different stages of analysis can be identified for the process of ‘type construction’ (Kluge 2000), these being:

1. Development of relevant analysing dimensions; where the type is defined as a combination of attributes (properties and dimensions), the similarities and differences are identified and then the constructed groups and types are described in further detail, i.e. identifying the research question and the theoretical knowledge, and carrying out the sampling.

2. Grouping the cases and analysis of empirical regularities. This involves grouping cases in terms of defined properties and their dimensions. The cases are then analysed with regard to empirical regularities, by comparing them with each other, to check for *internal homogeneity* of the constructed groups, and to ensure high external heterogeneity in terms of the variation of data and the level of the typology, i.e. comparing and contrasting the cases.

3. Analysis of meaningful relationships and type construction. This involves analysing the first two stages of the typology construction to establish whether there are any meaningful
relationships developing between the cases, i.e. searching for contradicting / deviating cases, and considering further attributes.

4. Characterisation of the constructed types. This last stage involves writing detailed descriptions of the constructive types in terms of their combinations of attributes, their meaningful relationships, and finally, identifying the criteria for the characterisation of types (ideal, extreme, prototypes et al).

The aim of this paper is to explore the preliminary development of a remote site typology by identifying key concepts and principles in the design management and sustainability literature, to develop attributes. The next stage involves mapping cases to further clarify the attributes. To develop the typology, the attributes are explained – to do this, we draw on the fields of design management and environmental sustainability as remote sites are often environmentally sensitive and the design process for these construction projects needs to be managed.

Sustainable development, maintenance of biodiversity, and an ecological approach to design concepts are all potential attributes when constructing a typology for these sites and require further consideration of global environmental philosophies and strategies.

CHARACTERISTICS OF REMOTE SITES

Remotely located sites are most commonly thought of as those that are on an island distant from the mainland, or simply hundreds or thousands of kilometres from major urban concentrations, such as various Pacific Islands or Antarctica. These sites are typically located within environmentally sensitive regions, primarily due to the region being previously undeveloped or underdeveloped. Increasing global awareness of environmental issues and the emergent sustainability movement has focussed awareness, however, there is still very little evidence of research work conducted on remote site design management. Clearly most construction projects have a degree of remoteness and once we accept this notion we begin to view projects through the proxemics lens and explore difficulties associated with remoteness.

Remoteness can be based upon a continuum related to the physical distance of participants from the site:

- All project participants are initially not located adjacent to the project site, ie all design, construction and facility management actors are located in another city / urban area.
- Selected groups of project participants are initially located distant from the site, for example, the design team and project / construction management teams have their offices in other countries, regions etc, but they may move to the region or have agents in the region.
- The majority of project participants are located adjacent to the site and a selected few are located remote from the project site, for example, construction materials and components suppliers are required to transport their products to the site from other regions; or conceptual design teams win international design competitions and are located primarily in other countries or international clients commission new projects in various locations.
The majority of construction projects typically fall within the third category, however in this paper the first category of remoteness, which is the most extreme situation, is considered in detail. Within this type of remote site there are a range of types of projects and there are three predominant property markets including:

- Commercial projects, tourism, ecotourism
- Government / quasi government / non government organisation projects: scientific investigation, space exploration, earth evolution
- Civil infrastructure: mineral resource exploration and processing, oil/gas rigs, pipelines, dams

Remote sites can also be considered in relation to:

- the distance to the site from continuously available logistical support
- the difficulty of physical access to the site
- the hostility of the environment in terms of climate
- the extent of the availability of local /imported materials or labour resources.
- the environmental sensitivity

Remote site projects offer very unique challenges to those involved in the design, construction and management process. However there may be generic characteristics and issues in common underlying the unique and different sites.

**DESIGN MANAGEMENT**

A selected review of design management and lean design management, by Kestle and London (2002), established that lean design management and design management both make important contributions to the theory of management of design.

The lean design management field of research offers us such concepts as value stream, process integration, workflow, and waste minimisation, and is predominantly a production-oriented worldview. Lean design management principles can be readily applied to the remote and often hostile sites in for example Antarctica, where the main priorities for the client are shelter, a strict budget and a process driven construction programme.

The design management field of research offers us such concepts as value generation, knowledge integration and timely decision making. The design process has become increasingly complex and fragmented in recent years resulting in more actors who have design knowledge that requires integration.

Within the context of remote sites an exploratory design management model was developed by Kestle and London (2002) which involved developing a model that identified the key factors of design management for remote sites by reviewing and synthesising theoretical contributions from various production and sociological approaches to design management and responding to a context of key characteristics of remote sites.
The synthesis of the theoretical contributions from these production and sociologically oriented worldviews revealed four key factors including:

- value generation
- knowledge integration
- process integration
- decision making

Figure 1 Exploratory Design Management Conceptual Model for Remote Sites

The more holistic approach to design management as explored by a few researchers over the last few years identifies additional significant design management factors. For example, Huovila, Koskela, and Garnett, et al (1998), refer to the importance of and the means to achieve sustainable development. Whilst traditional design and construction focusses on cost, performance and quality objectives, sustainable design and construction focusses on value generation, minimization of resource depletion, minimization of environmental degradation and the importance of information flow management (Kibert 1994).

Minimising resource depletion and environmental degradation requires an extensive and clear understanding of the theoretical and applied research areas concerned with ‘environmental sustainability’. It is therefore important to acknowledge and describe the underlying concepts of sustainability within the context of the natural and built environment.

ENVIRONMENTAL SUSTAINABILITY

At the initial stages of a project, consideration of, and responses to, the environmental sensitivity of remote sites may often be paramount to the overall design development, construction or implementation stages for remote and often hostile sites. One of the underlying concepts of ‘sustainability’ is that our relationship with the built and natural environments is permanent and that there is an interdependent relationship between our activities and their effects on the...
planet. This is particularly relevant as many of the remote sites are pristine and therefore environmentally sensitive. The impacts created by any development activities, can have long-term effects on the unique ecosystems present.

The United Nations defines sustainable development as “the development with which the needs of the present generation are filled without jeopardising the possibilities for future generations to fulfil their needs” (Low 2001).

In recent years governing bodies have accepted that upholding certain principles in relation to sustainable development is their responsibility. There have been varying attempts to operationalise such high ideals and philosophies worldwide.

One of the most notable contributions was that made by the New Zealand government, with the introduction of the Resource Management Act (RMA) 1991. It is considered notable in terms of its aims, as the concept of sustainable development was first defined and incorporated in this Act which replaced the Town and Country Planning Act 1977 and 52 statutes. When the Resource Management Act was implemented, it was the first time that environmental protection, and sustainability had become a legal requirement in any Act of Parliament internationally. The Act promotes the sustainable management of the development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and safety, whilst - "sustaining the potential of natural and physical resources (except minerals), to meet the needs of future generations; safeguarding the life – supporting capacity of air, water, soil and ecosystems; and avoiding, remedying, or mitigating any adverse effects of activities on the environment "(RMA 1991).

It is noted that although enshrined in policy and regulatory processes, it is also suspected that sometimes implementation can be problematic. This further supports the need for a design management model for sustainable development.

Interpretations of the intent and meaning of the RMA in terms of sustainability range across the spectrum of cultural, social, economic and developmental realities. Low (2001) - a keynote speaker at the international conference on ‘Sustainability – state of the environment’, contended that there were four issues associated with the concept of sustainability:

1. avoiding / reducing wastage of resources such as gas, oil and other natural resources, but there are no objective scientific laws that tell us what are the acceptable levels of resource depletion;

2. protecting the environment: preventing or reversing the process of decline and damage;

3. achieving social stability: for future generations;

4. establishing cultural and spiritual levels and standards (values) for future agreements

These four interpretations involve value judgements. Similarly, many articles, papers and governmental acts and policies make value judgements when referring to sustainability. “The goals of sustainability are ecological and social, and the two issues are not separate”, (Rogers 1995). Environmental sustainability refers to biodiversity, sustainable environments, sustainable development, and ecological design.
Diverse biological and natural environments have intrinsic values in terms of their visual, educational, heritage and spiritual qualities. As an example, Antarctica is frequently referred to in terms of its intrinsic value (Article 3, Antarctic Treaty 1961) and is described as a ‘polar wilderness’. (Dingwall 1998).

**Sustainable environments** refer to the ways in which the natural and physical resources are managed to ensure that the integrity of the environment is maintained for future generations (RMA 1991). These environments are reliant on high levels of biodiversity and evidence of mature ecosystems which are rare within pristine sites. The management of these environments has largely been associated with responses to various legal instruments such as international treaties and national acts, for example the Antarctic Treaty 1961 and the NZ Environmental Protection Act 1994. Associated with such legal instruments are policies and protocols that give guidance, which are sometimes legally binding or simply advisory. Consequently those that have been recognised as having attributes to be preserved for future generations have been awarded a World Heritage listing (Tongariro National Park NZ, and Fraser Island Australia. The Treaty and the associated NZ Environmental Protection Act 1994), designates Antarctica as a natural reserve devoted to peace and science. It establishes environmental principles for the conduct of all activities, subjects all activities to prior environmental assessment, gives priority to scientific research that contributes to the understanding of the global environment, and prohibits for example, mineral resource extraction, and the introduction of non indigenous animals.

Regulatory frameworks such as the Antarctic Treaty 1961, the Environmental Protocol 1991, the Resource Management Act 1991, the Nature Conservation Act 1994 and the Burra Charter ensure that any person wanting to visit, develop or alter the nature of particular remote sites adhere to strict criteria that protect the physical or heritage values of the sites for present and future generations. Once environments are established as worthy of sustainable management, then the development of these unique environments is critical.

**Sustainable development** has often been regarded as a discourse that disputes what sustainable development might in fact mean (Low 1999). The World Business Council on Sustainable Development effectively breaks the term into ‘sustainable’ meaning continued, and ‘development’ meaning growth, hence the market liberalists interpret this to mean growth of corporate business, and ‘business as usual’ almost without ecological restraint. This approach is clearly challengeable. “Sustainable development denies the existence of global ecological limits. Sustainable development exists in a constellation with a number of other discourses: survivalism, market liberalism and green radicalism... sustainable development looks to a future beyond capitalism” (Low 1999). For the various environmental groups, sustainable development means development that demonstrates a ‘duty of care’ in terms of the natural environment. Hence there is quite a marked difference in terms of the sustainable development vision between the environmental groups and the World Business Council on Sustainable Development (Low 1999).

Sustainability, as mentioned earlier in a quote by Sir Richard Rogers is both ecological and social. The ecological dimension and how it relates to design is now briefly described. Ecological design refers to a design ethic and process that has ecological responsiveness as the main focus. “Ecological design is an anticipatory approach to design. It must be one that is critical of its influences over the earth’s ecosystems and resources and one that is responsive to their inherent constraints and opportunities” (Yeang 1995).
As referred earlier in terms of design management research, a more holistic approach has been explored by a few researchers such as Huovila and Koskela (1998), and Garnett et al (1998) over the last decade. They refer to the importance of and the means to achieve sustainable development. Traditional design and construction focusses on cost, performance and quality objectives, whilst sustainable design and construction focusses on value generation, minimization of resource depletion, minimization of environmental degradation and the importance of information flow management (Kibert 1994).

The selected review of design management and environmental sustainability literature has established that there are four key factors that apply specifically to remote site design management, being value generation, process integration, knowledge integration and decision making. These factors form the basis of the comparisons recorded in Table 1 and the typological descriptors, or attributes, of the three remote sites. The three sites have similar dimensions in regard to having only limited access, being pristine and environmentally sensitive, needing specialist remote site knowledge, logistical preplanning and good levels of information management.

The variances in terms of attributes of the three remote sites, is in the area of value generation in particular. Therefore the case studies chosen as examples focus on the way in which value is generated for the clients and stakeholders for these very different projects on these pristine remote sites.

CASE STUDIES

The following case studies are relevant examples for the development of a typology for remote sites, because of their contrasting physical attributes and very different developmental priorities. The two sites are both in environmentally pristine regions, yet offer and generate quite different values for the particular clients. These differing generators of value are discussed in more detail in the two following case studies. The first study is of an Australian Eco tourism resort on an island off the east coast of Australia, whilst the second is the research bases built to support international scientific investigations in the Ross Sea Region of Antarctica.

1. KINGFISHER BAY RESORT. FRASER ISLAND (AUSTRALIA).

This site was inscribed on the World Heritage list in 1992, which means that any project development has to comply with the criteria set down by UNESCO and the Australian Heritage Council (AHC). The Recreation Areas Management Act 1988 and the Australian Burra Charter are governed by the AHC, (ICOMOS 1999).

The client was the Queensland government, in particular the Department of Environment and Heritage National Parks and Wildlife Service (QNPWS). The value of the site to this particular client was realised in being able to develop this environmentally pristine site for restricted public access. QNPWS undertake the day-to-day management of this area. The following criteria were determined to ensure that this value was realised and not compromised:

1. environmentally sensitive site development in terms of planting and built environment footprint;
2. indigenously cultural focus in the design as a selling point to potential visitors;

3. easy access for the construction processes and for the subsequent visitor population (now 300,000 per year);

4. logistical support essential at construction and operational stages;

5. 3- star comfort levels in terms of lifestyle, relaxation and entertainment, whilst at the same time being cognisant of the desire for environmentally sustainable principles at the design, construction and operational stages of the project;

6. budget related to potential returns on investment in the project;

7. customer and environs education focus.

2. SCIENTIFIC BASES IN THE ROSS SEA REGION, ANTARCTICA

Antarctica has some 26 scientific bases and 42 countries who are consultative parties to the Antarctic Treaty. The scientific base stations and historic hut sites in the Ross Sea Region fall under the stewardship of the New Zealand Government and are managed on their behalf by Antarctica New Zealand and the Antarctic Heritage Trust respectively. Any development work has to comply with the requirements of the Antarctic Treaty 1961 and the Environmental Protection Act 1994. (Waterhouse 2001).

Value in terms of these Antarctic sites lies in the pristine nature of the continent, and the fact that Antarctica acts as a global barometer in terms of climate change, and the effects of global human activities on the world’s atmosphere, oceans and ecosystems. Scientific research is the prime activity on the 26 sites in Antarctica, with limited tourist activity being very strictly controlled. The value of these sites must not compromised. In addition, the scientific activities can only be carried out during the five month window of accessibility. The following criteria form the basis of the client priorities when developing projects on these sites.

1. minimal environmental impact;

2. robust and reliable shelter in terms of weather protection, as conditions can be life threatening;

3. logistical support essential during the construction process and intermittently at the operational stage(s);

4. scale of building size and function closely related and to be kept to a minimum in terms of m2 area and budget;

5. restricted window of constructability (late October to early February in any one year), hence building had to be capable of prefabrication for speedier assembly on site;

6. accessibility for materials and personnel deliveries to meet the tight deadlines;

7. budget related to the fiscal policies of the government of the time and to the scale and nature of the building project brief, (Kestle 1999).
The criteria are similar with respect to minimising environmental impact and access to the site for logistical support and personnel / visitors. (refer to Table 1, for a translation of the typological descriptors of the dimensions and properties (attributes) of these and other remote sites). These typological descriptors enable the categorisation of a range of remote sites and their particularities.
### Table 1: Remote Site Comparisons

<table>
<thead>
<tr>
<th>SITES</th>
<th>Design</th>
<th>Management</th>
<th>KNOWLEDGE INTEGRATION</th>
<th>VALUE GENERATION</th>
<th>ENVIRONMENTAL IMPACT / SENSITIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TONGARIRO NATIONAL PARK - NZ</strong></td>
<td>PROCESS INTEGRATION logistics, site access and construction preplanning</td>
<td>KNOWLEDGE INTEGRATION specialist remote site knowledge information technology for remote sites</td>
<td>Resource Management Act (1991), National Parks Act (1980), NZ Building Act (1991), Tongariro National Park Mgmt Plan (1996-2001) World Heritage Listing (1990,1993) Specialised design and construction technology to address extreme temperature ranges, high winds and precipitation</td>
<td>Environmental protection of site is the priority, given public accessibility Global value of the site evidenced by the World Heritage listing National Park. Primary activity is environmental and historical conservation and limited Eco tourism</td>
<td>Largely pristine and highly sensitive mature ecosystems Delicate ecological balance Limited number of sites for Department of Conservation ranger huts ski lodges Whakapapa and Turoa set aside as the only commercially developed areas</td>
</tr>
<tr>
<td><strong>ANTARCTICA</strong></td>
<td>Located on three volcanic mountains, two of which are still active Hostile climate, temps plus 25°C to minus 10°C, winds from 5 to 40 knots Limited access (4 months/ year) Detailed logistical preplanning of construction phases including equipment, personnel and materials essential to meet the tight deadlines</td>
<td>Antarctica Treaty (1961): 42 nations-of which 26 are the core Protocol on Environmental Protection Madrid Protocol 1991). Detailed logistical preplanning of the construction phases including equipment , personnel and materials – Hostile climate, very low humidity, no rain. World’s lowest temp.-89.6°C Desert conditions. Specialised design and construction technology to address extreme temperature ranges, high winds and a unique marine and desert environments.</td>
<td>Treaty was designed for peaceful and scientific endeavours (US space program) and to protect the resources from commercial gain and to keep it a continent free from military arms. Historical Conservation – Heroic Era huts</td>
<td>Primarily scientific investigations Emerging Eco and Historical Tourism Aesthetics have been of secondary importance, priority given to basic human needs basis related to physical survival. Previous threat of mineral resources exploitation. Emerging regulations governing environmental sites. Pristine with a scientific profile -closest we get to Mars on earth Research activities limited to quantitative studies. Government concern about longterm impacts (Wharton and Doran 1999)</td>
<td></td>
</tr>
<tr>
<td><strong>RESEARCH BASES</strong></td>
<td>5 America:1000 km Australia: 2500 km NZ (ChCh) 3835 km Africa: 4000 km Hostile climate, very low humidity, no rain. World’s lowest temp.-89.6°C Desert</td>
<td></td>
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<tr>
<td><strong>MCMURDO DRY VALLEYS</strong></td>
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</tbody>
</table>
### Fraser Island, Australia

**Adjacency to Australian landmass:** 270km north of Brisbane

**Limited access:** ‘Permit’ access only
- Only accessible by boat (for example 45mins by catamaran from Hervey Bay)
- Detailed logistical preplanning of the construction phases including equipment, personnel and materials

<table>
<thead>
<tr>
<th><strong>World Heritage</strong> listed site 1992</th>
<th><strong>World Heritage</strong> listed site(1992) due to unique sand ecosystem/ dune lakes geology (world’s largest sand island: complex dune systems), etc- Eco tourism</th>
<th><strong>World Heritage</strong> listed site due to unique sand ecosystem/ dune lakes geology (world’s largest sand island: complex dune systems), etc- Pristine, evolving ecosystem and highly sensitive. Coupled with other natural and cultural significance reasons. For eg fauna (rare frogs, bats and glider species, as well as marine life) and flora (‘wallum heaths’ are of particular evolutionary and ecological significance, complex peat swamps), and indigenous culture. Indigenous peoples only: 1,200-2000 years ago Threat of sand mining, mineral resources exploitation and various introduced flora / fauna species Development really only limited by restrictions on new accommodation and limited restrictions on public access</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNESCO 1972 ICOMOS: 1999 Australian Burra Charter governed by Qld and Australian Heritage Council. Subtropical, mild winters, hot and wet summers, high humidity, cyclonic zone, etc. Conditions are maritime with mean annual temperatures ranging from 14.1°C minimum to 28.8°C maximum. Rainfall is high, reaching 1,800mm on the highest dunes in the centre of Fraser Island (DASET, 1991; Sinclair and Morrison, 1990)</td>
<td>World Heritage listed site(1992) due to unique sand ecosystem/ dune lakes geology (world’s largest sand island: complex dune systems), etc- Eco tourism Aesthetics is critical to the resort development as is the relationship between the built environment and the local human experience</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

As a first stage of the development of a typology for remote sites, the typology analysis and discussion focussed on the development of relevant analysing dimensions; where the type is defined as a combination of attributes (properties and dimensions), the similarities and differences were then identified and then the constructed groups and types are described in further detail.

Table 1 graphically identifies the attributes of the selected remote sites in terms of their properties and dimension. Issues in common between the sites are that they are each considered to be ‘pristine’ sites. In addition, their post development impacts have to meet strict guidelines which are closely monitored by the New Zealand and Australian governments (and their agents).

Developmental activities in terms of the Antarctic sites are conducted in terms of supporting scientific activities or providing visitor life support for the duration of their time on the continent; shelter and safety being the prime priorities alongside environmental impact minimisation. Scientific activities are restricted to six months fieldwork per year and cannot be carried out at any time in the protected areas designated as Sites of Special Scientific Interest (SSSI).

Development on sites within the Tongariro National Park (New Zealand) has to meet the strict criteria as set down in the various Acts and National Park Management Plans. Visitor numbers exceed 700,000 per annum (TNP 1996), which creates various and significant challenges in terms of needing to minimise environmental impact whilst offering an eco tourism experience. Ninety per cent of the designated sites for development have already been built on, however further development of the skifield areas is envisaged.

Development of the Fraser Island eco tourism resort in Australia has to meet strict criteria in terms of environmental impact minimisation, and site responsive aesthetics, whilst offering visitor education on indigenous and environmental conservation. The main challenge is to manage 300,000 visitors per annum visiting this unique location, whilst endeavouring to keep the site in pristine condition.

All of the sites are remote in terms of distance from an urban area, with the Antarctic sites being completely isolated for six months of the year. However access is becoming easier due to advanced technology in terms of transportation and communications. The properties and dimensions of these remote sites are unique, a resulting in world heritage listings, and the development and implementation of an international treaty protecting the sites in Antarctica. Long term protection and monitoring of these remote sites is under threat from advancing technological systems and increasing demand for scientific investigation and eco tourism. The development of the next stages of a typology and conceptual model for remote sites becomes clearer and even more significant when reflecting on the delicate ecological balance of these environmentally sensitive remote sites.

At this early stage of developing a typology for remote sites, categorisation of specific types such as Type A, Type B, et al, requires further empirical evidence to confirm
and extend the various characteristics gathered to date (refer Table 1). The next stages in the development of a typology involves extending the literature review in the fields of design management and sustainable development, gathering further statistical and case study evidence, creating some meaningful relationships between the attributes, and then grouping the cases for further analysis.

The selected sites have a range of attributes that include: pristine environment; governmental monitoring; government as client; evolving and mature ecosystems; commercial value; design stakeholders; scientifically investigative activities; global impact; historical conservation; resource-rich; hostile climate; indigenous history.

The constructed types may involve a combination, or combinations, of these attributes. In addition, the constructed types may involve a combination of ‘meaningful relationships’ that exist between one or more of the attributes. These relationships may identify the interdependent characteristics of the attributes or they may describe the key similarities or points of difference of the attributes. The overriding characteristic of remoteness that occurs in varying degrees across all of these sites, means that some or all of the constructed types may need to respond in a flexible manner, to a varying range of unique remote site attributes.

REFERENCES


APPENDIX B

University of Canterbury Human Ethics Committee (HEC) ref HEC 2008/1.

1. Letter of Approval from the HEC University of Canterbury, for the research proposal “Thesis: Remote Site Design Management - Project A and Project B”.

2. Project Case Study A- Cape Roberts Drilling Project Antarctica, Information Sheet, and Participant Consent Form templates.

3. Project Case Study A- Cape Roberts Drilling Project Antarctica, Interview Questions.

4. Project Case Study B- UNSHA (Humanitarian Aid) Red R project Sudan (West Darfur), Participant Information Sheet and Consent Form templates.

5. Project Case Study B- UNSHA (Humanitarian Aid) Red R project Sudan (West Darfur), Interview Questions.
Ref: HEC 2008/1

4 February 2008

Ms Linda Kestle
Gateway Antarctica
UNIVERSITY OF CANTERBURY

Dear Linda

The Human Ethics Committee advises that your research proposal “Thesis: Remote Site Design Management – Project A and Project B” has been considered and approved.

However the Committee ask that all consent forms/information sheets together with the interview sheets are placed on University of Canterbury letterhead. Please also include a statement in the information sheets saying that you have also received University of Canterbury Human Ethics Committee approval for this project.

Thank you and best wishes for your project.

Yours sincerely

[Signature]

Dr Michael Grimshaw
Chair, Human Ethics Committee
In reference to your letter and file ref HEC 2008/1 received mid February 2008

I hereby enclose the Participant Consent Form templates and the Interview Sheet Templates for both Case Study a and Case Study B on University of Canterbury letterhead as requested. In addition there is now a statement on each of these templates to the effect that University of Canterbury Ethics Committee has approved the research associated with the remote design management project case studies A and B all as requested and required in the letter received from you on 14 February 2008.

Thank you

Linda Kestle
PhD student with Gateway Antarctica
Doctoral Thesis researcher: Linda Kestle

The University of Canterbury Human Ethics Committee has given their approval for this research project to be conducted.

PARTICIPANT CONSENT FORM - Case Study A

Interviews with reference to an historic case study being conducted on the Cape Roberts Drilling Project in Antarctica (1995-2001).

Research Thesis Title: Remote Site Design Management

Researcher: Linda Kestle
Contact Details: ph 09 817 8987; 025 98 08 94, email: lkestle@hotmail.com

Contact Person: If you have any concerns regarding the way in which this research process is being conducted please contact my supervisor, Prof Bryan Storey Gateway Antarctica University of Canterbury ph DD 03 364 2368

Information
You are invited to take part in a research project that I am conducting as part of my data collection for the doctoral thesis. I am using a multi-case study methodology and this project is just one of several being researched. The particular project in respect of this interview is an historical case study (conducted in 2003-2005) of the Cape Roberts Drilling Project in Antarctica (1995-2001).

The interview will draw questions from, and about the 'Final Report Document', in particular, as edited by Mr Jim Cowie of Antarctic New Zealand Christchurch, and published in 2002.

This part of the research, and this interview in particular, is focused on the report findings and recommendations, in terms of the management framework and approaches; the
preliminary and detailed planning and the operations stages of the project and the lessons
learned from a management perspective.

The research involves interviewing a number of participants who played key roles on the
actual project as well as other stakeholders as deemed appropriate and relevant to this
research project.

The interviews will take approximately 45 minutes per interviewee and will be audio-taped
for ease and accuracy of data collection and transcription.
The data collected from the interviews will contribute to the overall data and analysis
section of the historical case study and to the thesis overall.

Confidentiality will be preserved at all times in terms of the data collection and transcription
into the research thesis.

The use of the audio-tapes and the notes taken at the interview will only be used by the
researcher and will be kept secure at all times.
All audio-tapes and notes will be destroyed once the research write up has been
completed.

You may withdraw from participating in this research at any time or decline to answer any
of the questions at your discretion.

CONSENT

I have read this Participant Information and Consent Form. The details of the research
have been explained to me. My questions have been answered to my satisfaction.

I agree to participate in this research and to provide information to the researcher on the
understanding that my name will not be used without my permission.

I agree/ do not agree to the interview being audio-taped. I also understand that I have the
right to ask for the audio-tape to be turned off at any time during the interview.

I acknowledge that this information will only be used for this research and may be used /
published for the purposes of the phd thesis and any other scholarly publications
associated with this research.

I agree to the publication of my name, professional role and organisation in the thesis and
any resulting publication(s). I understand that the referencing of information will be
conducted according to scholarly standards.

Signed:

Name:

Title and Organisation:

Date:

Signature of Researcher:
University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. www.canterbury.ac.nz
Doctoral thesis researcher: Linda Kestle

The University of Canterbury Human Ethics Committee has given their approval for this research project to be conducted.

INTERVIEW SHEET –

In reference to the Cape Roberts Project Antarctica 1995-2001

The focus of the interview is on the official role that you played, the report findings of the project (as edited by Jim Cowie), the lessons learned, the recommendations made in that report, and particularly those viewed from a management perspective in terms of:

- the management framework and approaches,
- the pre planning
- the detailed planning stage(s)
- the operations stage
- communications
- HR
- funding

Name of Interviewee
Date

Q1
In your role (and your official capacity) as ...........................................on the Cape Roberts Project, please identify

a) Your job description, briefly, in terms of your key responsibilities on this project and how they may have changed during the course of the project..

b) If there were changes, how did these impact on your role and / or on the project overall
Q2 a) What in your official role, were the main (management) challenges that arose during the project... please answer this as concisely as possible, under the bulletted headings above.

b) Which of these challenges, and to what extent did they impact on your role and/or the project overall

Recommendations / lessons learned for future projects??

The next few questions are related to the exploratory conceptual design management model that I have developed for remote site projects. Please find a copy of the model attached to this questionnaire..

I would like to test some of those ideas with you in terms of the Cape Roberts Project in particular

Q3 In terms of the Cape Roberts Project and your role on that project, please comment on

a) Value Generation – (concerned with the value that the client / stakeholder places on the particular site and project)
   - the clients value criteria, and
   - the stakeholders value criteria

b) Knowledge Integration (a combination of relevant specialist knowledge across IT, pre-design briefing, pre-planning and the construction / operational stages)
   - specialist site knowledge
   - IT for remote site coordination

c) Process Integration (the need for integration of the following factors is paramount on these complex projects)
   - logistics and site accessibility
   - construction planning / methodology
   - alternative procurement strategies
   - creativity and production interface

d) Decision Making
   - Timely and critical (minimal operational windows)
   - Performance criteria (of staff and of project)
   - Environmental sustainability (sensitivities of the site and those impacts)
   - Economic constraints (tight / impossible budgets?)

Q4 Other comments, that you consider may be relevant to this research

...I am also interested to hear whether you think that the exploratory contexts for remote sites are sufficiently inclusive to cover the term ‘category ‘remote site’ (refer to the model again as supplied)

Thank you again for your time and insights as a key player on the Cape Roberts Project
These notes are to be read in conjunction with any pre-agreed audio taping
Linda Kestle
Researcher

Signed by the Interviewee
Date
Signed by the Researcher
Date
Doctoral Thesis

The University of Canterbury Human Ethics Committee has given their approval for this research project to be conducted

PARTICIPANT CONSENT FORM - Case Study B

Interviews with reference to the UNSHA (Humanitarian Aid) Red R project Sudan, (West Darfur).

Research Thesis Title: Remote Site Design Management

Researcher: Linda Kestle
Contact Details: ph 09 817 8987; 025 98 08 94, email: lkestle@hotmail.com

Contact Person: If you have any concerns regarding the way in which this research process is being conducted please contact my supervisor, Prof Bryan Storey Gateway Antarctica University of Canterbury, Christchurch.NZ ph DD 03 364 2368, or Assoc Professor Regan Potangaroa, School of Architecture and Landscape Architecture, Unitec, Auckland. NZ

Information
You are invited to take part in a research project that I am conducting as part of my data collection for the doctoral thesis. I am using a multi-case study methodology and this project /these projects is/are just one of several being researched.

This part of the research, and this interview in particular, is focused on the recommendations, in terms of the management framework and approaches; the preliminary and detailed planning and the operations stages of the project and the lessons learned from a management perspective.

The research involves interviewing a number of participants who played key roles on the actual project(s) as well as other stakeholders as deemed appropriate and relevant to this research project.

The interviews will take approximately 20-25 minutes per interviewee and will be audio-taped for ease and accuracy of data collection and transcription.
The data collected from the interviews will contribute to the overall data and analysis section of the historical case study and to the thesis overall.

Confidentiality will be preserved at all times in terms of the data collection and transcription into the research thesis.

The use of the audio-tapes and the notes taken at the interview will only be used by the researcher and will be kept secure at all times. All audio-tapes and notes will be destroyed once the research write up has been completed.

You may withdraw from participating in this research at any time or decline to answer any of the questions at your discretion.

CONSENT

I have read this Participant Information and Consent Form. The details of the research have been explained to me. My questions have been answered to my satisfaction.

I agree to participate in this research and to provide information to the researcher on the understanding that my name will not be used without my permission.

I agree/ do not agree to the interview being audio-taped. I also understand that I have the right to ask for the audio-tape to be turned off at any time during the interview.

I acknowledge that this information will only be used for this research and may be used/published for the purposes of the PhD thesis and any other scholarly publications associated with this research.

I agree to the publication of my name, professional role and organisation in the thesis and any resulting publication(s). I understand that the referencing of information will be conducted according to scholarly standards.

Signed:

Name:

Title and Organisation:

Date:

Signature of Researcher:
Doctoral thesis researcher: Linda Kestle

The University of Canterbury Human Ethics Committee has given their approval for this research project to be conducted.

INTERVIEW SHEET – In reference to the UNSHA (Humanitarian Aid) Red R project Sudan (West Darfur)

Name of Interviewee

Date

The objective of this research is to ascertain how projects operate in remote areas and how issues of “remoteness” are addressed and the recommendations that you would make particularly from a management perspective. These recommendations could be for the decision making both before and as work proceeds, the management framework, decision making, communications, HR or funding. This is achieved through the structured question set below.

In your role and official capacity as ................. what is your involvement with the West Darfur project and what is your job description or Terms Of Reference? Have your Terms Of Reference relating to the West Darfur project changed in your time on the job?

- How much do you know or have been told of the Darfur area and the situation there? How often have you been or get to Darfur?
- What advice would you give to anyone about to be stationed in Darfur?
- What in your view are the main issues for those stationed in Darfur and what part (if any) do you believe they are the result of its remoteness?
- What conclusions and recommendations would you have for future projects?

The next few questions are related to the exploratory conceptual design management model that I have developed for remote site projects.
Please find a copy of the model attached to this set of interview questions.

In terms of your involvement and understanding of the Darfur project could you please comment on the following areas:

- **Value Generation:**
  How do you know or measure the effectiveness of your role as it relates to Darfur? Are there any rules of thumb that you intuitively apply?
  What and how do you get feedback from “clients”?
  In what ways do you feel that you are accountable?

- **Knowledge Integration:**
  How is what you have learnt on Darfur recorded and passed on to others?
  How are you or would you like to improve this situation?
  Would such changes or are changes related to your involvement in Darfur easy to implement?
  Are their gaps in the specialist knowledge in the area in which you are involved for Darfur?

- **Process Integration:**
  What methods or approaches do you employ to achieve your goals and fulfil your role?
  How have you tried to improve on this or the system?
  What role does HR play or could play (for example in staff training, skills and experience)?

- **Decision Making:**
  How are your decisions made? Is this decision making centralised or de-centralised?
  How are budgets maintained?
  How significant are sustainability issues in your role?

...I am also interested to hear whether you think that the exploratory contexts for remote sites are sufficiently inclusive to cover the term /category ‘remote site’ (refer to the model again as supplied)

Thank you again for your time and insights

These notes are to be read in conjunction with any pre-agreed audio taping

Linda Kestle
Researcher

Signed by the Interviewee
Date
Signed by the Researcher’s Assistant Regan Potangaroa
Date

University of Canterbury Private Bag 4800, Christchurch 8140, New Zealand. www.canterbury.ac.nz